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3. Physics of Complex Fluids

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2. Theoretical Nuclear Physics

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2. Particle Phenomenology
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HYDRODYNAMICS AND ATMOSPHERIC PHYSICS

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1. Atmospheric Physics

(1) Atmospheric corrections for the resources satellite images

Satellite visible images are unavoidably masked by the cloud, aerosol and water vapor existing in the atmosphere. These effects may be removed by some means, except the cloud. This is the so-called atmospheric correction. In this project we will estimate the atmospheric correction parameters for the resource satellite images by using the multi-spectral data from multiple satellites. Of all the meteorological parameters the aerosol optical thickness is believed to be the most important one for the atmospheric correction. The aerosol optical thickness may be retrieved from the VISSR visible channels data aboard the operational meteorological satellite GMS and the ocean color imager data of the ROCSAT-1. The latter is launched in December 1998. We developed new method of extracting the aerosol optical thickness and test its validity. (Chung-Yi Tseng)

(2) Application of the semi-Lagrangian method to cloud model

Recently the use of semi-Lagrangian method is extended to the meso- and small-scale models. The numerical efficiency in its application to the non-hydrostatic models is limited by fast moving acoustic and gravity waves. Furthermore, there exist overshoot and undershoot of the forecast variables during the integration formula used in the semi-Lagrangian scheme. Modified schemes have been proposed to improve the performance and efficiency. We apply a quasi-monotone semi-Lagrangian scheme to a three-dimensional non-hydrostatic cloud model. The ice phase is considered in the microphysical parameterization in order to investigate its effects on the precipitation structure. The results indicate that the monotone scheme can suppress efficiently the noise generated in the model and simulate correctly the time change of water substances without increasing the computation time. In addition, the new model can simulate some important features of the development of a cumulus cloud.

This year we continued to use semi-Lagrangian method as advection scheme in the cloud model to study the small-scale atmospheric flow. The stability analysis was performed in the semi-Lagrangian cloud model in order to understand the character of numerical solution for different Courant numbers or forcing terms, e.g. mechanical forcing or cloud microphysics. It is well known that when the semi-implicit semi-Lagrangian method is used as advection scheme, it affords an advantage of 3 to 6 times larger time step than Eulerian methods. The numerical solution is stable, but it is not accurate enough for large Courant number. Furthermore, the orographic forcing could not be neglected in small-scale models

and this mechanical forcing is more important than others in changing the atmospheric flow field. (Chung-Yi Tseng)

2. Basic Research in Hydrodynamics

(1) Research on bubble plume

The sea surrounds the Taiwan. So ocean is an important resource to our country. It is known that there is abundant in natural gas under Taiwan west offshore. The Chinese Petroleum Corporation set up the platform ship in the southwest offshore to drilling well for exploring natural gas. The gas blowout may be occurred in accident. Due to the gas containing of hydrocarbon that is harmful to marine life, the spread and diffusion of gas will cause offshore environment pollution. Thus, spread and diffusion of gas blowout are worth to investigate thoroughly. We are trying to do the experimental study on the bubble plume that is conducted in a tank filled with density stratified water. The laser light sheet is created to illuminate the flow field. A CCD (Charge-Coupled Detector) is applied to take the picture. The digital image process skill is employed to analyze the picture to obtain the spread characteristics of the bubble plume in stratified water. The effects of the gas flow rate and ambient water stratification on the bubble plume behaviors are also investigated. Experimental results are used to compare the numerical model calculation. The developed numerical model and experimental method will be applied to investigate gas blowout in Taiwan southwest offshore gas well blowout. The results can be used as references for offshore environment pollution assessment and control. (Bao-Shi Shiau)

(2) Maxwell-Navier-Stokes model on low gravity fluid transport phenomena

Considering the electromagnetic effects, we add Maxwell equations in CFD. The Computational Magneto-Aerodynamics is thus developed. Maxwell-Navier-stokes coupled equation has been employed to solve the equations of magneto fluid dynamics for conservation variables of mass, momentum and energy throughout the flow field. Incorporating the magneto-aerodynamics technique and using utilizing the Maxwell-Navier-Stokes equation model, we are going to integrate the conservation form governing equations in control volume and to develop a solver to simulation the magnetic effects on microgravity integrate materials processing. According the CFD technique, MUSCL is involved to solve the governing equations. In the investigation, we apply the developed model to simulate the Magnetic effects of Marangoni-Benard convection and of the horizontal Bridgman process. (Lai-Chen Chien)

(3) Thermoelectromagnetic convection of encapsulated floating zone

In a microgravity environment, the thermal convection is induced primarily by thermal-capillary stress in a liquid free surface or at liquid/liquid interface. An external applied magnetic field may reduce melt circulation. In order to control the thermalcapillary convection, the liquid encapsulated floating zone technique with electromagnetic field is developed. Electromagnetic liquid encapsulated floating zone is simulated by concentric two-fluid column system to investigate thermo-gravitational and thermo-capillary convection characteristics. The thermal and flow patterns of the two immisicible liquid system of FC-40 and 2 cst silicon oil under various gravity conditions are studied. The simulation incorporates numerical scheme based on volume of fluid transport equations with continuum mechanism. The two fluid and interface are handled by unique system of governing equations. The thermoelectromagnetic effects on the convection of encapsulated floating zone are simulated. (Lai-Chen Chien).

(4) Effects of tidal variability and continuous stratification at estuary

Several effects in the flow field of an estuary including interaction of river current and ocean current has been studied. Other important mechanism such as density stratification and tidal variation are not touched. Hence, it is worth paying more attentions in these topics. This project is conducted using numerical simulation. The main goal is to establish a 3-D numerical model. The vertical density stratification and tidal variation will be considered. (Robert R. Hwang, Wen-Chang Yang)

(5) Liquid encapsulated floating zone

In liquid encapsulated floating zone configuration, the liquid column is concentrically surrounded by immiscible liquid encapsulant and creates a column of two concentric immiscible liquid. The shape of the volume of fluid is held between equal diameter solid disks by surface tension. The liquid bridge has been extensively investigated since the early publication of Rayleigh and Plateau more than a century. Recently, with the availability of the reduced gravity environment and the potential of containless processing, the problem has been widely studied and applied in industry applications. We have simulated the encapsulated floating zone by volume of fluid model with continuum surface formulation to take care liquid/liquid or liquid air interface. The two fluids, inner cylinder filled with FC-40 and outer 2 cSt silicon oil, are handled by unique system of governing equations

and solved like single fluid problem with pressure based algorithm. The flow characteristics and the thermal properties of the liquid encapsulated floating zone in various gravity conditions are obtained. The micro-gravity effects on the crystal growth in liquid encapsulated floating zone process are simulated. (Lai-Chen Chien)

(6) Three-dimensional simulation of square jets in cross-flow

Direct Numerical simulations are performed to predict the transient three-dimensional flow interactions in the near field of a square jet issuing normal to a cross-flow. The near field flow features investigated here include, the presence of a horseshoe vortex system originating just upstream of the jet orifice which resulted from the interaction between the upstream laminar boundary layer and the transverse jet, a sequence of instability induced shear layer rollers formed above the jet orifice which wraps around the front side of the jet, and the folding of the lateral jet shear layer that initiates the formation of the counter rotating vortex pairs. In a careful study, it has been observed that the horseshoe vortex which forms upstream of the jet exhibit unsteady flow characteristics at a relatively high Reynolds number, and the shear layer vortices during their entire process of flow evolution maintained a quasi-steady state while remaining attached to the front side of the jet. The issue of `origin of the counter rotating vortex pair' and its evolution process starting from inception has been investigated to a complete detail. The results obtained from the present simulation also confirm the fact that the upright wake vortices behind the jet actually originate from the cross-flow boundary layer where they spiral in and lift away from the wall layer, and such findings are quite consistent with the experimental observations made by Fric and Roshko (1994). It is made clear topologically also that the unstable local surface excitations are the seeds from which upright vortices grow. The number and the size of the shear layer vortices increased as the flow interaction became more intense at a higher Reynolds number. Most importantly, the near-wall flow topology extracted from the simulated data are observed to be in excellent agreement with the experimental predictions made by Kelso, Lim and Perry (1996) for a round jet. The Reynolds number based on the jet width and the average cross-flow velocity at the inlet was varied between 4500 and 6000, and two different values of the jet to cross-stream velocity ratio, 2.5 and 3.5 are used for computations. The simulated flow features are observed to agree reasonably well with the flow visualization results presented in recent round jet experiments. (Amalendu Sau, Tony W.H. Sheu and Robert R. Hwang)

(7) Unsteady three-dimensional interaction and near-wall eruption

Direct Numerical simulations are performed to investigate the unsteady three dimensional vortex-vortex and vortex-surface interactions in the far field of a wall mounted rectangular block placed inside a channel. A sequence of stream wise rollers dominated the downstream interaction region, and they exhibit strong unsteady flow characteristic. The origin and the formation of wake vortices behind the rectangular block are investigated and they are found to be fundamentally different from what one observes behind a transverse jet. In the upstream region, an unsteady laminar necklace vortex-system formed at the upstream juncture of the rectangular block and the bottom plane of the channel. The effect of Reynolds number on the unsteady flow characteristic and on the interaction mechanism has also been investigated in a greater detail. (Amalendu Sau and Robert R. Hwang)

3. Physics of Complex Fluids

(1) Electromagnetic effects on material growth

Solidification material processes can be controlled by heat transfer, mass transfer, convection, thermodynamic and dynamic technique. The most popular one is applying an electromagnetic field during material processes. Besides the computational fluid dynamic equations, the Maxwell equations are coupled for the crystal growth facilities. The Maxwell equations are cast into conservative form similar to those of computation fluid dynamics. The applied electromagnetic forces reduces the convection. Thus the temperature distribution is more uniform compared with that of general condition. Furthermore, the effects of Lorentz force on micro-gravity material process can improve the product quality. (Lai-Chen Chien)

(2) Surfactant driven instability in a Hele-Shaw Cell

The interfacial instability of a moving air-liquid interface moving in a Hele-Shaw cell is studied. From the classical Saffmann-Taylor result, the interface will become unstable only when the less viscous air is pushing on the more viscous liquid. However, in our experiment, we have observed that an instability will develop even when the liquid is pushing the air if the liquid used in an aqueous surfactant solution. Detailed analysis of the experiment has revealed that a wetting layer on the air side of the interface on the all of the Hele-Shaw cell is needed to produce the observed instability. Based on this observation, a phenomenological model is constructed to explain the observed experimental results. The main hypothesis of the model is that surfactants accumulated on the advancing interface will either dissolve into the bulk to form micelles or diffuse into the wetting layer on the wall.

Instability of the interface will occur when the diffusing front of the surfactants in the wetting layer becomes unstable. In this aspect, the surfactant driven instability is very similar to that observed in directional solidification where the instability of the solidification front is controlled by the diffusion of impurities ahead of the front. Experiments are planned in the future to observe this diffusion front directly. (Chi-Keung Chan)

(3) Collapse of a granular pile

Usually, avalanches in granular systems are studied on granular piles by adding the granular material on the top of the piles either randomly or at a particular location to induce avalanches. However, in actual situations, another type of avalanches can also be produced in granular system by the removal of grains or collapse of structure close to the bottom of the pile. For example, in the landslide close to rivers, the collapses of nearby slopes are mainly due to the erosions of the river bed. Despite the practical importance of these avalanches, very little is known about the properties of these avalanches. An experimental investigation of the scaling properties of a collapsing rice pile induced by reducing the length of the base support of the pile is carried. It is found that two angles of repose are needed to describe the shape of the collapsing granular pile. Corresponding to these two angles of repose, the collapse of the granular pile can be characterized by local and global avalanches. Furthermore, it is found that the probability distributions of the avalanches depend on the sizes of the avalanches under consideration. (Pik-Yen Lai, Chi-Keung Chan)

(4) Nonlinear phenomena in chemical and biological systems

As it is generally observed, nonlinear phenomena is a cross-discipline study. With the new laboratory facilities which will be finished next year in place of the old library, we will be able to conduct experiments in systems of chemical and biological nature. The chemical system we have in mind is the Belousov-Zhabotinsky (BZ) reaction in which nonlinear temporal and spatial behaviors can be observed. We will be interested in the dynamic control of the pattern formation properties of such a system. As for the biological system, we will begin by carrying out preliminary studies in the aggregation behaviors of the slime mold (Dictyostelium). Similar to other pattern formation systems, interesting patterns can be created during the aggregation of the slime mold. We are interested in the non-linear dynamics of the collective behaviors of the individual ameoba in the slime mold. (Chi-Keung Chan)

(5) Effect of polymer on the critical behavior of binary liquid mixture

We studied the effects of a high molecular weight polymer (Polyacrylic Acid, PAA) on the critical behavior of a binary liquid mixture (Lutidine + Water, LW). A high precision refractometer was built to measure the temperature dependence of the refractive indexes of the two coexisting phases after the sample has phase separated. From the refractive indexes we mapped out the coexistence curve in which composition difference $\Delta c \sim (T - Tc)^{\beta}$. Here β and Tc are, respectively, the sample temperature and the critical temperature of the sample. We found $\beta = 0.40 \pm 0.01$ for the LW with 0.7 mg/cc PAA which is different from that ($\beta = 0.31 \pm 0.01$) of pure LW. (Kiwing To)

(6) Flow properties of semi-conducting electrorheological fluids

An electrorheological (ER) fluid is one that exhibits reversible changes in rheological properties when acted upon by an electric field. Such fluids are usually made of particle suspension with large dielectric constant mismatch between the particles and the fluid in which the particles are dispersed. Because of the controllable viscosity and fast response, ER fluid is regarded as a smart material for active devices which transform electric energy to mechanical energy. It has been widely accepted that the ER effect is the result of the formation of internal structures such as chains and columns of the suspended particles in the presence of an electric field. We have conducted experimental study of semi-conducting polyaniline ER fluids and found that the flow curves follow a scaling behavior at different applied electric field strength. We are trying to develop a model based on the electrical conductivity differences between different kind of polyaniline derivatives. (Hyoung J. Choi, Kiwing To)

(7) Jamming of granular flow in a two-dimensional hopper

We study experimentally the jamming phenomenon of granular flow of monodisperse disks of $D = 5$ *mm* diameter in a two-dimensional hopper with opening R. The jamming probability $J(d)$ is measured where $d=R/D$. We found that $J(d)$ decreases from 1 to zero when d increases from 2 to 5. From observing the disk configurations of the arch in the jamming events, the jamming probability can be explained quantitatively by treating the arch as the trajectory of a restricted random walker. (Kiwing To, Pik-Yin Lai, Hyuk-Kyu Pak)

NUCLEAR PHYSICS AND ACCELERATOR-BASED PHYSICS

1. Experimental Nuclear Physics and Accelerator-Based Physics

(1) Laser electron photon experiment
(2) PHENIX experiment at RHIC
(3) (p,n) reactions on ^{6,7}Li at 35 MeV
(4) Isovector part of optical potential studied by analog transitions through (p,n) reaction at 35 MeV
(5) M-shell ionization in rare-earth elements by lithium ions
(6) Effect of dilution gas on SiCN films growth using methylamine
(7) High power stable single-fundamental mode vertical cavity surface-emitting lasers with a zinc diffused absorber

2. Theoretical Nuclear Physics

(1) A local density approximation treatment for the pauli exclusion operator in hypernuclei
(2) Two-frequency shell model for hypernuclei and meson-exchange hyperon-nucleon potentials
(3) $B^0 \rightarrow D^{*+}D^{*-}$ decay mechanism

1. Experimental Nuclear Physics and Accelerator-Based Physics

(1) Laser electron photon experiment

Since 1998 we have been collaborating with the LEP (Laser-Electron-Photon) experiment at SPring-8, Japan. The objectives are to study the vector meson photo-production and its related physical implications. We had finished the design and construction of the time-of-flight (TOF) detector array which consisted of 40 200cm(L)×12cm(W)×4cm(T) plastic scintillation bars. We achieved the time resolution of the TOF system to be about 100ps for each scintillation bar, it is good enough to separate pion and kaon at 2 GeV/c by the mass cut.

The first physical run of the experiment were performed during the period of May, 2000 to June, 2001. In these runs, polarized laser light of wavelength 488 and 351 nm were shined on the 8 GeV electron beam of SPring-8 synchrotron to produce 1 - 2.4 GeV backscattered polarized gamma and then to induce vector meson production. A 65 mm thick CH_2 and liquid hydrogen target plus various nuclear targets were used separately in the experiments. The signal detecting system was arranged in a series of Cerenkov counter - SSD vertex detector-drift chamber - magnetic dipole spectrometer - drift chamber (×2) - TOF array. A clear signal of ϕ mesons via K+K- reconstruction and interesting K+ decay asymmetry w.r.t. the photon polarization is seen from the preliminary analysis of the collected data. We expect to have the system calibration and final analysis finished by the spring of year 2002 and get the results published soon.

In the future two major detector upgrades are currently under way: gamma detector and Time-projection chamber. We are in charge of developing and constructing the crucial component in the read-out chain of TPC: Flash ADC modules in Taiwan. The TPC is scheduled to be installed in the summer of year 2002 and start data taking for the physics subject of nuclear medium effects of vector mesons and KΛ production starting from the fall. (C. W. Wang, and W. C. Chang)

(2) PHENIX experiment at RHIC

We participate in the PHENIX experiment at the Relativistic Heavy Ion Collider (RHIC), Brookhaven National Laboratory. First heavy ion run of Au+Au at 130 GeV/c in Yr 2000 has proven the performance of the detector systems and the centrality dependence of charged particle multi-plicities has been measured. Three journal publications are referred to http://www.phenix.bnl.gov/phenix/WWW/run/phenix/publications.html .

Next beam run including heavy ion runs and pp runs started from the summer of Yr 2001 and will last till the spring of Yr 2002. Detailed study using energy loss method (dEdx) to improve the particle identification of low momentum e, π and K particles is going on. The strangeness production of ϕ mesons in Au+Au collisions at = 200 GeV/c via K+K- and e+e- channel will be investigated as one of the signatures of Quark-Gluon Plasmas. (W. C. Chang)

(3) (p,n) reactions on ^{6,7}Li at 35 MeV

An experimental study of the (p,n) reaction on ^{6}Li and ^{7}Li was carried out at Ep=35 MeV. In addition to the well investigated transitions to low-lying states in the residual nuclei, those to high-lying unbound states were investigated. Cross sections and their angular distributions were explained by microscopic distorted wave Born-approximation theory with transition densities obtained by shell model calculation. An effective nucleon-nucleon interaction M3Y gives reasonable results when it is used both in the shell-model and DWBA calculations. It has found that the dominant contribution for the 1^+ - 2^+ transition in the ^{6}Li(p,n)^{6}Be reaction are those from the spin-quadrupole type $\Delta J(\Delta L, \Delta S)$=1(2,1) ,2(2,1) and 3(2,1) components. A sizeable 1(0,1) GT-component is found for the $3/2^-$ - $5/2^-$ transition in the ^{7}Li(p,n)^{7} be reaction. (Y. C. Yu)

(4) Isovector part of optical potential studied by analog transitions through (p,n) reaction at 35 MeV

Quasielastic (p,n) reactions were studied at an incident proton energy of 35 MeV. Differential cross section for isobaric analog $\Delta J^{\pi}=0^{+}$ (fermi-type) transitions and their angular distributions were measured in twenty-seven N>Z target nuclei ^{7}Li, ^{9}Be, ^{13,14}C, ^{15}N, ^{50}Cr, ^{54,56}Fe, ^{58,60,62,64}Ni, ^{70}Zn, ^{71}Ga, ^{92}Zr, ^{110,112,114,116}Cd, ^{116,118,120}Sn, ^{140}Ce, ^{172,174,176}Yb, and ^{208}Pb. Pure $\Delta J^{\pi}=0^{+}$ fermi-type transitions were observed in twenty-three of them. As for the four light odd-A nuclei, Fermi-type transition strengths were evaluated with the microscopic DWBA by subtracting from the raw data the contributions from mixed $\Delta J^{\pi}\neq 0^{+}$ components. Thus twenty-seven $\Delta J^{\pi}=0^{+}$ angular distribution were obtained, and fitted by macroscopic DWBA calculations with the Lane-model optical potential to derive systematically the isovector part of the potential. The best-fit parameters for each target are presented. The present results combined with our previous analysis on thirteen other nuclei in the $17 \leqq A \leqq 48$ region cover almost the entire mass region. They were used to obtain A-dependent global parameters by least-squares fit. (Y. C. Yu)

(5) M-shell ionization in rare-earth elements by lithium ions

M-shell x-rays of the rare-earth elements $_{60}$Nd, $_{64}$Gd, $_{67}$Ho, and $_{71}$Lu were measured for lithium ions bombardment in the energy range 1.0-6.0 MeV. The M-shell x-rays with energies of 0.978-1.631 keV were detected with a LINK analytical detector. The efficiency of the detector was determined by using the known atomic-field bremsstrahlung cross sections from low energy electron beams and K-shell x-ray measurements with light projectiles. The measured cross sections were compared to the predictions of the first Born approximation and the ECPSSR (energy loss and Coulomb deflection effects, perturbed stationary state approximation with relativistic correction) theories. The best theoretical description of the present data is given by the ECPSSR theory even though the discrepancy between data and theory is increasing at higher projectile energies. (Y. C. Yu)

(6) Effect of dilution gas on SiCN films growth using methylamine

Methylamine (CH_3NH_2) was employed with SiH_4 to deposit amorphous silicon carbon nitride films due to its easy dissociation as well as containing both carbon and nitrogen elements. The effect of dilution gas, such as H_2, N_2 , Ar and He on the film growth was studies in electron cyclotron resonance plasma chemical vapor deposition (CVD) reactor. At a microwave power of 250W and a substrate temperature of 700 °C , ternary silicon carbon nitride film has been successfully deposited using He as dilution gas. However, only binary silicon nitride films were formed using dilution gases of Ar, N_2 and H_2 but otherwise similar conditions. Characterization of the films using FTIR, XPS and optical emission study of the plasma were employed to study the growth process. Possible explanations and discussion for the growth behaviors of the dilution gases are presented. (Y. C. Yu)

(7) High power stable single-fundamental mode vertical cavity surface-emitting lasers with a zinc diffused absorber

We report that an implant vertical-cavity surface-emitting laser operates at stable single-fundamental mode with a maximum output power of 3.2 and 4.4 mW at room-temperature and –7 °C respectively. The stable single mode operation is achieved by using a higher-order mode absorber formed by zinc diffusion. (Y. C. Yu)

2. Theoretical Nuclear Physics

(1) A local density approximation treatment for the Pauli exclusion operator in hypernuclei

An attempt is made to simplify the complications of computing hyperon-nucleon G-matrix elements arising from the Pauli exclusion operator contained in the integral equation. We perform a two-frequency shell model folded-diagram calculation on hypernuclei using two different treatments for the Pauli exclusion operator Q_2, namely, a local density approximation where Q_2 is replaced by a nuclear-matter Pauli operator $\overline{Q}(\rho)$ with ρ being a density parameter, and an exact calculation where Q_2 is expressed in terms of shell model wave functions. With a proper choice of ρ, it is possible to reach a reasonable accuracy by using the local density approximation Pauli operator. For heavy hypernuclei, this $\overline{Q}(\rho)$ can be used to save tremendous computing time. (Y. H. Tzeng)

(2) Two-frequency shell model for hypernuclei and meson-exchange hyperon-nucleon potentials

A two-frequency shell model is proposed for investigating the structure of hypernuclei starting with a hyperon-nucleon potential in free space. In a calculation using the folded-diagram method for $^{16}_{\Lambda}O$, the Λ single particle energy is found to have a saturation minimum

at an oscillator frequency $\hbar\omega_\Lambda \approx 10$ MeV, for the Λ orbit, which is considerably smaller than $\hbar\omega_N = 14$ MeV for the nucleon orbit. The spin-dependence parameters derived from the Nijmegen NSC89 and NSC97f potentials are similar, but both are rather different from those obtained with the *Jülich— B* potential. The *ΛNN* three-body interactions induced by *ΛN - ΣN* transitions are important for the spin parameters, but relatively unimportant for the low-lying states of ${}^{16}_{\Lambda}O$. (Y. H. Tzeng)

(3) $B^0 \to D^{*+}D^{*-}$ decay mechanism

The Cabibbo-suppressed decay $B^0 \to D^{*+}D^{*-}$ is a promising channel for searches of CP violation in B^0 meson decays at future B-factories. In 1999, this reaction was first observed by the CLEO collaboration at the Cornell Electron Storage Ring (CESR). The measured branching ratio for this decay mode is about 6.2×10^{-4}. Now, in order to use this decay channel to study CP violation, we must first understand the reaction mechanism. Using the field theoretic approach for heavy mesons we have developed in recent years [2],we study this reaction in the heavy quark limit. The basic decay amplitude for $B^0 \to D^{*+}D^{*-}$ is expected to be dominated by the quark level processes of $b \to cW^+, W^+ \to cd$. This reaction is rather special, in the sense that all the mesons involved are heavy. The field theoretic approach for heavy mesons we developed recently provides an ideal framework in which to study this decay. In our approach, the wave function of a heavy meson is represented by an effective meson-quark-quark vertex. Therefore the decay process corresponds to a Feynman diagram which can be calculated with standard methods. (C. Y. Cheung)

Particle Physics

1. Experimental High Energy Physics

(1) ATLAS experiment
(2)The Fermilab CDF Collaboration
(3) Neutrino and Astroparticle Physics Group
(4) AMS experiment

2. Particle Phenomenology

(1)Study of charmless and charmful baryonic *B* decays
(2) Implications of recent $\overline{B}^0 \to D^{(*)0}X^0$ measurements
(3) $B \to J/\psi K^*$ decays in QCD factorization
(4) Applications of QCD factorization to semi-inclusive *B* decays
(5) Symmetry breaking effects in heavy mesons
(6) Factorization theorem
(7) Sudakov effects
(8) Nonleptonic decays
(9) Power counting
(10) Out of equilibrium and RHIC physics
(11) Direct Photons: a nonequilibrium signal of the expanding quark-gluon plasma
(12) Meson propagators in spontaneously broken gauge theories
(13) A guided Monte Carlo method for optimization problems
(14) Quantum bit commitment

3. Particle Astrophysics and Cosmology

(1) AMiBA: Array for Microwave Background Anisotropy
(2) Complex visibilities of cosmic microwave background anisotropies
(3) The weak-field expansion for processes in a homogeneous background magnetic field

1. Experimental High Energy Physics

(1) ATLAS experiment

The National Science Council and the Taiwan group signed the Memorandum of Understanding (MoU) with CERN and ATLAS in February 2002. This completes the formal process for Taiwan to join ATLAS.

During 2001, it was decided by the Semiconductor Tracker (SCT) group that the opto-harnesses used in reading out all the 6 million channels of the detector will be produced in Taiwan. The optopackage, which houses two VCSEL's and one PIN in a package of size 5.5mm x 5.5mm x 1.5mm and is the World's smallest transceiver, is designed by the Taiwan group. The optopackage will be placed on a flex-board called dogleg and bonded to the driver and the receiver IC's to be provided by the Rutherford Appleton Laboratory. Each harness consists of 6 doglegs connected on the one end to twelve meter-long low mass flex cables which provide power to the sensors and the readout modules. The 12 single fibers from the VCSEL and 6 single fibers form PIN need to be spliced to ribbon cables and protected with a splice protector. The ribbon cables need to be terminated to MT connectors. The detailed assembly and quality assurance procedures, including the design and manufacturing of many jigs and test modules and equipments, were completed during the year

The production readiness review (PRR) of the SCT opto-harness was held in Academia Sinica and Radiantech on November 26-28, 2001. It was concluded that the opto-harness is ready for production. A pre-series of eight harnesses will be produced and checked for the installation with the sensor modules to make sure the clearance of 1.2mm between the harnesses and the silicon sensor modules is enough. After that, the production of the remaining 800 opto-harnesses will start some time around May 2002.

The PIXEL group of ATLAS decided in June 2001 to adopt the opto-package designed and produced by Taiwan. The design concept is similar to the SCT opto-package.

For both SCT and PIXEL, optical signals from one harness will be received by a 12 channel PIN array module on the readout driver board (ROD). The timing and trigger signal will be sent through a 12 channel VCSEL array module on ROD to the PIN's on the harness. Taiwan group is now the only source that can provide such arrays for ATLAS. Samples of the 12 channel VCSEL and PIN array modules are being delivered to the SCT group for making and testing prototype ROD modules. The arrays are based on a unique low cost design by Dr. Ming Lee Chu. The special feature of the design is passive alignment with receptacle connection to MT connector. It had been verified by temperature cycling that the alignment is robust.

The high speed (1.6 GHz) transmitter that we made for optical link of the Liquid Argon Calorimeter group passed neutron total dose and single event error radiation tolerance tests.

However, it was discovered in September 2001 that the Maxim driver chip contains a CMOS part which provides the DC bias for the VCSEL. This CMOS part fails the γ-ray total dose test. A redesign of the circuit to by-pass this part of the Maxim chip was done and the new prototype module passed the γ-ray and proton tests in November 2001. A backup design using Synergy instead of the Maxim driver chip was also made and the prototype transmitters also passed the radiation hardness test. The production readiness review for LAr optical link will be on February 6, 2002. We expect to produce about 2000 TX that LAr group needs in 2002.

The Tile Calorimeter group needs a high speed TX similar to that of the LAr group. However, they like to have dual TX for redundancy. We produced 15 prototype dual TX for the Chicago University group in mid-2001. These work perfectly for their optical link readout and the Chicago group had ordered 298 such dual TX from us. 16 of these had been delivered and the rest will be delivered in early 2002.

We are also producing the prototype stamp-size rigid-flex cards for the Transition Radiation Tracker frontend electronics. The design does not conform to normal manufacturing specs and is challenging for the manufacturing engineer.

The SCT dogleg is now being trial-produced in Taiwan as well. In addition to these, the Paris University group was inquiring about the possibility of using Taiwan made optical TX and RX. Samples were provided for them.

It is clear that over the past two years, Taiwan group has emerged as the major group in optical links and related electronics design and production for all major sub-detectors of the ATLAS experiment. Building on our experience of design and production of the dense optical interface module (DOIM) for the CDF silicon vertex detector SVXII, we have established ourselves as the unique team with expertise in optical readout for high energy experiments. (S. C. Lee)

(2)The Fermilab CDF Collaboration

For the next decade, Fermilab Tevatron Collider remains the highest energy frontier of particle physics. With the completion of Main Injector (which will enhance the luminosity) and with the upgrade of the collider detectors (CDF and D0), Tevatron Run II provides the potential for discovery of new phenomena and opportunities for the precision measurements in hadron collider physics.

In a press release on March 1, 2001, Fermilab Driector Michael Witherell announced the start of Collider Run II at Tevatron, the highest energy particle accelerator now operating in the world. "I am delighted that we are starting Run II on time," Witherell said. "Now we can look forward to the excitement of seeing new physics results. We can't predict what Nature has in store for us. All we can guarantee is the opportunity for discovery."

Run II will continue, with a mid-course interruption for further upgrades and improvements to accelerators and detectors, until 2007. At about that time, results will begin to emerge from a new accelerator, the Large Hadron Collider (LHC) at CERN, which will have seven times the Tevatron's energy and will overtake the Tevatron at the high-energy frontier.

To cope with the Tevatron Run II physics goals, the CDF Collaboration has gone through a major upgrade of its detectors in the past years. The High Energy Physics (HEP) group of Academia Sinica has been making important contribution to the upgrade project on:

1. Dense Optical Interface Module (DOIM) for SVXII detector optical readout, and
2. Production Farm for data analysis.

A. DOIM/SVXII project

Academia Sinica is responsible for the optical readout system for the silicon detector. A total of 700 pairs of Dense Optical Interface Module (DOIM) have been successfully produced in summer, 2000. Ming-Lee Chu is the spearhead of the project. The edge emitting laser diode array and PIN photodiode array were designed and manufactured by the Telecommunication Laboratory of ChungHwa Telecom Company led by Dr. T.T. Shi. The DOIM package assembly was done at Radiantech Inc. located in the Science-Based Industrial Park in Hsin-Chu.

The on site IQC, BER test and system integration of DOIM modules with the portcard (TX) and FTM (RX) were done by Paul Chang and Fang-Chang Kang. Extensive tests had been done to ensure the mid section fiber cables were intact during the installation. The cabling and testing was very time consuming due to the limited space available. Paul left us in March 2001 for an industrial work. Suen Hou joined us in May and takes over the DOIM operation and maintenances job.

In October 2000, a commissioning run of the CDF Detector was carried out. A "Barrel 4" Silicon detector was also installed to the performance of the silicon and the link. Twenty-eight pairs of DOIM were used for the optical readout. On Oct. 14, the first silicon hit was observed. It marks the milestone of the high energy physics experiment as it is the first time the silicon data were readout via optical link. The CDF Detector was rolling into the Collision Hall in January 2001 immediately after the insertion of the silicon detector into the CDF Detector.

Various problems have been encountered since then and most of the efforts of the silicon team are given to solve the problems in order for the smooth operation of the silicon detector. Major problem is the unstable of the power supply. Also sections of the cooling pipe were clogged. Many cooling problem was fixed during the scheduled six weeks maintenance shutdown in October 2001. The DOIM optical link had gone through a major checkup for bit

error problems too. The total channels giving errors were reduced to about a dozen channels. The examination includes a check up of all fiber channels before entering the FTM boards. RX modules for those having bit error were all replaced.

Currently a stable running condition of the silicon detector has been achieved and ready to take the physics data. The DOIM performance is expected to remain stable and the radiation damage is expected to be lower than the silicon detector or other portcard components.

B. PC Farm project

The CDF experiment at the FNAL is designed to take data at a maximum throughput of 20 MB/s. The production farm should process data at a similar rate. It should also have enough computing power for reprocess part of the data and for Monte Carlo simulation.

The PC Farm project was proposed by the Academia Sinica group and endorsed by the CDF collaboration. Currently Yen-Chu Chen and Miroslav Siket are the major man force to the farm project.

The farms are composed of more than one hundred PC's and will grow in the future to accommodate the future need of the experiment. All PC's connect to a network switch, which is capable of transferring up to 256 Gb/s. In view of that each PC can reach only 100 Mb/s maximum this switch is quite sufficient even for upgrade plan. A SGI SMP computer is used to transfer data in between the mass storage system and the PC's. Another SGI SMP computer is used as the control node and for putting together files of the physics type.

Software (The Farm Processing System, FPS) is written to control and monitor the farm. Most of the information needed for monitoring is on the web for easy access. More effort is needed to improve the stability of the farm processing and make it easy to operate.

In the past few months, beside data processing, reprocessing and Monte Carlo event generation, the farm was used to help debugging the analysis program. For a new code developed the program manager ran it with about one thousand events and later on ten thousand events to filter out defects easily seen with low statistics. After that the program was moved to the farm for a test with hundred thousand events to shake out defects happening rarely.

The farm has done several tests with the Monte Carlo event generation to prove the connectivity from submitting the jobs toward the end of storing data onto tapes and being available to users. Mass production of the Monte Carlo generation will start in the near future.

The experiment started to take data in July of 2001. The farm is catching up with the data processing and reprocessing after the program and calibration are prepared. As of January 10 of 2001, 113 million or so events have been processed, twenty more million events to go. Details of the data processing are listed in the following table.

	Streams				
	A (High Pt)	B (e, g)	G (Jet, Et)	J (J/Y)	Total
2001 July	3106972	13209511	9687134	9501168	35504785
Aug.	657670	8362497	6620484	9043838	24684489
Sep.	1159064	10447183	10148347	5274438	27327868
Oct.	244132	2842894	1647563	992040	5726629
Dec.	1230263	8991574	6065506	3333672	19621015
2002 Jan.	89309				89309
Summary	6487410	43853659	34467870	28145156	112954095

Note that these include all events being processed by different versions of the reconstruction program. (P. K.Teng)

(3) Neutrino and Astroparticle Physics Group

Group Members at the Academic Sinica (2000-2001)

Chang Wen-chen, Chen Chin-ping, Hsu Hui-Chin, Jon Guo-Ching, Kiang Ge-Cheng, Lai Wen-Ping[1], Lee Feng-Shiuh, Lee Shih-Chang, Li Hau-Bin[2], Li Jin[3], Lin Shin-Ted, Luo Ching-Shan, Qiu Jin-Fa, Su Da-Shun, Teng Ping-Kun, Wang Chang-Wan, Wang Xin-Wen[3], Wong Tsz-king[4], Xin Biao[5], Yue Qian[3], Zhuang Bao-An[3]

[1]Visitor from Chung Kuo Institute of Technology, Taipei,
[2]Ph.D. student from National Taiwan University,
[3]Visitor from Institute of High Energy Physics,Beijing,
[4]Principal Investigator,
[5]Visitor from the China Institute of Atomic Energy, Beijing,
[6]**T**aiwan **EX**periment **O**n Neutrin**O**

The principal focus of the TEXONO[6] Collaboration in 2000-2001 is the construction and commissioning an experimental program at the Kuo-Sheng Reactor Neutrino Laboratory [1] located at 28m from the core #1 of the Kuo-Sheng Power Reactor at the northern coast of Taiwan. The 50-ton shieldings and cosmic ray-veto are commissioned. A versatile and general-purpose electronics, data acquisition and monitoring system as well as remote access protocols are set up. Data are stored and can be accessed via a 600~Gbyte IDE disk array at AS. These infra-structures would allow much flexibilities to place different detectors in the inner target volume. Papers on (a) electronics and data acquisition systems[2], and (b) prototype CsI(Tl) measurements[4] were published. The Kuo-Sheng Experiment is the first

particle physics experiment performed in Taiwan.

The experimental program for Reactor ON/OFF Period I (July 2001 to March 2002) will be based on both (a) an Ultra-Low Background High-Purity Germanium Detector (ULB-HPGe) and (b) a total of 46 kg of CsI(Tl) crystal scintillator taking data simultaneously but with independent trigger. The scientific goals are the studies of neutrino interactions at low energy, including neutrino-electron scattering, neutrino magnetic moments, neutrino-nucleus interactions, and neutrino radiative decays. The experiment is also suited for a feasibility background studies of performing a Dark Matter-WIMP search with CsI(Tl) crystals. The ULB-HPGe data indicates threshold and background level comparable to underground Dark Matter experiments (the challenge now is that it is at a shallow-depth location—*and* in the vicinity of the reactor core). It is expected that we can achieve world-level sensitivities in neutrino magnetic moments and radiative lifetimes. The CsI(Tl) detector is also operating and analysis is underway.

Proceeding in parallel with reactor experiment are the various R\&D program. This includes: (1) Feasibility studies of scintillating CsI(Tl) crystals for Dark Matter Searches-a paper on neutron calibration was published [7], (2) Radio-purity measurements with Accelerator Mass Spectrometry, (3) Development of Gd- and Yb-loaded crystals for low energy solar neutrino detection-a paper on the studies with GSO crystal was published [3], (4) Upgrade of Kuo-Sheng electronics for the SPring-8/LEPS experiment, (5) Study of Ultra-Low Energy Germanium detector of Dark Matter searches and neutrino-nuclei coherent scattering, and (6) participation in a bigger framework in the discussions of (a) Very Long Baseline High Energy Neutrino Experiment from Tokyo to Beijing, and (b) the detection scheme of very high energy tau-neutrinos using mountain ranges as target and air as the subsequent showering volume.

The research program is a collaborative effort between institutes/universities from Taiwan (Academia Sinica, Institute of Nuclear Energy Research, National Taiwan University, National Tsing Hua University, and Nuclear Power Plant II), China (Institute of High Energy Physics, China Institute of Atomic Energy, Institute of Radiation Protection, Nanjing University, Tsing Hua University) and the United States (University of Maryland), with the AS group playing the leading role. It is the first generation collaborative efforts in large-scale basic research between scientists from Taiwan and China. The technical strength and scientific connections of the Collaboration are expanding and consolidating.

The first Ph.D. thesis of the TEXONO collaboration was successfully completed by Dr. Liu Yan from the IHEP group, which gives a detailed account of the conceptual design and prototyping studies of the reactor pilot experiment. Three more Ph.D. students are in the pipeline, and a new one is expected to join in 2002.

The various TEXONO publications and reports, as well as selected photos and

transparencies, can be assessed directly from our Web-site at

http://hepmail.phys.sinica.edu.tw/~texono/

A list of our publications in SCI-Journals in 2001 is shown below.

Publications(SCI) in 2001:

1. "A CsI(Tl) Crystal Scintillator for the Studies of Low Energy Neutrino-Electron Scatterings", H.B. Li et al., TEXONO Collaboration, hep-ex/0001001, Nucl. Instrum. Methods A 459, 93 (2001).
2. "The Electronics and Data Acquisition Systems of a CsI(Tl) Scintillating Crystal Detector for Low Energy Neutrino Experiment", W.P. Lai et al., TEXONO Collaboration, hep-ex/0010021, Nucl. Instrum. Methods A 465, 550 (2001).
3. "Measurement of Intrinsic Radioactivity in a GSO Crystal", S.C. Wang, H.T. Wong, and M. Fujiwara, hep-ex/0009014, Nucl. Instrum. Methods A, in press (2001).
4. "Studies of Prototype CsI(Tl) Scintillating Crystal Detector for Low-Energy Neutrino Experiments", Y. Liu et al., TEXONO Collaboration, hep-ex/0105006, Nucl. Instrum. Methods A, in press (2001).
5. "Energy Calibration of CsI(Tl) Crystal for Quenching Factor Measurement in Dark Matter Search" (Chinese), Q. Yue et al., High Energy Physics and Nuclear Physics, in press (2001).
6. "Monte Carlo Study on the Effect of Shielding in TEXONO Neutrino Experiment" (Chinese), D.L. Chen et al., High Energy Physics and Nuclear Physics, in press (2001).
7. "Nuclear Recoil Measurement in CsI(Tl) Crystal for Cold Dark Matter Detection", M.Z. Wang et al., nucl-ex/0110003, submitted to Phys. Rev. C (2001).
8. "Sensitivities of Low Energy Reactor Neutrino Experiments", H.B. Li and H.T. Wong, hep-ex/0111002, submitted to Journ. Phys. G (2001).

(Tsz-king Wong)

(4) AMS experiment

Phase II of the AMS experiment (AMS-02) is to build a superconducting magnet based precision magnetic spectrometer to put on the International Space Station (ISS), now scheduled in November 2004, to search for anti-matter and dark matter. The superconducting magnet is of cylindrical shape with inner diameter around 1.1 meter and outer diameter around 3 meter. It consists of two main dipole coils to provide the transverse magnetic field with peak value over 1 Tesla and 12 correction coils to provide return loop for the magnetic field lines so that the total magnetic moment of the superconducting magnet is zero. Taiwan group is now building a cold mass replica of the superconducting magnet for test purposes.

Compared to the Phase I magnetic spectrometer AMS-01 which uses permanent magnet

and was tested flied on board the shuttle Discovery for 10 days in June 1998, AMS-02 is almost a totally new detector. The silicon tracker now consists of 8 double-sided layers instead of 6. Due to the much stronger fringe field, all the photomultipliers of the time-of-flight (TOF) counter need to be replaced by fine-mesh ones and the direction of the axes of these photomultipliers need to be individually aligned to the local magnetic field greatly increasing mechanical complexity. A ring imaging Cerenkov counter (RICH) with aerogel as the radiator as well as perfect reflecting side mirrors and multi-cathod photomultiplier arrays, replaces the aerogel threshold counter (ATC) in AMS-01. In addition, a transition radiation detector made of radiators and straw tubes is added on top of the upper TOF for enhanced tracking and particle identification. Finally a sampling electromagnetic calorimeter made of lead-scintillating fiber layers is added at the bottom of the detector. All the electronics need to be re-design and rebuild.

The conceptual design of the new electronics started in mid-2000. Taiwan, in collaboration with MIT, is responsible for the design of the data acquisition (DAQ), trigger and monitoring systems. A large portion of the electronics modules will be produced in Taiwan.

The main single board computer (JSBC) is based on Power PC 750 central processing unit. A memory buffer module (JBU) provides 2 Gbyte of buffer SDRAM. The AMS-wire module implements the communication protocol designed by MIT and Taiwan. The CAN and 1553 module implements such protocol for monitoring control and house-keeping. The high rate data link module (HRDL) sends data and receives command at high rate. All these modules are connected through a back plane conforming to compact PCI standard. Each of these modules has at least four-fold redundancy. However, there is only one fiber connecting the payload to the space station. As a result, data from 4 HRDL needs to go through a multi plexer module (JHIF) to select only one output before converting electrical to optical signal.

During the past year, the design of the first version of all these modules were completed and system test is now undergoing. The production of the flight modules is expected to start in 2002.

All the electronics components have to be radiation-tolerant for total dose and for single event errors (SEE). During the past year or so, three heavy-ion beam tests were carried out at GSI. Around 50 components were screened for SEE tolerance. In particular, IBM Power PC 750 chips are qualified for space-use and SDRAM based on stack-capacitor technology is selected in favor of those based on trench capacitor technology.

We had also convinced the ALTERA Company to manufacture the APEX CPLD (complex programmable logic devices) on epitaxial wafers. ALTERA provided us with such samples packaged with exposed dies. We collaborated with Padova University, Italy to

use the heavy-ion beam there for SEE measurements of the ALTERA samples. Two beam tests were done during the year. Preliminary results indicate that the APEX chip manufactured on epi-wafer is comparable to other space-grade complex FPGA in SEE tolerance. ALTERA had informed us, before learning of our test results, that all their APEX CPLD of the type we used are now manufactured on epi-wafer.

Besides hardware, Taiwan group, together with MIT, is also responsible for developing all the firm-ware and soft-ware needed to make the electronics system work. We had been able to implement Linux on JSBC and Linux drivers for the various modules of the system had been written. The program needed to carry out the system test for the prototype system is now being developed. (S. C. Lee)

2. Particle Phenomenology

(1) Study of charmless and charmful baryonic *B* decays

Inspired by the claim of an observation of the decay modes $p\bar{p}\pi^{\pm}$ and $p\bar{p}\pi^{+}\pi^{-}$ in B decays by ARGUS in late 80's (ruled out by CLEO later), baryonic B decays have been studied extensively around early 90's with focus on the two-body decay modes, e.g. $B \to p\bar{p}, \Lambda\bar{\Lambda}$ .Up to date, none of the two-body baryonic B decays has been observed. Many of earlier model predictions are too large compared to experiment. For example, the previous limit on $\bar{B}^0 \to p\bar{p} < 7\times10^{-6}$ set by CLEO has been recently pushed down to the level of 1.6×10^{-6} by Belle, whereas the model predictions are either too large or marginally comparable to the experimental.

We study the two-body and three-body charmful baryonic B decays: $\bar{B}^0 \to \Lambda_c \bar{p}$ and $\bar{B} \to \Lambda_c \bar{p}\pi(\rho)$. The factorizable W-exchange contribution to $\bar{B}^0 \to \Lambda_c \bar{p}$ is negligible. Applying the bag model to evaluate the baryon-to-baryon weak transition matrix element, we find $B(\bar{B}^0 \to \Lambda_c \bar{p}) \le 7.2\times10^{-6} \left| g_{B^0 p \sum_b{}^+} / 6 \right|^2$ with $g_{B^0 p \sum_b{}^+}$ being a strong coupling for the decay $\sum_b{}^+ \to \bar{B}^0 p$ and hence the predicted branching ratio is well below the current experimental limit. The factorizable contributions to $B^- \to \Lambda_c \bar{p}\pi^-$ can account for the observed branching ratio of order 6×10^{-4}. The branching ratio of $B^- \to \Lambda_c \bar{p}\rho^-$ is larger than that of $B^- \to \Lambda_c \bar{p}\pi^-$ by a factor of about 2.6. We explain why the three-body charmful baryonic B decay has a larger rate than the two-body one, contrary to the case of mesonic B decays.

We present a systematical study of two-body and three-body charmless baryonic B decays. Branching ratios for two-body modes are in general very small, typically less than 10^{-6}, except for the decays with a Δ resonance in the final state. For example, the

branching ratio of the tree-dominated decay $B^- \to p\bar{\Delta}^{--}$ can be as large as 6×10^{-6}, and the penguin-dominated decay $B^- \to \sum + \bar{\Delta}^{--}$ is at the level of 1×10^{-6}. For three-body modes we focus on octet baryon final states. The leading three-dominated modes are $\bar{B}^0 \to p\bar{n}\pi^-(\rho^-)$, $n\bar{p}\pi^+(\rho^+)$ with a branching ratio of order 3×10^{-6} for $\bar{B}^0 \to p\bar{n}\pi^-$ and 8×10^{-6} for $\bar{B}^0 \to p\bar{n}\rho^-$. The first measurement of the penguin-dominated decay $B^- \to p\bar{p}K^-$ by Belle indicates that the q^2 dependence of heavy-to-light baryon form factors is favored to be of the monopole form. The penguin-dominated decays $B^- \to p\bar{p}K^{-(*)}$ and $\bar{B}^0 \to p\bar{n}K^{-(*)}$, $n\bar{n}\bar{K}^{0(*)}$ all have appreciable rates. In contrast, the branching ratios of $\bar{B}^0 \to \Lambda\bar{p}\pi^+(\rho^+)$ are at most on the verge of 10^{-6}. We explain why some of charmless three-body final states in which baryon-antibaryon pair production is accompanied by a meson have a larger rate than their two-body counterparts: either the pole diagrams for the former have an anti-triplet bottom baryon intermediate state, which has a large coupling to the B meson and the nucleon, or they are dominated by the factorizable external W-emission process. (H.-Y. Cheng and K.-C. Yang)

(2) Implications of recent $\bar{B}^0 \to D^{(*)0}X^0$ measurements

The recent measurements of the color-suppressed modes $\bar{B}^0 \to D^{(*)0}\pi^0$ imply non-vanishing relative final-state interaction (FSI) phases among various $\bar{B} \to D\pi$ decay amplitudes. Depending on whether or not FSIs are implemented in the topological quark-diagram amplitudes, two solutions for the parameters a_1 and a_2 are extracted from data using various form-factor models. It is found that $|a_2(D\pi)| \sim 0.35 - 0.60$ and $|a_2(D^*\pi)| \sim 0.25 - 0.50$ with a relative phase of order 60° between a_1 and a_2 . If FSIs are not included in quark-diagram amplitudes from the outset, a_2^{eff}/a_1^{eff} and a_2^{eff} will become smaller. The large value of $|a_2(D\pi)|$ compared to $|a_2^{eff}(D\pi)|$ or naïve expectation implies the importance of long-distance FSI contributions to color-suppressed internal W-emission via final-state rescatterings of the color-allowed tree amplitude. (H.-Y. Cheng)

(3) $B \to J/\psi K^*$ decays in QCD factorization

The hadronic decay $B \to J/\psi K^*$ is analyzed within the framework of QCD factorization. The spin amplitudes A_0, $A_\parallel$ and $A_\perp$ in the transversity basis and their relative phases are studied using various different form-factor models for B-K^* transition. The effective parameters a_2^h for helicity h=0,+,- states receive different nonfactorizable contributions and hence they are helicity dependent, contrary to naïve factorization where a_2^h are universal and polarization independent. QCD factorization breaks down even at the twist-2 level for transverse hard spectator interactions. Although a nontrivial strong phase for the $A_\parallel$ amplitude can be achieved by adjusting the phase of an infrared divergent contribution, the

present QCD factorization calculation cannot say anything definite about the phase $\phi_{\parallel}$. Unlike $B \to J/\psi K$ decays, the longitudinal parameter a_2^0 for $B \to J/\psi K^*$ does not receive twist-3 corrections and is not large enough to account for the observed branching ratio and the fraction of longitudinal polarization. Possible enhancement mechanisms for a_2^0 are discussed. (H.-Y. Cheng, Y. Y. Keum, and K.-C. Yang)

(4) Applications of QCD factorization to semi-inclusive *B* decays

We have systematically investigated the semi-inclusive B decays $B \to MX$, which are manifestations of the quark decay $b \to Mq$, within a framework inspired by QCD-improved factorization. These decays are theoretically clean and have distinctive experimental signatures. We focus on a class of these that do not require any form factor information and therefore may be especially suitable for extracting information on the angles α and γ of the unitarity triangle. The nonfactorizable effects, such as vertex-type and penguin-type corrections to the two-body b decay, $b \to Mq$, and hard spectator corrections to the 3-body decay $B \to Mq_1\bar{q}_2$ are calculable in the heavy quark limit. QCD factorization is applicable when the emitted meson is a light meson or a charmonium. We discuss the issue of the CPT constraint on partial rate asymmetries. The strong phase coming from final-state rescattering due to hard gluon exchange between the final states can induce large rate asymmetries for tree-dominated color-suppressed modes $(\pi^0, \rho^0, \omega)X_{\bar{s}}$. The nonfactorizable hard spectator interactions in the 3-body decay $B \to Mq_1\bar{q}_2$, though phase-space suppressed, are extremely important for the tree-dominated modes $(\pi^0, \rho^0, \omega)X_{\bar{s}}, \phi X, J/\varphi X_s, J/\varphi X$ and the penguin-dominated mode $\omega X_{s\bar{s}}$. In fact, they are dominated by the hard spectator corrections. This is because the relevant hard spectator interaction is color allowed, whereas the two-body semi-inclusive decays for these modes are color-suppressed. Our result for $\beta(B \to J/\psi X_s)$ is in agreement with experiment. The semi-inclusive decay modes: $\bar{B}_s^0 \to (\pi^0, \rho^0, \omega)X_{\bar{s}}$, $\rho^0 X_{s\bar{s}}$, $\bar{B}^0 \to (K^- X, K^{*-} X)$ and $B^- \to (K^0 X_s, K^{*0} X_s)$ are the most promising ones in searching for direct CP violation. In fact, they have branching ratios of order $10^{-6} - 10^{-4}$ and CP rate asymmetries of order(10-40)%. The decays $\bar{B}_s^0 \to (\pi^0, \rho^0, \omega)X_{s\bar{s}}$ and $B^- \to \phi X$ are electroweak-penguin dominated. Some of them have sizable branching ratios and observable CP asymmetries. (H.-Y. Cheng and A. Soni)

(5) Symmetry breaking effects in heavy mesons

We investigate symmetry breaking effects in the static and transition properties of heavy mesons. Heavy mesons are particles consisting of one heavy valence quark (bottom or charm) and one light valence quark (up, down, or strange). It is well known that in the hypothetical limit where the heavy quark mass is taken to be infinite, we have heavy quark

symmetry with which we can relate the static and transition properties of heavy mesons with different flavors and spins. However, this is only a zeroth order approximation. In the real world, heavy quarks have finite masses, and in order to have a more accurate description of heavy meson properties, it is both necessary and important to consider also the various symmetry breaking effects. In this work, we study the effects due to finite heavy quark mass, which breaks heavy quark symmetry. Moreover, we also considered SU(2) symmetry breaking due to ligth quark (u, d) mass difference and electromagnetic effects. (C.-Y. Cheung, C.-W. Hwang, and W.-M. Zhang)

(6) Factorization theorem

The fundamental concept of perturbative QCD (PQCD) is factorization theorem, which states that nonperturbative dynamics of a high-energy QCD process either cancel or can be absorbed into hadron wave functions. The remaining part, being infrared finite, is calculable in perturbation theory. A full amplitude is then expressed as the convolution of a hard amplitude with hadron wave functions. A wave function, because of its nonperturbative origin, is not calculable. However, PQCD still possesses a predictive power, since a wave function is universal, *i.e.*, process-independent. With this universality, a wave function determined by some means, such as QCD sum rules and lattice theory, or extracted from experimental data, can be employed to make predictions for other processes involving the same hadron. Nonperturbative dynamics is reflected by infrared divergences in radiative corrections. There are two types of infrared divergences, soft and collinear. Soft divergences come from the region of loop momentum, where all its components are as small as a soft scale Λ. Collinear divergences arise from the region with the loop momentum parallel to the momentum of a massless fast-moving particle. In both regions the invariant mass of the radiated gluon diminishes as Λ^2, and the corresponding loop integrand may diverge as $1/\Lambda^4$. As the phase space for loop integration vanishes like $d^4l \sim \Lambda^4$, logarithmic divergences are generated.

Factorization of the above infrared divergences in a QCD process needs to be performed in momentum, spin, and color spaces. Factorization in momentum space means that a hard amplitude does not depend on the loop momentum of a soft or collinear gluon, which has been absorbed into a hadron wave function. Factorization in spin and color spaces means that there are separate fermion and color flows between a hard amplitude and a wave function, respectively. To achieve these, we rely on the eikonal approximation for loop integrals in leading infrared regions, the insertion of the Fierz identity to separate fermion flows, and the Ward identity to sum up diagrams with different color structures. Under the eikonal approximation, a soft or collinear gluon is detached from the lines in a hard amplitude and in other wave functions. The Fierz identity decomposes a full amplitude into contributions characterized by different twists. The Ward identity is essential for proving factorization

theorem in a nonabelian gauge theory.

We have derived the factorization of the scattering processes $\pi\gamma^* \to \gamma(\pi)$ and $\pi\gamma^* \to \pi$, and of the exclusive B meson decays $B \to \gamma l\bar{\nu}$ and $B \to \pi l\bar{\nu}$ at leading twist. Our proof is performed in the covariant gauge, in which collinear divergences also exist in irreducible diagrams for $\pi\gamma^* \to \gamma(\pi)$. The colleciton of these collinear gluons forms a path-ordered exponential along the light cone, which renders the pion distribution amplitude explicitly gauge invariant. The appearance of this exponential is a consequence of the Ward identity. It has been shown that in the heavy quark limit a gauge-invariant B meson wave function can be defined. The B meson wave function absorbs soft divergences of the decay processes, which differ from the collinear divergences in the pion distribution amplitude. However, it is still possible to construct a light-cone B meosn wave function, if an appropriate frame with the photon (pion) moving in the minus or plus direction is chosen. (H-n. Li)

(7) Sudakov effects

According to the above factorization theorem, the $B \to \pi$ form factor is written as

$$F^{B\pi} = \phi_B(\chi_1) \otimes H(\chi_1, \chi_2) \otimes \phi_\pi(\chi_2) \qquad (1)$$

where $\phi_B(\phi\pi)$ is the B meson (pion) distribution amplitude, and x the momentum fractions associated with the spectator quarks. A difficulty immediately occurs. The lowest-order diagram for the hard amplitude H is proportional to $1/\chi_1\chi_2^2$. If the pion distribution amplitude vanishes like χ_2 as $\chi_2 \to 0$ (in the leading-twist, *i.e.*, twist-2 case), $F^{B\pi}$ is logarithmically divergent. If the pion distribution amplitude is a constant as $\chi_2 \to 0$ (in the next-to-leading-twist, *i.e.*, twist-3 case), $F^{B\pi}$ even becomes linearly divergent. These end-point singularities have also appeared in the evaluation of the nonfactorizable and annihilation amplitudes for two-body nonleptonic B meson decays discussed below.

In PQCD calculations small parton transverse momenta k_T are included, which smear the end-point singularities from small momentum fractions. Because of the inclusion of parton transverse momenta, double logarithms $\ln^2(Pb)$ are generated from the overlap of collinear and soft enhancements in radiative corrections to meson wave functions, where P denotes the dominant light-cone component of a meson momentum, and b is the variable conjugate to k_T. The resummation of these double logarithms leads to a Sudakov form factor $\exp[-s(P,b)]$, which suppresses the long-distance contributions from the large b region with $b \sim 1/\bar{\Lambda}$, $\bar{\Lambda} \equiv M_B - m_b$ representing a soft scale with the B meson (b quark) mass $M_B(m_b)$. This suppression renders k_T^2 flowing into the hard amplitudes of order

$$k_T^2 \sim O(\bar{\Lambda} M_B) \qquad (2)$$

The off-shellness of internal particles then remain of $O(\bar{\Lambda} M_B)$ even in the end-point region, and the singularities are removed. This mechanism is so-called Sudakov suppression. (T. Kurimoto, H-n. Li, and A. I. Sanda)

(8) Nonleptonic decays

Two-body nonleptonic B meson decays are a challenging subject for both theorists and experimentalists. These modes are complicated because of nonperturbative QCD dynamics, and important, because measurements of their CP violation reveal the information of the unitarity angles. The conventional approach to two-body nonleptonic B meson decays is based on the factorization assumption (FA), in which nonfactorizable and annihilation contributions are neglected and final-state-interaction effects are assumed to be absent. Factorizable contributions are expressed as products of Wilson coefficients, meson decay constants, and hadronic form factors, which are then parametrized by models. Hence, the amplitude of the decay B→ππ is expressed as

$$\begin{aligned} A(B \to \pi\pi) &= C(\mu)\langle \pi\pi | O(\mu) | B \rangle, \\ &\approx C(\mu) f_\pi \langle \pi | (\bar{q}b)_{V-A} | B \rangle, \end{aligned} \qquad (3)$$

where C is the Wilson coefficient, O the four-fermion operator, f_π the decay constant, $(\bar{q}b)_{V-A}$ the V-A weak current, μ the renormalization scale, and the matrix element in the second line the B→π transition form factor $F^{B\pi}$.

Under the above approximation, FA is simple and provides qualitative estimation of branching ratios of various two-body nonleptonic B meson decays. However, there exist several serious theoretical drawbacks in FA. First, FA breaks the scale independence of decay amplitudes, which are physical quantities. Meson decay constants and form factors, being measurable, are scale-independent, while Wilson coefficients are scale-dependent as indicated in Eq. (3). Hence, decay amplitudes, expressed as their products, become scale-dependent.

Second, nonfactorizable amplitudes are not always negligible. It has been known that the decay modes, whose factorizable contributions arise from the internal W-emission with the small Wilson coefficient $a_2 = C_1 + C_2/N_c$, are dominated by nonfactorizable contributions. The ratio of the $B_d^0 \to D^+\pi^-$ and $B^+ \to D^0\pi^+$ branching ratios and the $B \to J/\psi K^*$ decays are the examples.

Third, the evaluation of strong phases is ambigious in FA. Strong phases are crucial, since they are related to CP asymmetries A_{CP} in two-body nonleptonic B meson decays:

$$A_{CP} \propto \sin\delta \sin\phi, \qquad (4)$$

where δ represents the strong phase. To extract the unitarity angle φ from the data of A_{CP}, δ must be determined unambigiously. In FA strong phases arise from the Bander-Silverman-Soni (BSS) mechanism (the charm loop), which are proportional to

$$\int du u(1-u)\theta(u)1-u)q^2 - m_c^2), \qquad (5)$$

q being the external momentum flowing through the charm loop and m_c the charm quark mass. Since q^2 is unknown, the above integral has large uncertainty. The problems of FA are

resolved in the PQCD approach. The infrared divergences in the vertex corrections are treated in the presence of the spectator quark. Therefore, the leading-twist B meson (pion) wave function can be defined, which absorbs the two-particle reducible infrared divergences on the B meson (pion) side. The two-particle irreducible infrared divergences cancel between the pair of diagrams, for instance, with the gluon emitted from the b quark attaching the light quark and the spectator quark, which form the outgoing pion in the $B\to\pi$ transition. In this treatment the external quarks remain on-shell, and the problem of the scale dependence is resolved without breaking gauge invariance.

In the PQCD picture the hard amplitudes for various topologies of diagrams, including factorizable, nonfactorizable and annihilation, are all six-quark amplitudes. That is, the B→π decay amplitude is written as the convolution,

$$A(B\to\pi\pi)=\phi_B\otimes H^{(6)}\otimes\phi_{\pi 1}\otimes\phi_{\pi 2} \qquad (6)$$

where $H^{(6)}$ represents a six-quark amplitude. In PQCD the end-point singularities do not exist because of the inclusion of Sudakov effects. Therefore, factorizable, nonfactorizable and annihilation amplitudes can be estimated in a consistent way in PQCD.

In PQCD strong phases mainly arise from the annihilation amplitudes, which are almost imaginary. The detailed reason is referred to. The strong phases are large, since they appear at the same order as the factorizable amplitudes. The BSS mechanism also contributes to the strong phases. In terms of the momentum fractions x_2 and x_3 asociated with the two pions, the invariant mass q^2 apearing in Eq. (5) is given by $q^2=x_2x_3M_B^2$ unambigiously. However, compared to the annihilation contributions, the BSS mechanism is of next-to-leading order, and less important. (Y. Y. Keum, H-n. Li, and A. I. Sanda; Y. Y. Keum and H-n. Li; C. H. Chen and H-n. Li)

(9) Power counting

The power behaviors of various topologies of diagrams for two-body nonleptonic B meson decays with the Sudakov effects taken into account has been discussed in details. The relative importance is summarized below:

$$\text{emission : annihilation : nonfactorizable}$$
$$=1:\frac{2m_0}{M_B}:\frac{\overline{\Lambda}}{M_B}, \qquad (7)$$

with m_0 being the chiral symmetry breaking scale. The scale m_0 appears because the annihilation contributions are dominated by those from the *(V-A)(V+A)* penguin operators, which survive under helicity suppression. In the heavy quark limit the annihilation and nonfactorizable amplitudes are indeed power-suppressed compared to the factorizable emission ones. Therefore, the PQCD formalism for two-body charmless nonleptonic B meson decays coincides with the factorization approach as $M_B\to\infty$. However, for the physical

value M_B~5 GeV, the annihilation contributions are essential. Note that all the above topologies are of the same order in α_s in PQCD. The nonfactorizable amplitudes are down by a power of $1/m_b$, because of the cancellation between a pair of nonfactorizable diagrams, though each of them is of the same power as the factorizable one. (C. H. Chen, Y. Y. Keum, and H-n. Li)

(10) Out of equilibrium and RHIC physics

It had been shown by Baier et al. (2001) in the limit $Q_S>>\Lambda_{QCD}$ corresponding to very large nuclei and/or very high collision energy, thermalization occurs relatively fast while the system is still undergoing one-dimensional expansion. These authors' analysis indicated that thermalization indeed occurs in the following steps. During the first period of time the most important process is the emission of soft gluons which overwhelm, in terms of number, the primary hard gluons at time $\tau\sim\alpha^{-5/2}Q_S^{-1}$. These soft gluons then quickly equilibrate and form a thermal bath, which initially carries only a small fraction of the total energy. The thermal bath then draws energy from the hard gluons. Full thermalization is achieved when the primary hard gluons have lost all their energy. We have introduced a real-time kinetic description which naturally accounts for the finite lifetime and nonequilibrium aspects of this bottom up QGP equilibration.(H.-L. Yu)

(11) Direct Photons: a nonequilibrium signal of the expanding quark-gluon plasma

Direct photon production from a longitudinally expanding quark-gluon plasma (QGP) at Relativistic Heavy Ion Collider (RHIC) and Large Hadron Collider (LHC) energies is studied with a real-time kinetic description that is consistently incorporated with hydrodynamics. Within Bjorken's hydrodynamical model, energy nonconserving (anti)quark bremsstrahlung $q(\bar{q})\to q(\bar{q})\gamma$ and quark-antiquark annihilation $q\bar{q}\to\gamma$ are shown to be the dominant nonequilibrium effects during the transient lifetime of the QGP. For central collisions we find a significant excess of direct photons in the range of transverse momentum $1\text{-}2\le p_T\le 5$GeV/c as compared to equilibrium results. The photon rapidity distribution exhibits a central plateau. The transverse momentum distribution at midrapidity falls off with *a power law* $P_T^{-\nu}$ with $2.5\le\nu\le 3$ as a consequence of these energy nonconserving processes, providing a distinct experimental *nonequilibrium signature*. The power law exponent ν increases with the initial temperature of the QGP and hence with the total multiplicity rapidity distribution dN_γ/dy. (S.-Y. Wang, D. Boyanovsky, and K.-W. Ng)

We study the production of photons through the non-equilibrium relaxation of a disoriented chiral condensate. We propose that to search for non-equilibrium photons in the direct photon measurements of heavy-ion collisions can be a potential test of the formation of disoriented chiral condensates. (D.-S. Lee and K.-W. Ng)

(12) Meson propagators in spontaneously broken gauge theories

In the past few years, I have been mainly engaged in the development of a consistent method of renormalization of the Standard Model in particle physics in four dimensional space-time. This is a collaboration with Hung Cheng of MIT, and Er-Cheng Tsai at the National Taiwan University. In the area of renormalization, most people nowadays are using the method of dimensional regularization. While it has been a success in treating gauge theories such as QED, Yang-Mills, etc, it encounters problems when one employs this method to renormalize gauge theories that are incorporated with chiral fermions. The main issue is how to handle γ^5. The definition of γ^5 is ambiguous in the method of dimensional regularization. However, in four dimensions, it can be rigorously defined. We have been able to develop a consistent and rigrous renormalization method in four dimensions to handle the problem with chiral fermions, i.e. with γ^5. This is a combination of the use of Ward identities with the method of subtraction. In this way, all the parameters are rigorously fixed.

A renormalization method for the Standard Model in four dimensions is important. First, the problem of the ambiguity in 5 can be taken care of in four dimensions. Second, it is an extension of the renormalization of Dyson. Thus, a renormalization method according to Dyson et.al. can be carried out beyond QED. Third, one can perform perturbative calculations on various physical amplitudes using this method without ambiguity. There is recent controversy on several experimental results which indicate that there is deviation from the prediction of the Standard Model. A calculation on these quantities using an unambiguous method should be useful and important. We are beginning to carry out such a calculation. (H. Cheng, S.-P. Li, and E.-C. Tsai)

(13) A guided Monte Carlo method for optimization problems

Over the past years, I have been trying to develop efficient optimization algorithms in order to treat highly complex problems such as the protein folding problem, the spin glass problem and the like. These problems have many important applications in everyday life. On the other hand, problems like these have been classified as NP hard problems and cannot be solved exactly. Thus, efficient algorithms that can find the optimal, or near optimal solutions are always needed.

In the past couple of years, in collaboration with one of my colleagues, T.K. Lee, we have been able to develop a new algorithm to treat global optimization problems. We call this algorithm the *guided Monte Carlo method*. In its original form, this algorithm could only treat optimization problems with continuous variables such as the Lennard-Jones microcluster problem. Although this algorithm has been shown to be powerful, the original algorithm has its own limitation. Many optimization problems in fact are problems with discrete variables,

such as the spin glass problem, the TSP, etc. In the past couple of months, I have been able to improve this algorithm to treat discrete optimization problems. With this improved algorithm, I have been able to treat three dimensional spin glass systems of dimension up to 12×12×12 with very high accuracy. One of the reasons for the success of this algorithm is the reduction of CPU time that it needs as compared to other methods such as the genetic algorithm. On the other hand, it can give much better results than those conventional algorithms such as simulated annealing. With this new algorithm, many discrete optimization problems can be treated. For example, the spin glass problem has been around for several decades and there are still many long-standing controversial problems in the field of spin glass such as the stability of the spin glass phase when a magnetic field is applied. The most recent study could only numerically treat system size of up to 600 spins. With this new algorithm, I believe we can vastly improve the numerical study and thus can help further develop a more rigrous theory for spin glass. Other problems can slso be studied in a similar fashion. One of our long term goal would be to study problems in biophysics such as the protein folding problem and the DNA sequencing problem. All these problems will need help from efficient new algorithms. (T.-K. Lee and S.-P. Li)

(14) Quantum bit commitment

Quantum bit commitment (QBC) is an important quantum cryptographic protocol involving a sender (Alice) and a receiver (Bob). Alice is secretly committed to a bit b (0 or 1), which she wants to communicate to Bob at a later time. In order to assure Bob that she will not change her mind in the interim period, Alice gives Bob a quantum mechanical wave function, which can later be used to verify her honesty. A QBC protocol is secure if (a) Alice cannot change her commitment without being discovered, and (b) Bob can obtain no knowledge of Alice's commitment before she discloses it. An unconditionally secure protocol is one which is secure even if Alice and Bob were endowed with unlimited computational power.

It is generally believed that unconditionally secure QBC is ruled out in principle by a "no-go theorem". We point out that the theorem only establishes the existence of a cheating unitary operator in any scheme of QBC, however there is no proof that the unitary operator is always known to the cheating party (Alice), hence it does not necessarily follow that QBC is insecure. In this work, we propose a scheme where Alice cannot construct the required unitary operator because it depends on Bob's unknown random choices; consequently the scheme is not breakable even with the help of a quantum computer. (C.-Y. Cheung)

3. Particle Astrophysics and Cosmology

(1) AMiBA: Array for Microwave Background Anisotropy

As part of a 4-year Cosmology and Particle Astrophysics (CosPA) Research Excellence Initiative in Taiwan, AMiBA - a 19-element dual-channel 85-105 GHz interferometer array is being specifically built to search for high redshift clusters of galaxies via the Sunyaev-Zeldovich Effect (SZE). In addition, AmiBA will have full polarization capabilities, in order to probe the polarization properties of the Cosmic Microwave Background. AMiBA, to be sited on Mauna Kea in Hawaii or in Chile, will reach a sensitivity of ~ mJy or 7 μ K in 1 hour. The project involves extensive international scientific and technical collaborations. The construction of AMiBA is scheduled to starting operating in early 2004. (K. Y. Lo, T. H. Chiueh, R. N. Martin, K.-W. Ng, H. Liang, U.-L. Pen, and C.-P. Ma)

We consider optimal observational strategies for interferometric measurements of the cosmic microwave background temperature and polarization, such as AMIBA. We conclude that even short drift scans extending over five fields of view allow almost complete ground subtraction at no cost in sensitivity, while providing excellent l-space resolution. Under such conditions, close-packing gives the highest sensitivity, and most of the signal arises from the shortest baselines. Drift scanning and continuous mosaicing also allow for clean E and B mode separation which is not otherwise possible. We address the issue of point source subtraction, optimal map construction and power spectrum estimation. (U.-L. Pen, K.-W. Ng, M. J. Kesteven, and B. Sault)

(2) Complex visibilities of cosmic microwave background anisotropies

We study the complex visibilities of the cosmic microwave background anisotropies that are observables in interferometric observations of the cosmic microwave background, using the multipole expansion methods commonly adopted in analyzing single-dish experiments. This allows us to recover the properties of the visibilities that is obscured in the flat-sky approximation. Discussions of the window function, multipole resolution, instrumental noise, pixelization, and polarization are given. (K.-W. Ng)

(3) The weak-field expansion for processes in a homogeneous background magnetic field

We study the neutrino-photon processes such as $\gamma\gamma \to \nu\bar{\nu}$ and $\nu\gamma \to \nu\gamma$ in a background magnetic field smaller than the critical magnetic field $B_C \equiv m_e^2 / e$. Using Schwinger's proper-time method, we extract leading magnetic-field contributions to the above processes. Our result is valid throughout the kinematic regime where both neutrino and photon energies are significantly smaller than m_W. We briefly discuss the astrophysical implications of our result.

The weak-field expansion of the charged fermion propagator under a uniform magnetic field is studied. Starting from Schwinger's proper-time representation, we express the charged fermion propagator as an infinite series corresponding to different Landau levels. This infinite series is then reorganized according to the powers of the external field strength B. For illustration, we apply this expansion to $\gamma \to \nu\bar{\nu}$ and $\nu \to \nu\gamma$ decays, which involve charged fermions in the internal loop. The leading and subleading magnetic-field effects to the above processes are computed. (T.-K. Chyi, C.-W. Hwang, W. F. Kao, G.-L. Lin, K.-W. Ng, and J.-J. Tseng)

SOLID STATE PHYSICS AND BIOPHYSICS

1. Surface Science and Thin Films

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(2) Creating a Pd-covered single-atom sharp W pyramidal tip
(3) Quantum size effects in low-temperature growth of Pb islands on Si(111)7×7 surfaces
(4) Correlation between quantized electronic states and oscillatory thickness relaxations of 2D Pb islands on Si(111)-7×7 surfaces
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1. Surface Science and Thin Films

(1) Structure and diffusion of small Ir and Rh clusters on Ir(001) surface

It is known that Ir adatoms diffuse on Ir(001) surface by atomic-exchange mechanism, whereas Rh adatoms diffuse on this surface by atomic-hopping mechanism. The question is how about their clusters, and how the mechanisms can affect their diffusion behavior and energetics. Using the field ion microscope, we have measured diffusion parameters of individual Rh and Ir adatoms and small clusters on Ir(001) surfaces. We also show how the activation energy changes as a function of the cluster size and shape. From the probability of observing different atomic configurations during diffusion, different diffusion mechanisms are investigated. By considering the energetics of different atomic processes, it appears that atomic-exchange is still favored for Ir dimers. But for clusters larger than trimers, the exchange mechanism is no longer favored. (T-Y Fu and T. T. Tsong).

(2) Creating a Pd-covered single-atom sharp W pyramidal tip

Single-atom sharp pyramidal W tips, wrapped in a Pd overlayer, having atom-perfect wedges can be routinely and repeatedly created using a surface-science technique. This single-atom tip is thermally stable up to 1000 K because of exceptionally large surface-energy anisotropy of the Pd covered W(111) surface. We conclude from atom-by-atom analysis that the W tip is covered with only one physical monolayer of Pd. We also investigate the mechanism and energetics of the atomic processes involved in its formation. (T-Y Fu, L. C. Cheng, C. H. Nien and T. T. Tsong).

(3) Quantum size effects in low-temperature growth of Pb islands on Si(111)7×7 surfaces

Flat-top Pb islands with critical and magic thickness have been observed in the Pb/Si(111)7×7 system at 200K by using scanning tunneling microscopy. The growth behavior, different from that in the Stranski-Krastanov mode, arises from a quantum size effect. Quantized states are detected in the I-V spectra on the Pb islands of varying thickness. Our observation of asymmetrical and oscillatory relaxation in the island height reveals that the charge distribution of confined electrons can influence the interlayer spacing. A simple model based on the infinite potential well can explain well all of our results. (W. B. Su, S. H. Chang, C. S. Chang, L. J. Chen and T. T. Tsong).

(4) Correlation between quantized electronic states and oscillatory thickness relaxations of 2D Pb islands on Si(111)-7×7 surfaces

Two-dimensional lead (Pb) islands of varying heights have been grown on the Si(111)-7×7 surface at low temperature. Individual islands are investigated concurrently with real-space and local-probe scanning tunneling microscopy and spectroscopy. Quantum size effects, manifested in the formation of new electronic bound states, redistribution of surface charge density, and oscillatory relaxations in island thickness are found to be perfectly correlated to each other. (W. B. Su, S. H. Chang, W. B. Jian, C. S. Chang, L. J. Chen, and T. T. Tsong).

(5) Dynamic behavior of Si magic clusters on Si(111) surfaces

In a STM study of Si(111) surfaces from room temperature (RT) to 600℃, we find a special type of clusters which are not only stable with respect to surface diffusion, but are also the fundamental unit in mass transport phenomena, step fluctuations, and epitaxial growth. We characterize the structure of these magic clusters at various tunneling biases. These clusters are mobile at temperatures above ~400℃. Most of the time, the cluster hops within a half-cell of Si(111)-(7×7). Sometimes it hops out of its original half, and moves to a spot usually a few hundred Å away. Using Arrhenius analysis, we derive path specific hopping rate parameters for these clusters. We also find that Si(111) steps fluctuate at elevated temperatures through detachment and attachment of magic clusters. We also find that the filling of 2D Si craters and the decay of 2D Si islands at elevated temperatures also proceed through attachment and detachment of Si magic clusters at step edges. When a 2D islands decay below a threshold size, it will suddenly decompose into several Si magic clusters. We believe the concept of magic clusters may have important implication on the fundamental mechanism in epitaxial growth of many covalently bonded semiconductors. (I. S. Hwang, M. S. Ho, and T. T. Tsong).

(6) Direct observation of electromigration of Si magic clusters on Si(111) surfaces

Using scanning tunneling microscopy, we have observed electromigration of Si on Si(111)-(7×7) surfaces and have identified the diffusion species to be Si magic clusters. Effects of the directed motion along the direction of the heating current in electromigration and those in thermal migration are determined separately and quantitatively. We also observe the preferential filling of two-dimensional (2D) Si craters and the preferential detachment of Si magic clusters from the edges of 2D Si islands near the cathode side. The driving force for this anisotropic behavior is much stronger than previously recognized. (M. S. Ho, I. S. Hwang and T. T. Tsong)

(7) Direct observation of atomic steps in dissociation of single H_2O molecules at Si(111)-7x7 surfaces

The adsorption of single water molecules on Si(111)-7x7 surface is investigated by scanning tunneling microscopy at elevated temperatures. A water molecule decomposes first into H and OH upon adsorbing on the surface. The OH radical can hop between neighboring adatom sites. At temperatures above 290 °C, it can further decompose into an H-atom and an O-atom, resulting in complete dissociation of a water molecule. Thus surface diffusion of single O-atoms is studied quantitatively for the first time with diffusion parameters derived from Arrhenius plots. Two main adsorption states for O-atoms appear as protruded spots but with different image brightness. They can switch from one state to the other randomly at an adatom site. This study will cast light on the fundamental mechanisms in the very initial stage of the wet oxidation process at silicon surfaces. (R. L. Lo, I. S. Hwang and T. T. Tsong)

(8) Determination of Si_3N_4/Si(111)-(8 x 8) surface

By collaborating with Prof. S. Gwo and Prof. Y. C. Chou at National Tsing-Hua University, a new structural of the Si_3N_4/Si(111)-(8 x 8) surface is proposed and determined by a combined study of Kikuchi Electron Holography, Scanning Tunneling Microscopy, and *ab initio* Calculations. (Ching-Ming Wei)

(9) Self-Diffusions of adatoms on Ni(100) surface

By collaborating with Dr. C. M. Chang and Prof. J. Hafner, *ab-initio* density functional theory is used to study the self-diffusion of adatoms on Ni(100) surface. In this paper, we have pointed out that all the previous theoretical results about the exchange diffusion on FCC (100) surfaces are not correct due to a small surface unit cell used in their calculations. (Ching-Ming Wei)

(10) Ultra high resolution X-ray micro-radiography using phase contrast enhancement.

We have reached highest lateral resolution in X-ray radiography using hard-X-ray—0.2 micrometer. Using an opticsless approach to apply phase contrast enhancement allows direct observation of small biological specimen with high lateral resolution, high contrast and time resolution.

Real time applications to the biological specimens, including small insects and animals have been tested in Taiwan and Korea synchrotron facilities. Large scale collaborative team has been formed to implement this technique to the medical

diagnosis and therapy.

The application in materials science has generated a number of interesting observation. Grain boundaries in pure materials—metal as well as polymer—was first time observed by X-ray radiography. High speed in radiology using phase contrast effect enables us to identify a tensile stress induced Ga diffusion in the Al alloy. Real time observation of the Zn electroplating process revealed a very special growth mode—Zn growth on H_2 bubbles—which links to very common growth defects.

With these successful applications, a beamline capable of producing hard-x-ray by using a wavelength shifter insertion device at SRRC (Synchrotron Radiation Research Center), was approved and is scheduled to operate at the summer 2002 which will be dedicated to phase contrast radiology and eventually becomes a general user facility. (Yeukuang Hwu)

(11) Synchrotron radiation based spectromicroscopy using photoelectron emission microscope

High lateral resolution (<100nm), high time resolution (video rate) and high energy resolution (<0.1 eV) spectromicroscopy has been established. This was the first successful SR spectromicroscopy in Taiwan and its applications include the observation of small local difference in the surface chemical state and the magnetic domain structures. An unique application of this technique in the hard-X-ray region has generate very high resolution capable to capture phase enhanced radiology. Similar spectroscopy under development in SRRC(Synchrotron Radiation Research Center) which will be opened to general users. (Yeukuang Hwu)

(12) Development synchrotron radiation techniques in the characterization of nanostructured materials.

Due to the lack of long range order in the structure of nanostructured materials, we have been collaborating with various materials research groups to develop suitable characterization methods, using synchrotron radiation, to characterized and analyze the structural and electronic properties of nanostructured materials.

Several methods, including EXAFS(Extended X-ray Absorption Fine Structure), XANES(X-ray Absorption Near Edge Structure), DAFS(Diffraction Anomalous Fine Structure) and SR-XRD(X-ray diffraction) have been applied in an integrated and complementary fashion. Such approach has been proven useful to provide additional information in the investigation of nanostructured materials. (Yeukuang Hwu)

(13) Diamond thin films

The Liquid phase metal enhanced diamond growth has been studied. Ag, Cu, Pd, Fe, Co, Ni etc. have been used as catalysts. Microwave and hot-wired plasma CVD method have been used for melting those metal catalysts. Carbon source-graphite powder in different ratios. These samples then were heated by either microwave or hot-wire in pure hydrogen gas environment at pressures about few torr. At the melting point of the metal catalyst, carbon molecules were dissociated and diffused into the molten metal, then recombined inside the molten metal as diamond structure. Hydrogen was also acted as one of the catalyst to stabilize the diamond structure and etch the non-diamond carbon off. From the results we have found that Ag is the best catalyst instead of Fe, Co or Ni, and hydrogen gas is necessary for diamond growth. It is concluded that gas phase reaction is still important in this process. (Y. Liou)

(14) Metal thin film and superlattices

Co thin films and Co/Au superlattices with different Co layer thickness have been grown on different substrates, such as Si, Ge, GaAs and MgO, by molecular beam epitaxy. The surface and crystal structures of the films or superlattices have been characterized by reflection high energy electron diffraction and x-ray diffraction. Textural growth instead of epitaxial growth was observed. Surface magnetism on the film surface and magnetic coupling between each Co layer were studied by magneto-optical Kerr effect and super conducting quantum interference device. Perpendicular magnetization was observed with Co layer thickness less than 10A. Magnetic coupling was ferromagnetic in these Co/As superlattices. (Y. Liou)

2. Magnetism

(1) The planar hall effect in permalloy films

We have studied the transverse field effect on the planar Hall effect sensitivity of 79 Permalloy films. This phenomenon was explained by considering the Zeeman-energy and the effective single-domain-rotation effects. In particular, for the square sample, it was found that the PHE sensitivity is as high as 310 Ω/T at the film thickness t = 500 Å, and the inoperative range for the transverse field becomes the narrowest among all the samples. More discussion was published in J. Appl. Phys. 90, 6297(2001). (S. U. Jen)

(2) Magnetostriction of Co-rich Co-Fe-Ni films

Co-rich Co-Fe-Ni ternary alloys were made either in a bulk or in a thin-film form. The strain-gauge method was employed to measure saturation magnetostriction λ_S of the bulk samples. In addition, the optical-cantilever method was used to measure λ_S of the thin-film samples. Firstly, in the case of bulk sample, we found that in the Co-rich corner of the Co-Fe-Ni ternary diagram, if e/a = 26.9, λ_S is zero, if e/a>26.9, λ_S is positive, and if e/a<26.9, λ_S is negative. The existence of the zero-λ_S line is closely related to the drastic sign changes of λ_{100} and λ_{111} in the region and to the structural transition from the fcc to the bcc phase near e/a = 26.9. Secondly, in the case of thin-film sample, we found that the zero-λ_S line is greatly bent toward the Co-Ni axis. λ_S is a function of the film thickness. More details were published in J. Magn. Magn. Mater. 236, 312(2001). (S. U. Jen)

(3) Magnetic, optical and electric properties of magnetic films and multilayers

Magnetic thin films have been intensively studied during recent years in our Institute. We will continue to study the magnetic, optical and electrical properties of various magnetic thin films prepared by MBE, evaporation, and sputtering etc. techniques. The spin valve effect has been the most promising candidate for a high density recording read head etc.. However, the antiferromagnetic biasing layer used in the spin valve structure to date is either easily oxidized, corrosive, or has a Neel temperature lower than the working temperature. We proposed to use antiferromagnetically coupled Fe/Si/Fe trilayer to replace the biasing layer. Because the Curie temperature of Fe is much higher than the usual Neel temperature, it is much promising for the industry. Thus, we studied the structure and coupling effect of Fe/Si trilayers and multilayers and determined the different phase of silicide and nature of coupling for different structure, thickness, and buffer layers. (Y. D. Yao, Y. Liou and S. F. Lee)

(4) Physical property of phase change materials

Optical recording technology has developed rapidly over the past few years, encouraging a renewed interest in phase change materials for use as erasable media. These materials, usually chalcogenide thin films, are switched between amorphous and crystalline states using the heat of a focusde laser beam. In general ,rouduy 20% reflectivity differences between the amorphous and crystalline states are required for recording purpose. Various phase change materials e.g. GeSbTeSe etc. have been febricated, and their physical properties will be investigated under this research topic. (Y. D. Yao)

(5) Tunneling magnetoresistance

Spin dependent tunneling magnetoresistance with Co and NiFe as electrodes, Al_2O_3 as insulating barrier were fabricated. When a thin layer of Co or CoFe was inserted in the NiFe/Al_2O_3 interface, magnetoresistance was strongly enhanced. The spin polarization effect, the oxidation process, and the crystal structures were studied. (Y. D. Yao and S. F. Lee)

(6) Surface Magneto-Optical Kerr Effect

A surface magneto-optical Kerr effect system was built by modifying a surface analytical system-VG ESCA Lab. The surface analytical system includes XPS, AES and LEED functions. The modification includes several deposition instrument-e-beam evaporator, filament evaporator, and a Moke instrument with a magnetic inside the vaccum chamber. Ultrathin films of Co deposition on Si or Ge surface have been studied. Perpendicular magnetization and alloy formations have been analyzed. Magnetic dead layers for different substrates and temperatures have been measured. A buffer-layer between Co and substrate in order to prevent alloy formation will influence the Co layer mag1etic property from perpendicular to in-plane magnetization. Co deposited on Si or Ge at room temperature shows no clear crystal structure observed from LEED. Since the crystal structure of Co thin films is undefined, we have difficulty to determine the relationship between the structure and the magnetic property. Co thicker films (>5 monolayers) have only in-plane magnetization but thinner films (<5 monolayers)have both in –plane and perpendicular magnetization.(Y. D. Yao,Y. Liou and S. F. Lee)

(7) Magnetic fluid study

In recent year, a great deal of efforts has been made on the understanding of the physical phenomena in various magnetic fluids. Magnetic field induced optica1 transmission studies in some magnetic fluid system have been investigated by us recently. In this year, we will continue to study magnetic and optical properties of some magnetic ferrofluids and magnetic fluids of colloidal particles as functions of the macro-size magnetic colloidal particles, the concentration of SDS, incident optical wavelengths, and applied magnetic fields etc.. (Y. D. Yao)

(8) Electronic properties of metallic thin films

A SQUID (Superconducting Quantum Interference Device) based small resistance bridge is in place. A resolution of 10^{-10} Ohm has been tested and will be incorporated

with a varying temperature, up to 9 tesla magnetic field sample space. We will measure very small resistance in metallic thin films and multilayers when current is applied perpendicular to the film plane. This so-called CPP technique was used to determine relative importance between bulk and interface effects of Giant Magnetoresistance effect. We will measure CPP resistance in Ferromagnet/Superconductor multilayers to study the interplay between cooper pair and ferromagnetic exchange field. (S.F. Lee)

(9) Physical properties of ferromagnet/superconductor multilayers

Electric and magnetic properties of trilayers and multilayers of superconducting Nb, NbTi, and ferromagnetic Co are studied. When a small magnetic field is applied perpendicular to the layer plane, Paramagnetic Meissner effect was observed but only when the superconducting layer thickness is no smaller than the penetration depth. When superconducting layer thickness is reduced, A crossover from three-dimensional behavior to two-dimensional one was observed. Form the parallel upper critical field versus temperature, we see the linear crossover to nonlinear behavior. The angular dependence of upper critical can also be used to judge this crossover, but our observation cannot be well-described by the theory. (S. F. Lee)

(10) Calorimetric evaluation of magnetic ordering and spin reorientation in ErGa3

Calorimetric measurements between 0.3 and 10 K have been made on a single crystal of the AuCu3-type cubic compound ErGa3. The temperature dependence of specific heat exhibits an antiferromagnetic ordering-induced peak near 2.7K, a second peak at 2.5K due to spin reorientation, and a Schottky anomaly with crystal field parameters x=0.17and W=0.22 K, all being in agreement with the result from neutron studies. The sum of the calculated entropies associated with the order-disorder process (R1n2) and the crystal-field effect, respectively, is lower by 0.1R than the experimentally derived magnetic entropy values at approximately 6 to 10 K. This diference provides an estimate of a 2-J/mol heat for the spin rotation process. An anticipated transition from an amplitude-modulated magnetic structure to an equal magnetic moment structure at temperatures near $T_N/2$ was not observed. (Y. Y. Chen, Y. D. Yao, C. R. Wang, and S. H. Lin)

(11) Magnetism in doped High Tc single crystals

Superconductivity in ferromagnetic Ru oxide based high Tc materials is an important phenomena discovered recently. We are working on another family of materials, BiPbSrCaCuO-2212 with Dy and Ho doping. These materials have much

higher Tc, ~90K, preliminary measurement at room temperature shows interesting results. Different concentrations are being investigated for their magnetic behavior. (Y K. Hwu, S. F. Lee, Y. D. Yao).

3.Quantum Size Effects and Nanostructures

(1) Size-Induced Transition from Magnetic Ordering to Kondo Behavior in (Ce, Al) Compounds

Magnetic ordering and Kondo behavior coexist in three (Ce,A1)-based compounds, $CeA1_2$, Ce_3Al and Ce_3Al_{11}. A common feature apparently independent of crystal structures also prevails in terms of the size-induced transition between these two magnetic phenomena. Calorimetric data show that, as the particle sizes are reduced to nano-scale, the specific heat anomaly associated with the magnetic ordering diminishes. Meanwhile, he increased coefficient γ of the linear term in specific heat indicates a large enhancement of the Kondo behavior. In 80Å-$CeAl_2$, for example, magnetic ordering completely disappears and the extrapolated γ reaches 9500 mJ $molCe^{-1}$ K^{-2} at absolute zero. This value falls in the highest range ever reported for heavy fermion compounds. Phys. Rev. Lett. 84, 4990. (Y. Y. Chen, Y. D. Yao, T. K. Lee etc.)

(2) Size effects on superconductivity and magnetism in $CeCo_2$

Both Ce and Co are essentially nonmagnetic in Pauli-paramagnetic $CeCo_2$, which undergoes a superconducting transition near 1 K. When made into 68-Å nanoparticles, the compound becomes paramagnetic with an effective magnetic moment of 6.1 μ_B/f.u. and undergoes a spin glass transition at T~12K. Low temperature calorimetric measurements indicate that they remain non-superconducting down to 0.4 K. Meanwhile, a Kondo behavior prevails such that the electronic specific heat coefficient γ is enhanced, reaching 300 mJ/mol K^2 at 0.4 K. Such intriguing effects are attributed to the increase of electronic energy level spacing and the change of energy band structure caused by size reduction. (Y.Y. Chen, C.R. Wang, Y.D. Yao etc.)

(3) Nano-electronics

Taking advantage of modern electron-beam lithography technology, we are able to fabricate various nanometer-scaled electronic devices with the critical dimension as small as 30 nm. The objective is two-fold: to study novel (quantum) effects associate the small length scale of the devices and to utilize these effects for applications such as signal detection or information processing. The relevant length scales range from

electron wavelength to phase breaking length, or spin relaxation length in magnetic systems. The materials that may be employed are superconductors, ferromagnets, semiconductors and novel materials such as carbon nanotubes and other synthesized nanowires, colloidal particles. These materials are patterned or arranged into one-dimensional narrow wires, quantum dots and point contacts. When incorporated with tunnel barriers, they can be configured into single electron transistors. Being able to control number of active electrons in single electron level, this transistor has niche in very demanding applications such as sensitive charge detectors and electrometers. The following is a brief to our recent research activities:

a. Suppression of superconductivity by spin imbalance in ferromagnetic-superconductor-ferromagnetic single electron transistors

We present here an experimental demonstration for suppression of superconductivity by spin imbalance. This effect is manifested under spin-polarized quasiparticle current injection in ferromagnet-superconductor-ferromagnet (Co/Al/Co) single electron transistors. The measured superconducting gap as a function of magnetic field reveals a dramatic decrease when the magnetizations of the two leads are misaligned. The effect of suppression increases with increasing source-drain voltage. A comparison with numerical calculations for single electron transistor in sequential tunneling regime is performed. The imbalance of spins is a nonequilibrium process. For this process to be effective, a sufficiently long spin relaxation time and a short energy relaxation time are required. Various factors that may affect this process are considered. This method may render it applicable to control superconductivity at low temperatures within low fields. Details are published in Physical Review Letters, 88, 047004 (2002).

Accumulation of excess spins is maximized when the magnetizations of the two ferromagnetic leads are in antiferromagnetic alignment. In our case, the AF alignments are caused by random domain distributions in the two Co leads, and the observed hysteresis in the superconducting gap as a function of applied field is simply a sign of magnetization reversal in probably a single domain. This then enables measurement of the magnetization relaxation time of a small domain. Experimentally, this relaxation time is found to be very long at low temperature (T~250mK) and has a strong temperature dependence. The dynamics of small domains is of interest as it is related to the response time of nano-spintronics.

b. Magnetic field-tuned superconductor-insulator transition in one-dimensional arrays of small Josephson junctions

We have studied experimentally the magnetic field induced superconductor-insulator quantum phase transition in one-dimensional arrays of small Josephson

junctions. It is found that the critical magnetic field that separates the two phases corresponds to the onset of Coulomb blockade of Cooper pairs tunneling in the current-voltage characteristics. The current-voltage characteristics for insulating states of samples having high normal resistances show clear Coulomb blockade threshold voltages, and are different from that of samples with low normal resistances. The resistance data are analyzed in the context of the superfluid-insulator transition in one dimension, and a finite temperature scaling analysis is performed to extract the critical exponents. The dynamical exponents z are determined to be close to 1, and the correlation length exponents ν are found to be approximately 0.3 and 0.45 in the two groups of measured samples. Details are published in Physical Review Letters, 87, 186804, (2001).

c. Gate-controlled spin polarized current in ferromagnetic single electron transistors

We theoretically investigate spin dependent transport in ferromagnetic/normal metal/ferromagnetic single electron transistors by applying master equation calculations using a two dimensional space of states involving spin and charge degrees of freedom. When the magnetizations of ferromagnetic leads are in anti-parallel alignment, the spins accumulate in the island and a difference of chemical potentials of the two spins is built up. This shift in chemical potential acts as charge offset in the island and alternates the gate dependence of spin current. Taking advantage of this effect, one can control the polarization of current up to the polarization of lead by tuning gate voltages. Details are to be published in Physical Review B as a regular article.

d. Single electron memory device with Au colloidal islands

By combining advanced electron beam lithography and nanophased-material synthesis techniques, we have successfully prepared single electron memory devices with Au colloidal islands linked by C_{60} derivatives. The transport measurements exhibit clear Coulomb blockade type current-voltage characteristics and hysteresis-type current modulation as a function of applied gate voltage. With the guidance provided by Monte Carlo simulation, we proposed a model circuit and gave an estimate of the sample parameters. (C. D. Chen)

4. Crystal Growth and Optical Properties of Non-linear Crystals

(1) Single crystal growth and their optical properties

Crystal growth is a science of high application. The various crystals can be used in manufacturing electronic, semiconductor as well as solid state laser devices and also are important materials for optical and instrument industry. Eighty decade is the

period of rapid expanding in tunable laser materials. After the successful growing of Cr:$BeAl_2O_4$ and Ti:Al_2O_3 laser crystals, there were found more than thirty laser crystals that can produce tunable laser light. In this project we are going to study the doping gannet family about their crystal growth and optical properties measurement.

Due to small and hardy requirement, the laser crystals are usually pumped by LD so that the efficient stability and reliability obtained great improvements. The aim of the first year project is to study the growth and optical properties of Nd: YAG crystal. The remaining time is then go to the study of those tunable doped YAG laser crystal and also other tunable laser materials.

The doped gannet crystals of large diameter can be grown by Czochralski pulling technique. X-ray diffraction and other optical measurements are employed to identify the structure and to inspect the quality of different doped garnet laser rods. It is hoped that the final outcome of this project can successfully manufacture some tunable solid state lasers for application usage. (W. -S. Tse)

(2) Semiconductor spectra study

Recently, we have added a high resolution Fourier Transform infrared spectrometer. We propose to measure the electronic excitation spectra of various donor and acceptor impurities in silicon and germanium. The measurements will be made mostly with the sample cooled to liquid helium temperature. Due to the very high resolution of the spectrometer, the positions of the peaks of the absorption lines could be determined precisely. Weak lines could also be resolved and observed. The shape and the width of the absorption lines from the high resolution measurements are also going to be used to study the possible reasons for the line broadening phenomenon.

Right now we are studying the behavior of a novel impurity center, i.e. magnesium-oxygen complex in silicon, which has never been reported in the literature before. Magnesium is well-known to be interstitial donor impurities in silicon. When diffused into silicon containing oxygen, the excitation spectrum observed clearly demonstrates for the first time that magnesium can complex with dispersed oxygen in silicon to form magnesium-oxygen complex donors. During the course of studying the behavior of this novel complex impurity, we have further found an unexpected phenomenon, which indicates that this complex impurity pair can even be formed in silicon at temperatures as low as ordinary room-temperature. The result of such an unusual feature has been accepted to be published in Physica B 302-303, 197-200 (2001). Considering that silicon is the material to be widely used in many important semiconductor industries today, it should be quite interesting to be aware of the

possibility that the basic characteristic of this material might change on its own at room-temperature. (T. -M. Ho)

5. Strongly Correlated Many-body Systems

(1) Phase separation in the t-J models

In 1998 we published a paper in Phys. Rev. B to study the phase separation in the t-J model. Our conclusion is that there is no phase separation for $J/t \leq 0.5$. Recently another group has come to the completely opposite conclusion that there is a phase separation for all values of J/t. Hence we have recalculated the phase separation boundary with larger system and higher order in the power-Lanczos method. Our conclusion is that there is no phase separation for $J/t \leq 0.4$. It is difficult to make a definite statement between $0.4 \leq J/t \leq 0.5$. This result essentially agrees with our previous result. Two papers on this topic are published in J. Phys. and Chem. of Solids and Physica C. (T. K. Lee)

(2) Resonant neutron peak, angle resolved photoemission and condensation energy in High Tc superconductors

In Phys. Rev. B 62, 1 (2000) we report our study for the t-t'-J model that the peak/dip/hump features observed in angle resolved-photo-emission spectra (ARPES) arise from the scattering of electrons by collective spin excitations which at the same time is also responsible for the neutron resonance mode. The doping dependence and the dispersions of the peak/dip/hump positions are shown to be consistent with experiments. The collective spin excitations are obtained by using the renormalized random phase approximation.

We have carried this calculation further in Phys. Rev. B64, 104518 (2001) to show that the superconducting condensation energy for optimally doped and overdoped cuprates are accounted for semi-quantitatively by including again the renormalized random phase approximation. The collective spin excitations responsible for the resonant neutron peak associated with the ARPES peak/dip/hump feature is also related to the condensation energy. (T. K. Lee)

(3) Magnetic polarization induced by nonmagnetic impurities in high Tc cuprates

The magnetic polarization induced by nonmagnetic impurities such as Zn in high Tc cuprates is studied by the variational Monte Carlo method. The variational wave function is constructed from the eigenstates obtained from Bogoliubov-de Gennes

mean-field Hamiltonian for the two-dimensional t-J model. A Jastrow factor is introduced to account for the induced magnetic moment and the repulsion between holes and the impurity. A substantial energy gain is obtained by forming an antiferromagnetic polarization around the impurity. We also find the doping dependence for the induced magnetic moment consistent with experiments. (T. K. Lee)

(4) Trapped atomic gases and Bose-Einstein condensation

We are also researching on physics of quantum many-body systems in atomic traps. This is an active field of research opened up by recent experimental advances, in particular the achievement of Bose Einstein Condensation. These trapped gases provide excellent opportunities to study many fundamental questions of theoretical interests. We are working on many of these fascinating issues, including trapped gases with internal (spin) degrees of freedom, physics of low dimensionality, possibility of (Cooper) pairing in trapped fermions, properties of superfluid mixtures etc. (Yip and Zhukov)

6. Biophysics

(1) Transverse Wave Propagation Equation in Circulatory System and Its Application to Physiology.

(2) E-M Field Effect on Biological System and Its Applications.

(3) Pulse Spectrum Analysis and Chinese Medicine.

Rats will be used as the experimental animal to study the effect of organ on the blood pressure wave and flow.

Energy in the circulatory system is mainly in the form of pressure. Kinetic energy is only a few percent. The pressure wave is the main energy source to push the blood flow. This project will study the relation between blood pressure wave and blood flow especially the blood pressure wave and the blood flow into organs. The main organ is kidney.

We will study the change of its elasticity and resistance effect on the blood pressure wave as well as the blood flow.

Besides, we have derived the transverse wave propagation equation in the artery and is studying the wave propagation property at the branch point. Organ or vascular bed will be included in this equation. Studies of the flow in the renal artery aorta and microcirculation in the kidney have been performed to evaluate the accuracy of the equation. In clinical application, blocking of the small artery, changing of elasticity of the arterial wall... all will be shown in the resonant frequency of this organ. This model

is closely related to Chinese Medicine which also emphasizes the pressure pushes the blood flow(氣行血). (W.-K. Wang)

(4) X-ray crystallography for macromolecules

The goal of this project is to construct a method to greatly increase the speed and accuracy of determining the structures of macromolecules by using x-ray diffraction data. We have developed a new method, the guided simulated annealing method, which puts emphasis on the amplitude of the structure factors instead of the phases as in the direct method. This method has some initial success with several large molecules and is now in the process of applying to study proteins. (T.K. Lee)

STATISTICAL AND COMPUTATIONAL PHYSICS

1. Equilibrium Phase Transitions

(1) Exact universal amplitude ratios for two-dimensional Ising model and a quantum spin chain.
(2) Critical behaviour of semi-infinite quenched dilute Ising-like systems in three dimensions: Ordinary transition.
(3) Universal scaling functions for bond percolation on planar random and square lattices with multiple percolating clusters.
(4) Polydispersity effect and universality of finite-size scaling function in continuum percolation.
(5) Exact amplitude ratio and finite-size corrections for the $M \times N$ square lattice Ising model.
(6) Random-cluster multi-histogram sampling for the q-state Potts model.
(7) Surface critical behavior of random systems at the special transition.
(8) Exact asymptotic expansions of free models on torus.

2. Nonequilibrium Statistical Physics

(1) Statistical properties of quasistatic fracture.
(2) Spiral cracks in drying precipitates.
(3) Heuristic derivation of continuum dynamics from microscopic dynamics.

3. Chaos and Nonlinear Dynamics

(1) Exact phase diagram for an asymmetric avalanche process.
(2) Multifractal charaterization of stochastic resonance.
(3) Pattern competition in photorefractive semiconductors.
(4) Multistability and high dimensional chaos in a semiconductor microwave device with time-delay feedback.
(5) Universality and scaling in waves of a sandpile model on regular and random lattices.
(6) Renormalization group study of a sandpile model on planar lattices.
(7) Universality and scaling in transition to synchronous chaos with local-global interactions.

4. Random Medium and Complex Fluid

(1) New mechanism of X-ray radiation from a relativistic charged particle in a dielectric random medium.
(2) Correlation function of random heteropolymer solutions.
(3) New phase transition in polymer solutions with multicomponent solvent.

5. Theoretical Biological Physics

(1) Lattice model of transmembrane polypeptide folding.
(2) Proteinlike behavior of a spin system near the transition between ferromagnet and spin glass.
(3) Structure determination of organic molecules from diffraction data by simulated annealing.
(4) [SMMP] A modern package for simulation of proteins.
(5) Multicanonical parallel simulations of proteins with continuous potentials.
(6) Evaluating the risks of engineered viruses: modeling pathogen competition.
(7) Helix-Coil transition in closed circular DNA.
(8) RNA folding in the presence of counterions.
(9) Protein folding in the presence of power-law correlations.
(10) Persistent and anti-persistent correlations in protein families and superfamilies.

The faculty members of this research group are Chin-Kun Hu, Kwan-Tai Leung, and Simon C. Lin. The postdoctoral fellows are Jau-Ann Chen, S. Hayryan (January 2001 - December 2002), Chai-Yu Lin (January 2001 - December 2002), A. M. Povolotsky (October 2001 - July 2002), A. Silchenko (left in May 2001), and Z. E. Usatenko (left in June 2001), Ming-Chya Wu (September 2001 - December 2003). The visiting associate research fellow is N. Sh. Izmailian (December 2001-July 2002).

During January-December 2001, we have published one paper in a conference proceedings and 17 papers in SCI journals, including one paper in *Nature*, 3 papers in *Physical Review Letters*, 7 papers in *Physical Review E*, one paper in *Journal of Computational Chemistry*, 2 papers in *Journal of the Physical Society of Japan*, one paper in *Computer Physics Communications*, one paper in *Physica B*, and one paper in *Ecol. Appl.*. Among authors of these 17 papers, Chi-Ming Chen was a visitor in the summer of 1999 and J. Dushoff was a postdoctoral fellow who left in August 2000.

We have submitted 10 manuscripts to SCI journals; two of them have been accepted by it *Physical Review E* as of Jan 15, 2002. The main research results are listed below.

1. Equilibrium Phase Transitions

(1) Exact universal amplitude ratios for two-dimensional Ising model and a quantum spin chain.

Let f_N and ξ_N^{-1} represent, respectively, the free energy per spin and the inverse correlation length of the critical Ising model on $N\times\infty$ lattice, with $f_N \to f_\infty$ as N$\to\infty$. We obtain analytic expressions for a_k and b_k in the expansions: $N(f_N - f_\infty) = \sum_{k=1}^{\infty} a_k / N^{2k-1}$ and $\xi_N^{-1} = \sum_{k=1}^{\infty} b_k / N^{2k-1}$ for square, honeycomb, and plane-triangular lattices, and find that $b_k / a_k = (2^{2k}-1)/(2^{2k}-1)$ for all of these lattices, i.e. the amplitude ratio b_k / a_k is universal. We also obtain similar expansions for the ground state energy and the first energy gap of a critical quantum spin chain and find that the amplitude ratios have the same values[N. Sh. Izmailian and C.-K. Hu, Phys. Rev. Lett. **86**, 5160-5163 (2001)]. (C. -K. Hu)

(2) Critical behaviour of semi-infinite quenched dilute Ising-like systems in three dimensions: Ordinary transition.

We study the surface critical phenomena of the semi-infinite quenched bulk dilute $|\phi^4|$ model in three dimensions using the massive field theory without resort to the ε-expansion. This theory involves two length parameters: the usual bulk "mass" (inverse correlation length) m, and the

surface enhancement constant c. Surface critical exponents are evaluated for the ordinary transition, which correspond to the limit $c/m \to \infty$, in the two-loop approximation at the random bulk fixed point. The associated double series expansions are analyzed using Pade approximants and Pade-Borel resummation techniques. Our numerical results for the surface critical exponents are in agreement with those obtained by Ohno and Okabe in the first order of $O\sqrt{\varepsilon}$ expansion [Z.E.Usatenko, M. A. Shpot and C.-K. Hu, Phys. Rev. E **63**, 056102 (2001)]. (C. -K. Hu)

(3) Universal scaling functions for bond percolation on planar random and square lattices with multiple percolating clusters.

Percolation models with multiple percolating clusters have attracted much attension in recent years. Here we use Monte Carlo simulations to study the bond percolation on $L_1 \times L_2$ planar random lattices, duals of random lattices, and square lattices with free and periodic boundary conditions in the vertical and horizontal directions, respectively, and with various aspect ratio L_1/L_2. We calculate the probability for the appearance of n percolating clusters, W_n, the percolating probabilities, P, the average fraction of lattice bonds (sites) in the percolating clusters, $\langle c^b \rangle_n \left(\langle c^s \rangle_n \right)$, and the probability distribution function for the fraction c of lattice bonds (sites) in percolating clusters of subgraphs with n percolating clusters, $f_n(c^b)(f_n(c^s))$. Using a small number of nonuniversal metric factors, we find that W_n, P, $\langle c^b \rangle_n \left(\langle c^s \rangle_n \right)$, and $f_n(c^b)(f_n(c^s))$ for random lattices, duals of random lattices, and square lattices have the same universal finite-size scaling functions. We also find that nonuniversal metric factors are independent of boundary conditions and aspect ratios [H. P. Hsu, S. C. Lin, and C.-K. Hu, Phys. Rev. E **64**, 016127 (2001)]. (C. -K. Hu)

(4) Polydispersity effect and universality of finite-size scaling function in continuum percolation.

We use a Monte Carlo method to calculate the exisience probability E_p for polydisperse continuum percolation and find that systems with mono- and polydispersity have the same finite-size scaling function for their E_p. Using an analytical argument with the idea of correlation function, we derive an equation for E_p, which is well approximated by the error function and is confirmed by the simulation results [H. Watanabe, S. Yukawa, N. Ito, C.-K. Hu, C.-Y. Lin, W.-J. Ma. J. Phys. Soc. Japan **70**, 1537-1542 (2001)]. (C. -K. Hu)

(5) Exact amplitude ratio and finite-size corrections for the $M \times N$ square lattice Ising model.

Let f, U and C represent, respectively, the free energy, the internal energy and the specific heat of the critical Ising model on the $M \times N$ square lattice with periodic boundary conditions, and

f_∞ represents f for fixed M/N and $N \to \infty$. We find that f, U and C can be written as: $N(f - f_\infty) = \sum_{i=1}^{\infty} f_{2i-1} / N^{2i-1}$, $U = -\sqrt{2} + \sum_{i=1}^{\infty} u_{2i-1} / N^{2i-1}$ and $C = 8 \ln N / \pi + \sum_{i=0}^{\infty} c_i / N^i$, i.e. N_f and U are odd function of N^{-1}. We also find that $u_{2i-1} / c_{2i-1} = 1/\sqrt{2}$ and $u_{2i} / c_{2i} = 0$ for $1 \le i < \infty$ obtain analytic equations for f, U, and C up to orders $1/N^5$, $1/N^5$, and $1/N^3$, respectively, which implies an analytic equation for c_5 [N. Sh. Izmailian and C.-K. Hu, Phys. Rev. E **65**, in press (2002)]. (C. -K. Hu)

(6) Random-cluster multi-histogram sampling for the q-state Potts model.

Using the random-cluster representation of the q-state Potts models we consider the pooling of data from cluster-update Monte Carlo simulations for different thermal couplings K and number of states per spin q. Proper combination of histograms allows for the evaluation of thermal averages in a broad range of K and q values, including non-integer values of q. Due to restrictions in the sampling process proper normalization of the combined histogram data is non-trivial. We discuss the different possibilities and analyze their respective ranges of applicability. [M. Weigel, W. Janke, C.-K. Hu, Phys. Rev. E **65**, in press (2002)]. (C. -K. Hu)

(7) Surface critical behavior of random systems at the special transition.

We use a three dimensional massive field theory up to the two-loop approximation to study the surface critical behavior of semi-infinite quenched random Ising-like systems at the special transition. Besides, we extend up to the next-to leading order, the previous first-order results of the $\sqrt{\varepsilon}$ expansion obtained by Ohno and Okabe [Phys. Rev. B **46**, 5917 (1992)]. The numerical estimates for surface critical exponents in both cases are computed by means of the Pad\'e analysis. Although our $\sqrt{\varepsilon}$ expansion results are consistent with Ohno and Okabe's first-order results, our higher order results are still unreliable because they imply a negative value of the critical exponent η. In the case of the massive field theory we also perform Padé-Borel resummation of the resulting two-loop series expansions for surface critical exponents and obtain $\eta_\parallel$=-0.238, Δ_1=1.098, $\eta_\perp$=-0.104, β_1=0.258, γ_{11}=0.839, γ_1=1.426, δ_1=6.521, and δ_{11}=4.249. These values are quite consistent with those obtained from the Pad\'e analysis and they imply $\eta = 2\eta_\perp - \eta_\parallel$=0.030 consistent with six-loop renormalization group calculation by Pelissetto and Vicari [Phys. Rev. B **62**, 6393, (2000)]. These values are different from critical exponents for pure semi-infinite Ising-like systems and show that in a system with quenched bulk randomness the plane boundary is characterized by a new set of surface critical exponents at the special transition [Z.E.Usatenko and C.-K. Hu]. (C. -K. Hu)

(8) Exact asymptotic expansions of free models on torus.

For the free models of statistical mechanics on torus, exact asymptotic expansion of the free energy in the vicinity of the critical point is found. It is shown that there is direct relation between the terms of the expansion and the Kronecker's double series. The latter can be expressed in terms of the elliptic θ-functions in all orders of the asymptotic expansion [E. V. Ivashkevich, N. Sh. Izmailian, and C.-K. Hu]. (C. -K. Hu)

2. Nonequilibrium Statistical Physics

(1) Statistical properties of quasistatic fracture.

We consider the slow generation of crack networks as a problem of pattern formation. Issues of pattern selection and the associated statistical properties are addressed by means of a detailed study of a spring-block model. Developed after desiccation experiments, the model describes the nucleation and propagation of cracks in an overlayer on a frictional substrate. Competition between stress concentration at crack tips and pinning effect by friction leads to a cellular, hierarchical pattern of cracks. We characterize the events prior to cracking by a growth of correlation in the stress field, and those during cracking by progressive damages manifested in the number of broken bonds and energy released. Qualitatively distinct regimes are shown to correspond to different stages of the evolution. Consistent with experiments, fragment area is quadratic in the sample thickness and decreases at larger friction. A novel scaling behavior of the dynamics in the thickness and substrate coupling is derived and verified, suggesting why morphologically similar patterns are so ubiquitous over a wide range of scales. (K.-t. Leung and Z. Neda)

(2) Spiral cracks in drying precipitates.

Under non-uniform stresses, instead of generating a network the crack propagates preferentially to maximize stress relief. This often leads to crack paths with fascinating shape. We investigate the formation of spiral crack patterns during the desiccation of thin layers of precipitates in contact with a substrate. This symmetry-breaking fracturing mode is found to arise naturally not from torsion forces, but from a propagating stress front induced by the fold-up of the fragments. We model their formation mechanism using a coarse-grain model for fragmentation and successfully reproduce the spiral cracks. Fittings of experimental and simulation data show that the spirals are logarithmic, corresponding to constant deviation from a circular crack path. Theoretical aspects of the logarithmic spirals are discussed. In particular

we show that this occurs generally when the crack speed is proportional to the propagating speed of stress front. [K.-t. Leung, Z. Neda, L. Jozsa and M. Ravasz, Nature **410**, 166 (2001); and preprint]. (K. -t. Leung)

(3) Heuristic derivation of continuum dynamics from microscopic dynamics.

Many nonlinear dynamical systems of interest are nonequilibrium by nature, meaning that a Gibbs ensemble and hence the partition function cannot be defined. To understand such systems, one has to start from the dynamics. A continuum, coarse-grained description of the dynamics is often advantageous over a discrete, microscopic one because more powerful tools are available for the former. In the literature, such continuum theories are seldom derived but usually proposed on grounds of symmetry and intuition. To partially remedy the situation, we introduce an approximate scheme of derivation from discrete microscopics for stochastic systems. The method was tested against accepted results for the Ising model and driven diffusive systems, with complete agreements. Apart from reassuring the validity of the standard field theory of driven diffusive systems, which has been cast in doubt recently, the method is quick and generally useful when more systematic and rigorous approaches such as omega expansion do not apply [K.-t. Leung, Phys. Rev. E **63**, 016102 (2001)]. (K. -t. Leung)

3. Chaos and Nonlinear Dynamics

(1) Exact phase diagram for an asymmetric avalanche process.

The Bethe ansatz method and an iterative procedure based on detailed balance are used to obtain exact results for an asymmetric avalanche process on a ring. The average velocity of particle flow, ν, is derived as a function of the toppling probabilities and the density of particles, ρ. As ρ increases, the system shows a transition from intermittent to continuous flow, and ν diverges at a critical point ρ_c with exponent α. The exact phase diagram of the transition is obtained and α is found to depend on the toppling rules [V. B. Priezzhev, E. V. Ivashkevich, A. M. Povolotsky, and C.-K. Hu, Phys. Rev. Lett. **87**, 084301 (2001)]. (C. -K. Hu)

(2) Multifractal charaterization of stochastic resonance.

We use a multifractal formalism to study the effect of stochastic resonance in a noisy bistable system driven by various input signals. To characterize the response of a stochastic bistable system we introduce a new measure based on the calculation of a singularity spectrum for a return time sequence. We use wavelet transform modulus maxima method for the singularity spectrum computations. It is shown that the degree of multifractality defined as a width of singularity spectrum can be successfully used as a measure of complexity both in the case of

periodic and aperiodic (stochastic or chaotic) input signals. We show that in the case of periodic driving force, singularity spectrum can change its structure qualitatively becoming monofractal in the regime of stochastic synchronization. This fact allows us to consider the degree of multifractality as a new measure of stochastic synchronization also. Moreover, our calculations have shown that the effect of stochastic resonance can be catched by this measure even from a very short return time sequence. We use also the proposed approach to characterize the noise-enhanced dynamics of a coupled stochastic neurons model. We use a multifractal formalism to study the effect of stochastic resonance in a noisy bistable system driven by an input signal. We use also the proposed approach to study the noise-enhanced dynamics of coupled stochastic neuron models [A. Silchenko and C.-K. Hu, Phys. Rev. E **63**, 041105 (2001)]. (C. -K. Hu)

(3) Pattern competition in photorefractive semiconductors.

We analytically study the photorefractive Gunn effect in an n-GaAs subjected to two external laser beams which form a moving interference pattern (MIP) in the semiconductor. When the intensity of the spatially dependent part of the MIP, denoted by I_0 m, is small, the system has a periodic domain train (PDT), consistent with the results of linear stability analysis. When I_0 m is large, the space-charge field induced by the MIP will compete with the PDT and result in complex dynamics, including amplification of high-field domains and a quasiperiodic route to chaos [Y.-H. Shiau and C.-K. Hu, J. Phys. Soc. Japan. **70**, 3636-3640 (2001)]. (C. -K. Hu)

(4) Multistability and high dimensional chaos in a semiconductor microwave device with time-delay feedback.

We propose a tunable microwave device consisting of a Gunn diode with time-delay feedback, which will emit high-dimensional chaotic waves. The wavelength is controlled by two incident laser beams which trigger the moving multiple Gunn-domains. Predicted phenomena include the coexistence of stationary and chaotic states, complicated hysteresis loops, persistent bistabiliy, transient and high-dimensional chaos, *etc*.. This device is potentially useful for secure microwave communications, memory devices, applications involving photorefractive effects, *etc*. (Y.-H. Shiau, H.-P. Chiang, Y.-C. Cheng, and C.-K. Hu).

(5) Universality and scaling in waves of a sandpile model on regular and random lattices.

Rice pile experiments suggest that self-organized criticality (SOC) might not be as "universal" and insensitive to the details of the system as ordinary systems driven to criticality by a turning parameter (Nature **379**, 49, 1996). Here we use Monte Carlo simulations to calculate probability distributions of areas of all, last, dissipating, and dissipating-last waves of

Bak-Tang-Wiesenfeld sandpile model of SOC on triangle, honeycomb, and random lattices with various linear dimensions. We find that such distributions have very nice finite-size scaling behaviors and these lattices have the same set of critical exponents as those of the square lattice (Phys. Rev. Lett. **77**, 107, 1996) (C.-Y. Lin and C.-K. Hu).

(6) Renormalization group study of a sandpile model on planar lattices.

One important step in the renormalization group (RG) approach to a lattice sandpile model is the exact enumeration of all possible toppling processes of sandpile dynamics inside a cell for RG transformations. Here we first propose a computer algorithm to carry out such exact enumeration for cells of planar lattices and we consider both the reduced-high RG equations proposed by Pietronero, Vespignani, and Zapperi (PVZ) [Phys. Rev. Lett. **72**, 1690 (1994)] and real-height RG equations proposed by Ivashkevich [Phys. Rev. Lett. **76**, 3368 (1996)]. Using this algorithm we are able to carry out RG transformations with large cell size, e.g. 3×3 cell for the sq lattice in PVZ RG equations, which is the largest cell size at the present, and find some mistakes in a previous paper [Phys. Rev. E **51**, 1711 (1995)]. For square (sq) and plane trianglar (pt) lattices, we obtain the only attractive fixed point for each lattice and calculate the avalanche exponent τ and the dynamical exponent z. Our results suggest that the multiple toppling events, which was negected in PVZ RG equations, should be included in the construction of RG equations in order to get accurate τ and z. (C.-Y. Lin and C.-K. Hu)

(7) Universality and scaling in transition to synchronous chaos with local-global interactions.

We consider transition to synchronous chaos in coupled map lattice as a dynamic phase transition. Synchronous chaos in spatially extended system often requires non-local interactions as a prerequisite. Such systems whose dynamics have both local and global components have been studied in modelling neuronal dynamics. Such dynamics leads to integro-differential equations in several systems. We study synchronous chaos in local-global coupled system. We find that this is a continuous transition in an unique universality class for many maps. For smaller nonlinearities, the behavior is different at short times but system essentially stays in same universality class. System with local-global couplings differs from pure global coupling in value of dynamic exponent z and behavior at small time scales and small length scales. Synchronized state could be viewed as a dynamic absorbing state. A comparison with directed percolation in presence of nonlocal couplings is presented. (P. M. Gade and C.-K. Hu)

4. Random Medium and Complex Fluid

(1) New mechanism of X-ray radiation from a relativistic charged particle in a dielectric random medium.

Based on the diffusional scattering of pseudophotons, within the framework of Born approximation, we propose a new mechanism of X-ray radiation from a relativistic charged particle moving in a system consisting of microspheres distributed randomly in a dielectric material. The mechanism leads to a stronger dependence of radiation intensity on the particle energy, $\gamma = E/mc^2$, than that predicted by the transition radiation, and explains recent experimental data from a detector which contains randomly distributed superconducting granules [Zh. S. Gevorkian, C. P. Chen, and C.-K. Hu, Phys. Rev. Lett **86**, 3324 (2001)]. (C. -K. Hu)

(2) Correlation function of random heteropolymer solutions.

We study the density-density correlation function of the dense random heteropolymer solutions. We show that a phase transition is possible due to the heterogeneity of polymers. We also show that the critical behavior of the system is described by the *O(N)* model at *N=0* [Zh.S. Gevorkian and C.-K. Hu]. (C. -K. Hu)

(3) New phase transition in polymer solutions with multicomponent solvent.

Considering the density-density correlation function of a concentrated polymer solution with multicomponent solvent we find a phase transition due to the heterogeneity of excluded volume constant. This new phase transition implies a strong enhancement of the scattered light intensity in the critical region, which can explain a recent experiment showing strong light scattering from a ternary polymer system consisting of polyethylene oxide (PEO) dissolved in nitroethane and 3methyl-pentane. (Zh.S. Gevorkian and C.-K. Hu)

5. Theoretical Biological Physics

(1) Lattice model of transmembrane polypeptide folding.

Folding of hydrophobic polypeptides into unique three-dimensional structures in a membrane is investigated by Monte Carlo simulations using the bond fluctuation model. Its ground state structure can be a helix or a double helix depending on the competition of hydrogen bonding and backbone bending energies. The folding pathway of hydrophobic polypeptides in a nonpolar environment is found to favor the helical structure over the double helix. The folding time of a transmembrane domain increases exponentially with the chain length. Folding at low temperatures exhibits an Arrhenius-like behavior. We discuss the kinetics of both random folding and channel complex assisted folding of a polypeptide chain. Our results suggest a significantly smaller energetic barrier in the folding pathway for channel complex assisted folding [C.-M. Chen, Phys. Rev. E 63, 010901 (2001)]. (C. -M. Chen)

(2) Proteinlike behavior of a spin system near the transition between ferromagnet and spin glass.

A simple spin system is studied as an analog for proteins. We investigate how the introduction of randomness and frustration into the system effects the designability and stability of ground state configurations. We observe that the spin system exhibits protein-like behavior in the vicinity of the transition between ferromagnet and spin glass. Our results illuminate some guiding principles in protein evolution [C.-Y. Lin, C.-K. Hu, and Ulrich H.E. Hansmann, Phys. Rev. E **64**, 052903 (2001)]. (C. -K. Hu)

(3) Structure determination of organic molecules from diffraction data by simulated annealing.

We study simulated annealing techniques for crystal structure determination from diffraction data. We demonstrate that for this problem the efficiency of simulated annealing can be systematically improved by an iterative simulation protocol. Our approach is tested for the example of 9-(methylamino)-1 H-phenalen-1-one-1, 4-dioxan-2-yl hydroperoxide solvate ($C_{18}H_{19}NO_5$) [H.-P. Hsu, U. H. E. Hansmann, and Simon C. Lin, Phys. Rev. E **64**, 056707 (2001)]. (Simon C. Lin)

(4) [SMMP] A modern package for simulation of proteins.

A Fortran package is presented which provides useful routines for molecular simulation of proteins within the standard geometry model. Highly efficient algorithms for the calculation of energy and its derivatives are implemented. A set of energy minimization routines and modern Monte-Carlo algorithms are added. Three different parameter sets are used to calculate the internal energy: ECEPP/2 potential, ECEPP/3 and the FLEX potential. The solvation energy of the protein can be calculated using the solvent accessible area method. The program is fast and may be successfully exploited even on a single PC. The code is free and open, and can be easily modified. Hence, the package allows researchers and students in a simple and inexpensive way to become familiar with protein simulation techniques, and is especially suitable for lecturers teaching molecular simulation. Yet, when exploited on advanced computers or PC clusters, it is a powerful tool in protein studies and also valuable for advanced researchers (Frank

Eisenmenger, U. H. E. Hansmann, Shura Hayryan, and C.-K. Hu, Computer Phys. Commu. **138**, 192-212 (2001)). (C. -K. Hu)

(5) Multicanonical parallel simulations of proteins with continuous potentials.

The determination of the three dimensional (3D) structure of a protein or peptide is a very important research problem in biological and medical sciences. Anfinsen's experiments (Science 1973, 181, 223) on renaturation of denatured proteins have shown that the native 3D structure of a (small) protein at low (room) temperatures is uniquely determined by its amino acid sequence, which suggests that it might be possible to determine the 3D structure of a protein from its amino acid sequence by pure computations. As a step toward that goal, in this paper we present a simple approach for parallelization of multicanonical Monte Carlo simulations of proteins with continuous potentials. Our method is based on the parallel calculation of the protein energy function. The algorithm is tested by simulated annealing and multicanonical simulations of two small peptides and known results are reproduced accurately. An acceptable degree of parallelization can be achieved in the simulation of Protein L using up to 30 PCs [S. Hayrian, C.-K. Hu, S.-Y. Hu, and R.-J. Shang, J. Comp. Chem. **22**, 1287-1296 (2001)]. (C. -K. Hu)

(6) Evaluating the risks of engineered viruses: modeling pathogen competition.

Recently there has been a great deal of interest in the potential use of genetically engineered baculoviruses as environmentally benign insecticides. Because baculoviruses often have a significant impact on the population dynamics of their hosts, any effort to assess the environmental impact of releasing engineered viruses must confront the question: Will genetically engineered baculoviruses outcompete wild-type strains, thereby altering the natural population dynamics of the host? To begin to answer this question, we develop a mathematical model of competitive interactions between genetically engineered and wild-type baculoviruses. We find that the interactions between these viruses are characterized mostly by dominance of one strain or the other, and that the chance that an engineered strain will outcompete a wild-type strain depends on its particular combination of speed of kill and infectiousness. That is, baculoviruses must kill their host to become infectious, so the faster speed of kill of most recombinant viruses confers a competitive advantage. Most such strains, however, also produce fewer infectious particles and so are less infectious. Our model shows that the extent of this decrease in infectiousness must be rather small for an engineered strain to become dominant. Nevertheless, even engineered strains that are at a substantial competitive disadvantage relative to the wild type may take decades to go extinct. An additional complicating factor is that the outcome of competition depends on the overwinter survival of these viruses, about which little is known even for wild-type viruses. Caution is therefore necessary in predicting the outcome of

competitive interactions involving introduced baculoviruses, and further work is needed in understanding pathogen overwinter survival rates [J. Dushoff and G. Dwyer, Ecological Applications **11**, 1602 (2001)]. (J. Dushoff)

(7) Helix-coil transition in closed circular DNA.

A simplified model for the closed circular DNA (ccDNA) is proposed to describe some specific features of the helix-coil transition in such molecule. The Hamiltonian of ccDNA is related to the one introduced earlier for the linear DNA. The basic assumption is that the reduced energy of the hydrogen bond is not constant through the transition process but depends effectively on the fraction of already broken bonds. A transformation formula is obtained which relates the temperature of ccDNA at a given degree of helicity during the transition to the temperature of the corresponding linear chain at the same degree of helicity. The formula provides a simple method to calculate the melting curve for the ccDNA from the experimental melting curve of the linear DNA with the same nucleotide sequence. (V. F.Morozov, E.SH. Mamasakhlisov, A.V.Grigoryan, Shura Hayrian, C.-K. Hu)

(8) RNA folding in the presence of counterions.

We consider a model of the large random RNA-like molecule in the solvent with sufficiently high concentration of counter-ions. The model includes the saturated (hydrogen bond-like) attraction between the complementary base pairs as well as screened Coulomb repulsion. We show that the proposed model exhibits a transition into the phase with a frozen tertiary and secondary structures dominated by a few thermodynamically relevant conformations just like the usual random heteropolymers. This agrees with the experimentally observed concept of slow folding of large RNA. The dependence of the secondary structure stability on the counter-ions concentration is studied also. We find that the obtained results are in qualitative agreement with experimental data. (E. SH. Mamasakhlisov, Shura Hayryan, V. F. Morozov, and C.-K. Hu)

(9) Protein folding in the presence of power-law correlations.

A model of random heteropolymer is studied using replica approach. Starting from a sequence-model Hamiltonian, the macromolecule is investigated in the presence of long-range correlations in sequence. We have predicted that random globule phase is unavailable for this class of heteropolymers. It is shown that at any temperature below θ point the polymeric globule has a strong trend to the microphase separation (MPS). The scale and magnitude of MPS are defined. The frozen phase can be reached only at the weak long-range correlations. (E.SH. Mamasakhlisov, Shura Hayrian, C.-K. Hu)

(10)Persistent and anti-persistent correlations in protein families and superfamilies.

This paper addresses the nonrandomness of proteins amino acids sequences. We consider the families and superfamilies of proteins according with their structural and functional properties. We use statistical method to analyze united random walks whose values formed by randomly sewed binary hydrophobic assignments of the amino acids along the proteins chains belonging to the same protein's family or superfamily. To quantify scaling features of proteins over united random walks, we use wavelet transform modulus maxima method. The results, which are based on proteins families and superfamilies in the PIR data base, clearly show that real proteins sequences can demonstrate both persistent and anti-persistent correlations depending on their fuctional and structural properties. Our results confirm the previous finding that proteins should have a nonrandom hydrophobicity structure to fold well. On the other hand, we observe that folding features do not depend on the type of correlations, that is in contradiction with the previous results giving a priority to the anti-persistent correlations. The presented wavelet-based approach to the study of proteins scaling properties could be used also as a power tool both for classification of proteins and for the study of their evolution. (A. N. Silchenko, Eugeny Sh. Mamasakhlisov, and C.-K. Hu)

III

List of Ongoing Research Projects

List of Ongoing Research Projects

中央研究院物理所九十年度計劃清單一覽表

(2000 年 8 月~2002 年 7 月)

主持人	計畫名稱	執行期間	計畫編號
王子敬	低能區微中子物理及探測器之研究	2000.08.01-2001.07.31	NSC89-2112-M-001-056
王子敬	微中子及天文粒子物理與探測器之研究	2001.08.01-2002.07.31	NSC90-2112-M-001-037
王明哲	重夸克及強作用物理之實驗探討(Ⅲ)(子計畫三):CDF 實驗之電腦模擬與數據分析	2000.08.01-2001.07.31	NSC89-2112-M-001-072
王明哲	重夸克及強作用物理之實驗探討(子計劃三)	2001.08.01-2002.07.31	NSC90-2112-M-001-040
王建萬	在 Spring-8 研究光致向量介子產生(Ⅲ)	2000.08.01-2001.07.31	NSC89-2112-M-001-057
王建萬	在 Spring-8 研究光致向量介子產生(Ⅳ)	2001.08.01-2002.07.31	NSC90-2112-M-001-025
王唯工	體外聲波對主動脈血壓波形之影響(2/3)	2000.08.01-2001.07.31	NSC89-2218-E-001-013
王唯工	正常鼠與高血壓之鼠腎臟脈動微循環與主動脈血壓波關聯之異同(2/3)	2000.08.01-2001.07.31	NSC89-2314-B-022-M08
王唯工	穴診儀之定量刻劃與動物實驗(二)	2001.01.01-2001.12.31	NRICM-90103
王唯工	正常鼠與高血壓之鼠腎臟脈動微循環與主動脈血壓波關聯之異同(3/3)	2001.08.01-2002.07.31	NSC90-2314-B-001-006
王唯工	體外聲波對主動脈血壓波形之影響(3/3)	2001.08.01-2002.07.31	NCS90-2213-E-001-036
任盛源	磁膜內應力及對磁性之影響	2000.08.01-2001.07.31	NSC89-2112-M-001-085
任盛源	外應力對磁膜內磁阻或電阻之影響	2001.08.01-2002.07.31	NSC90-2112-M-001-063
何侗民	矽與鍺中新雜質中心之形成及其特性之研究(2/3)	2000.08.01-2001.07.31	NSC89-2112-M-001-099
何侗民	矽與鍺中新雜質中心之形成及其特性之研究(3/3)	2001.08.01-2002.07.31	NSC90-2112-M-001-060
余岳仲	核微探針於電子材料之離子束分析研究	2000.08.01-2001.07.31	NSC89-2112-M-001-076
余岳仲	重離子誘發原子之 M-層游離截面研究	2001.08.01-2002.07.31	NSC90-2112-M-001-026
余海禮	微擾 QCD 與非平衡系統(1/3)	2000.08.01-2001.07.31	NSC89-2112-M-001-055
余海禮	微擾 QCD 與非平衡系統(2/3)	2001.08.01-2002.07.31	NSC90-2112-M-001-049
吳建宏	宇宙微波背景之圓偏極性	2000.08.01-2001.07.31	NSC89-2112-M-001-060
吳建宏	膺標量場之宇宙學	2001.08.01-2002.07.31	NSC90-2112-M-001-028

主持人	計畫名稱	執行期間	計畫編號
李世昌	重夸克及強作用物理之實驗探討(Ⅲ)(總計畫)及(子計畫一)	2000.08.01-2001.07.31	NSC89-2112-M-001-070
李世昌	參與 ATLAS 實驗搜尋新物理現象	2000.08.01-2001.07.31	NSC89-2112-M-001-075
李世昌	「科技萬花筒」電視節目腳本編製計畫-子計畫十二:高能物理	2000.12.01-2001.06.30	NSC89-2515-S-001-004
李世昌	參與 ATLAS 實驗搜尋新物理現象	2001.08.01-2002.07.31	NSC90-2119-M-001-008
李世昌	以精密質譜儀探測宇宙中之反物質及暗物質(Ⅲ)(總計劃)	2001.08.01-2002.07.31	NSC90-2112-M-001-041
李世昌	參與 ATLAS 實驗搜尋新物理現象	2001.08.01-2002.07.31	NSC90-2112-M-001-042
李世昌	以精密之太空質譜儀觀測宇宙射線(第一期)	2001.01.01-2001.12.31	本院 90 年度主題計劃
李世昌	以精密之太空質譜儀觀測宇宙射線(第二期)	2001.01.01-2001.12.31	本院 90 年度主題計劃
李定國	高溫超導的機制(1/3)	2000.08.01-2001.07.31	NSC89-2112-M-001-103
李定國	高溫超導的機制(2/3)	2001.08.01-2002.07.31	NSC90-2112-M-001-056
李尚凡	鈮/鈷和鈮鈦/鈷系統中超導性質二維至三維的轉變	2000.08.01-2001.07.31	NSC89-2112-M-001-087
李尚凡	超導/鐵磁多層薄膜的邊際效應與電流垂直平面電阻的量測(1/3)	2001.08.01-2002.07.31	NSC90-2112-M-001-064
李湘楠	B 物理與 CP 破壞	2001.08.01-2002.07.31	NSC90-2112-M-001-077
杜其永	顆粒流堵塞之實驗研究	2000.08.01-2001.07.31	NSC89-2112-M-001-054
杜其永	顆粒流堵塞之實驗研究(Ⅱ)	2001.08.01-2002.07.31	NSC90-2112-M-001-034
侯書雲	重夸克及強作用物理之實驗探討(總計劃)	2001.08.01-2002.07.31	NSC90-2112-M-001-038
姚永德	超薄磁性金屬膜之物理性質及相變形材料相變物理機制研究(Ⅱ)	2000.08.01-2001.07.31	NSC89-2112-M-001-088
姚永德	可用於光碟機之磁感應編碼元件之研發設計	2001.01.01-2001.12.31	90S13-J3
姚永德	超薄磁性金屬膜之物理性質研究(Ⅲ)	2001.08.01-2002.07.31	NSC90-2112-M-001-065
姚永德	超微小結構之物性研究	2001.01.01-2001.12.31	本院 90 年度主題計劃
胡宇光	超高解析度光電子能譜顯微術	2000.08.01-2001.07.31	NSC89-2112-M-001-089
胡宇光	相對比 X 光顯微術及能譜顯微術	2001.08.01-2002.07.31	NSC90-2112-M-001-072
胡進錕	展透與相變研究(3/3)	2000.08.01-2001.07.31	NSC89-2112-M-001-084

主持人	計畫名稱	執行期間	計畫編號
胡進錕	統計物理在跨領域之應用(1/3)	2001.08.01-2002.07.31	NSC90-2112-M-001-074
張志義	強子結構與非微擾量子色動力學(2/3)	2000.08.01-2001.07.31	NSC89-2112-M-001-079
張志義	強子結構與非微擾量子色動力學(3/3)	2001.08.01-2002.07.31	NSC90-2112-M-001-046
張嘉升	奈米系統中的區限效應對其相變的影響(1/3)	2001.08.01-2002.07.31	NSC90-2112-M-001-066
梁鈞泰	斷裂現象之圖型形成(2/2)	2000.08.01-2000.07.31	NSC89-2112-M-001-078
梁鈞泰	裂紋路徑之不穩性(1/2)	2001.08.01-2002.07.31	NSC90-2112-M-001-035
陳志強	可激發媒體在噪音影響下圖形產生之研究	2000.08.01-2001.07.31	NSC89-2112-M-001-058
陳志強	神經網路中同步發火現象之研究(1/2)	2001.08.01-2002.07.31	NSC90-2112-M-001-027
陳洋元	非傳統超導及不尋常磁性之研究(1/3)-子計畫三:重費米子系統之非傳統超導及量子相轉變研究	2000.08.01-2001.07.31	NSC89-2112-M-001-096
陳洋元	非傳統超導及不尋常磁性之研究(2/3)-子計畫三:重費米子系統之非傳統超導及量子相轉變研究	2001.08.01-2002.07.31	NSC90-2112-M-001-055
陳洋元	磁性超微粒之量子尺寸效應	2001.08.01-2002.07.31	NSC90-2112-M-001-075
陳啓東	單電子電晶體的量子效應研究(2/3)	2000.08.01-2001.07.31	NSC89-2112-M-001-101
陳啓東	單電子電晶體的量子效應研究(3/3)	2001.08.01-2002.07.31	NSC90-2112-M-001-059
章文箴	在 Spring-8 研究光致向量介子產生中之核物質效應	2000.08.01-2001.07.31	NSC89-2112-M-001-059
章文箴	在 Spring-8 研究光致向量介子產生中之核物質效應(Ⅱ)	2001.08.01-2002.07.31	NSC90-2112-M-001-036
曾忠一	半拉格朗日法在雲模式上的應用(五):地形效應	2000.08.01-2001.07.31	NSC89-2111-M-001-003
曾忠一	半拉格朗日法在雲模式上的應用	2001.08.01-2002.07.31	NSC90-2111-M-001-003
曾詣涵	奇異數 1 或 2 之超核系統(2/3)	2000.08.01-2001.07.31	NSC89-2112-M-001-080
曾詣涵	奇異數 1 或 2 之超核系統(3/3)	2001.08.01-2002.07.31	NSC90-2112-M-001-045
黃英碩	表面上動態過程與奈米結構性質之研究(1/3)	2001.08.01-2002.07.31	NSC90-2112-M-001-067
黃榮鑑	結合拉格蘭奇方法之波浪淺化效應之數值研究	2000.08.01-2001.07.31	NSC89-2611-E-001-003
黃榮鑑	二維方柱體渦漩逸出流場之研究(1/3)	2000.08.01-2001.07.31	NSC89-2611-E-001-004

主持人	計　　畫　　名　　稱	執行期間	計畫編號
黃榮鑑	二維方柱體渦漩逸出流場之研究(2/3)	2001.08.01-2002.07.31	NSC90-2611-E-001-002
黃榮鑑	含自由液面與複雜幾何邊界二維流場之數值研究	2001.08.01-2002.07.31	NSC90-2611-E-001-001
葉　平	以精密質譜儀探測宇宙中之反物質及暗物質(Ⅱ)總計畫	2000.08.01-2001.07.31	NSC89-2112-M-001-073
葉　平	以精密質譜儀探測宇宙中之反物質及暗物質(Ⅱ) (子計畫一):探測反物質及暗物質	2000.08.01-2001.07.31	NSC89-2112-M-001-074
葉崇傑	介觀超導與原子陷阱中之超流體(1/3)	2000.08.01-2001.07.31	NSC89-2112-M-001-105
鄭天佐	奈米材料和大分子中指定原子與分子鍵結特性的研究	2000.08.01-2001.07.31	NSC89-2119-M-001-0100
謝雲生	大功率固態雷射晶體(YB-YAG)之研究(I)	2001.01.01-2001.12.31	NSC90-2623-M-001-003

IV

Publication List of 2001

Chan, Chi-Keung（陳志強）

1. On-Uma Kheowan, C. K. Chan, V. S. Zykov, O. Rangsiman and S. C. Muller, *Spiral Wave Dynamics under feedback derived from a confined circular Domain*, Phys. Rev. E, 64, 035201-1 (2001).
2. L.-C. Jia, P. Y. Lai and C. K. Chan, *Avalanches and Flow Dyanmics of a Collapsing Granular Pile*, Traffic and Granular Flow '02, Springer Verlag, Germany, in press (2002).
3. H. J. Choi, S. T. Lim, Pik-Yin Lai and C. K. Chan, *Drag Reduction and Degradation of DNA in a Turbulent Flow*, submitted (2001).

Chang, Chia-Seng（張嘉升）

1. W.B. Su, S.H. Chang, C.S. Chang, W.B. Jian, L.J. Chen and T.T. Tsong, *Correlation between quantized electronic states and oscillatory thickness relaxations of 2D Pb islands on Si(111)7x7 surfaces*, Phys. Rev. Lett. 86, 5116 (2001).
2. W.B. Su, S.H. Chang, C.S. Chang, L.J. Chen and T.T. Tsong, *Quantum size effects in low temperature growth of Pb islands on Si(111)7x7 surfaces*, Jpn. J. Appl. Phys. 40, 4299 (2001).
3. T. T. Tsong, C. S. Chang, I. S. Hwang, T. Y. Fu, W. B. Su, M. S. Ho and R. L. Lo, *Electron and Atom Dynamics at Solid Surfaces and Relation to Epitaxy*, J. Phys. Chem. Solids 62, 1689-1730 (2001).
4. S. H. Chang, W. B. Su, W. B. Jian, C. S. Chang, L. J. Chen and T. T. Tsong, *Electronic Growth of Pb Islands on Si(111) at Low Temperature*, submitted to Phys. Rev. B.

Chang, Wen-Chen（章文箴）

1. B.B.Back *et al.* (E917 Collaboration), *Antilambda procduction in Au+Au collisions at 11.7 A GeV/c*, Phys. Rev. Lett. 87, 242301 (2001).
2. K.Adcox *et al.* (PHENIX Collaboration), *Measurement of the Midrapidity Transverse Energy Distribution from* $\sqrt{S_{NN}} = 130$ *GeV Au + Au Collisions at RHIC*, Phys. Rev. Lett. 87, 052301 (2001).
3. K.Adcox *et al.* (PHENIX Collaboration), *Centrality Dependence of Charged Particle Multiplicity in Au-Au Collisions at* $\sqrt{S_{NN}} = 130$ *GeV*, Phys. Rev. Lett. 86, 3500 (2001).
4. B.B.Back *et al.* (E917 Collaboration), *Baryon Rapidity Loss in Relativistic Au+Au Collisions*, Phys. Rev. Lett. 86, 1970 (2001).

5. W.C. Chang for the E917 collaboration, *E917 Results on Strangeness Production in Au+Au Collisions at AGS*, Proceedings of ICHEP2000, the 30th International Conference on High Energy Physics, p.573-577, World Scientific Publishing Company (2001).
6. T. Nakano for LEPS collaboration, *Multi-GeV laser-electron photon project at Spring-8*, Proceedings of Few Boday 16, Nucl. Phys. A684, 71c (2001).
7. B.B.Back *et al.* (E917 Collaboration), *Strangeness production in Au+Au collisions at AGS energies 2001*, Proceedings of Strangeness 2000, J. Phys. G27, 301-309 (2001).

Chen, Yen-Chu（陳彥竹）

1. CDF Collaboration, T. Affolder et al., *Measurement of* $\frac{d\sigma}{dY}$ *for high mass drell-yan* $e^+ e^-$ *pairs from* $\overline{P}$ *collisions at* $S^{1/2}$*=1.8 TeV*, FERMILAB-PUB-00-133-E, Jun 2000, e-Print Archive: hep-ex/0006025, Phys. Rev. D 63, 011101 (2001).
2. CDF Collaboration, T. Affolder et al., *Measurement of the top quark mass with the collider detector at fermilab*, FERMILAB-PUB-00-127-E, Jun 2000, Phys. Rev. D 63, 032003 (2001).
3. CDF Collaboration, T. Affolder et al., *Measurement of the w boson mass with the collider detector at fermilab*, FERMILAB-PUB-00-158-E, Jul 2000, e-Print Archive: hep-ex/0007044, Phys. Rev. D 64, 052001 (2001).
4. CDF Collaboration, T. Affolder et al., *Search for neutral supersymmetric higgs bosons in* $P\overline{P}$ *collisions at* $S^{1/2}$ *= 1.8 TeV*, FERMILAB-PUB-00-258-E, CDF-ANAL-EXOTIC-5328, Oct 2000, e-Print Archive: hep-ex/0010052, Phys. Rev. Lett. 86, 4472 (2001).
5. CDF Collaboration, T. Affolder et al., *Search for the supersymmetric partner of the top quark in* $\overline{P}$ *collisions at* $S^{1/2}$ *= 1.8 TeV*, FERMILAB-PUB-00-288-E, Nov 2000, e-Print Archive: hep-ex/0011004, Phys. Rev. D 63, 091101 (2001).
6. CDF Collaboration, T. Affolder et al., *Measurement of the two jet differential cross-section in* $P\overline{P}$ *collisions at* $S^{1/2}$ *= 1800 GeV*, FERMILAB-PUB-00-311-E, Dec 2000, e-Print Archive: hep-ex/0012013, Phys. Rev. D 64, 012001 (2001).
7. CDF Collaboration, T. Affolder et al., *First measurement of the ratio B(t* $\rightarrow$ *W B) / B(t* $\rightarrow$*W Q) and associated limit on the ckm element* $|V_{tb}|$, e-Print Archive: bf hep-ex/0012029, Phys. Rev. Lett. 86, 3233 (2001).
8. CDF Collaboration, T. Affolder et al., *Measurement of the t anti-t production cross section in p anti-p collisions at s**(1/2) = 1.8-TeV*, e-Print Archive: hep-ex/0101036. Phys. Rev. D 64, 032002 (2001).
9. CDF Collaboration, T. Affolder et al., *Search for narrow diphoton resonances and for gamma gamma + W / Z signatures in p anti-p collisions at s**(1/2) = 1.8-TeV*, e-Print Archive: hep-ex/0105066, Phys. Rev. D 64, 092002 (2001).

10. CDF Collaboration, T. Affolder et al., *Production of chi/c1 and chi/c2 in p anti-p collisions at s**(1/2) = 1.8-TeV*, Phys. Rev. Lett. 86, 3963 (2001).
11. CDF Collaboration, T. Affolder et al., *Cross section and heavy quark composition of gamma + mu events produced in p anti-p collisions*, e-Print Archive: hep-ex/0106004. Phys. Rev. D 65, 012003 (2002).
12. CDF Collaboration, T. Affolder et al., *Measurement of d(sigma)/dM forward-backward charge asymmetry for high mass Drell-Yan e+ e- pairs from p anti-p collisions at **(1/2) = 1.8-TeV*, e-Print Archive: hep-ex/0106047, Phys. Rev. Lett. 87, 131802 (2001).
13. E871 Collaboration, N. Leros et al., *HyperCP (E871) experiment at Fermilab: Search for direct CP violation in hyperon decays*, Nucl. Phys. Proc. Suppl. 99B, 211 (2001).
14. Jaroslav Antos, M. Breitung, Tony Chan, Paoti Chang, Yen-Chu Chen, Troy Dawson, Jim Fromm, Lisa Giacchetti, Tanya Levshina, Karen Shepelak, Miroslav Siket, Dane Skow, Stephen Wolbers, G.P. Yeh, Ping Yeh, *Design and First Tests of the CDF Run2 Farms, Computer Physics Communications*, Vol. 140, p239, (2001).
15. Jaroslav Antos, Marian Babik, Yen-Chu Chen, Miroslav Siket, Stephen Wolbers, *Design of the Production Farm web interface*, CDF Note 5556, Feb. 13 (2001).
16. Jaroslav Antos, Marian Babik, Yen-Chu Chen, Troy Dawson, Lisa Giacchetti, Terry Jones, Tanya Levshina, Igor Mandrichenko, Ramon Pasetes, Karen Shepelak, Miroslav Siket, Steven Timm, Stephen Wolbers, G.P. Yeh, Ping Yeh, *The CDF Run 2 Offline Computer Farms*, CDF Note 5702, Aug. 8, (2001).

Chen, Chii-Dong（陳啟東）

1. W. Kuo and C.D. Chen, *Scaling Analysis of Magnetic Field Tuned Phase Transitions in One-Dimensional Josephson Junction Arrays*, Physical Review Letters, 87, 186804, (2001).
2. C. D. Chen, Watson Kuo, D. S. Chung, J. H. Shyu, C. S. Wu, *Evidence for suppression of superconductivity by spin imbalance in Co-Al-Co single electron transistors*, Physical Review Letters 88, 047004, (2002).
3. Ampere A. Tseng, C. D. Chen, C. S. Wu, and Rudy E. Diaz, *Electron-Beam Lithography of Microbowtie Structures for Next Generation Optical Probe*, accepted for publication in J. of Microlithography, Microfabrication, and Microsystems, in press (2001).
4. C. D. Chen, Y. D. Yao, S. F. Lee and J.H. Shyu, *Magnetoresistance Study in Co-Al-Co and Al-Co-Al Tunneling Junctions*, accepted for publication in J. of Applied Physics, in press (2002).
5. C. D. Chen, Watson Kuo, D. S. Chung, J. H. Shyu, C. S. Wu, *Spin accumulation in ferromagnetic-superconductor- ferromagnetic double-barrier junctions*, Journal of Magnetism and Magnetic Materials, in press (2002).

6. C. D. Chen, Y. D. Yao, S. F. Lee and D. S. Chung, *Magnetoresistance Study in Ni-Al-Ni and Al-Ni-Al Tunneling Junction Systems*, Journal of Magnetism and Magnetic Materials, in press (2002).
7. Watson Kuo, C. D. Chen, *Gate-controlled spin polarized current in ferromagnetic single electron transistors*, Physical Review B, in press (2002).
8. S. M. Shih, W. F. Su, Y. J. Lin, C. D. Chen, *Fabrications and Electron Transport Properties of One Dimensional Arrays of Gold and Sulfur Containing Fullerene Nanoparticles*, submitted to Advanced Materials (2002).
9. S. M. Shih, W. F. Su, Y. J. Lin, C. D. Chen, *Two Dimensional Arrays of Self-assembled Gold and Sulfur Containing Fullerene Nanoparticles*, Nanotechnology, submitted (2002).
10. S. H. Liou, L. Yuan, L. Gao, Bill Doyle, Huaqing Yin, C. D. Chen, S. F. Lee and Y. D. Yao, *Switching behavior of patterned $Ni_{80}Fe_{20}$ islands*, submitted to Applied Physics Letters (2002).
11. S. F. Hu, Y. C. Wu, S. S. Liu, W. Z. Wong, C. L. Sung, C. D. Chen and T. Y. Huang, *An Investigation of Dual-Gate-Controlled Room Temperature Narrow-Channel Memory Based on Silicon-on Insulator Structure*, The 8th Symposium on Nano Device Technology (2001).

Chen, Chin-Ping（陳晉平）

1. Y.Liu, C.P.Chen, H.B.Li, C.H.Tang, C.Y.Chang, L.Hou, W.P.Lai, J.Li, S.T.Lin, C.S.Luo, J.F.Qiu, H.Y.Sheng, C.C.Wang, M.Z.Wang, S.C.Wang, H.T.Wong, B.Xin, Q.Yue, D.X.Zhao, S.Q.Zhao, Z.Y.Zhou, B.A.Zhuang, *Studies of prototype CsI(Tl) crystal scintillators for low-energy neutrino experiment*, Nucl. Instr. and Meth. in Phys. Research A, in press (2002).
2. W.P. Lai, K.C. Cheng, H.B. Li, H.Y. Sheng, B.A. Zhuang, C.Y.Chang, C.P. Chen,Y.P.Chen, H.C.Hsu, J.Li, C.Y.Liang, Y.Liu, Z.S.Liu, C.S.Luo, F.Shi, R.F.Su, P.K.Teng, H.T.Wong, Z.Y.Zhang, D.X.Zhao, J.W.Zhao, P.P.Zhao, Z.Y.Zhou, *The electronics and data acquisition systems of a CsI(Tl) Scintillating crystal detector for low energy neutrino experiment*, Nucl. Instr. and Meth. in Phys. Research A465, 550 (2001).
3. Zh. S. Gevorkian, C.P. Chen, and C.-K. Hu, *New mechanism of X-ray radiation from a relativistic charged particle in a dielectric random medium*, Phys. Rev. Lett. 86, 3324 (2001).
4. H.B. Li, Y. Liu, C.C. Chang, C.Y. Chang, J.H.Chao, C.P.Chen, T.Y.Chen, M. He, L. Hou, G.C.Kiang, W.P. Lai, S.C.Lee, J. Li, J.G. Lu, Z.P. Mao, H.Y. Sheng, R.F. Su, P.K. Teng, C.W. Wang, S.C. Wang, H.T. Wong, T.R. Yeh, Z.Y. Zhang, D.X. Zhao, S.Q. Zhao, Z.Y. Zhou, B.A. Zhuang, *A CsI(Tl) scintillating crystal detector for the studies of low energy neutrino interactions*, Nucl. Instr. and Meth. in Phys. Researc, in press (2002).

Chen, Jau-Ann（陳昭安）

1. J.-A. Chen and C.-K. Hu, *Virtural laboratory for computational physics*, technical report of LSCP (http://www.sinica.edu.tw/~statphys/) (2001).

Chen, Yang-Yuan（陳洋元）

1. Y. K. Chang, Y.H. Cheng, W.F. Pong, M.H. Tsai, Y.Y. Chen, J.W. Chiou, J.C. Jan, K. Asokan, F.Z. Chien, P.K. Tseng, T.E. Dann, M.S. Leu, T.S. Chin, *The Effect of Annealing Time on the Electronic Structure of the Fe-Cu-Nb-Si-B Alloys*, J. Electron Spectroscopy 114-116, 831-835 (2001).
2. Li-Ru Sung, Y.D. Yao, W. H. Lee and Y.Y. Chen, *Spin-Glass Freezing above the Ordering Temperature for the Kondo Antiferromagnet $CeNi_2Sn_2$*, Jpn. J. Appl. Phys. 40, L154-157 (2001).
3. C.R. Wang, Y.Y. Chen, Y.D.Yao, C.L. Chang, Y.S. Weng and C.Y. Wang, *Magnetic Properties in $CeCo_2$ Nanoparticles, Journal of Magnetism and Magnetic Materials*, in press (2001).
4. C.L. Yueh, J.C. Jan, J.W. Chiou, W.F. Pong, Y.K. Chang, Y.Y. Chen, Y.F. Lee, P.K. Tseng, S. L. Wei, C.Y. Wen, L.C. Chen and K.H. Chen, *Electronic structure of the Fe-layer-catalyzed carbon nanotubes studied by X-ray-absorption spectroscopy*, Applied Physics Letter, 79, 3179-3182. (2001).
5. J.C. Jan, K. Asokan, J.W. Chiou, W.F. Pong, P.K. Tseng, M.H. Tsai, Y.K. Chang, Y.Y. Chen, J.F. Lee, J.S. Wu, H.J. Lin, C.T. Chen, L.C. Chen, F.R. Chen and J.K. Ho, *Electronic Structure of Oxidized Ni/Au Contacts on p-GaN Investigated by X-ray Absorption Spectroscopy*, Applied Physics Letter, submitted (2001).
6. Y.Y. Chen, C.R. Wang, Y.D. Yao and S.Z. Xu, *Size effects on superconductivity and magnetism in $CeCo_2$*, Phys. Rev. Lett., submitted (2001).

Cheng, Hai-Yang（鄭海揚）

1. H. Y. Cheng and B. Tseng, *Resonant Final-State Interactions in Exclusive Hadronic D Decays to η and η'*, Chin. J. Phys. 39, 28 (2001).
2. H. Y. Cheng and K. C. Yang, *$B \to J/\psi K$ Decays in QCD Factorization*, Phys. Rev. D 63, 074011 (2001).
3. H. Y. Cheng and K.C. Yang, *Charmless $B \to VV$ Decays in QCD Factorization: Implications of $B \to \phi K^*$ Measurement*, Phys. Lett. B 511, 40 (2001).

4. H. Y. Cheng and K.C. Yang, *Analysis of $B\to \phi K$ Decays in QCD Factorization*, Phys. Rev. D 64, 074004 (2001).
5. H. Y. Cheng and A. Soni, *Semi-inclusive B Decays and Direct CP Violation in QCD Factorization*, Phys. Rev. D 64, 114013 (2001).
6. H. Y. Cheng and K.C. Yang, *Charmful Baryonic B Decays $B^0 \to \Lambda_c \overline{p}$ and $B \to \Lambda_c \overline{p}\pi$ (9)*, Phys. Rev. D, submitted (2002).
7. H. Y. Cheng, *Implications of Recent $\overline{B}^0 \to D(*)^0 X^0$ Measurements*, hep-ph/0108096, submitted to Phys. Rev. D (2002).
8. H. Y. Cheng, Y.Y. Keum and K.C. Yang, *$B \to J/\varphi K^*$ in QCD Factorization*, hep-ph/0111094, submitted to Phys. Rev. D (2002).
9. H. Y. Cheng and K.C. Yang, *Charmless Exclusive Baryonic B Decays*, hep-ph/0112245. submitted to Phys. Rev. D (2002).
10. H. Y. Cheng, *Exclusive and Semi-inclusive B Decays in QCD Factorization*, in Proceedings of the EPS International Conference on High Energy Physics, Budapest, July 12-18, 2001 (D. Horvath, P. Levai, A. Patkos, eds.), JHEP (http://jhep.sissa.it/) Proceedings Section, PrHEP-hep2001/448.
11. H. Y. Cheng, *Semi-inclusive B Decays and Direct CP Violation in QCD Factorization*, to appear in Proceedings of the First International Conference on Flavor Physics, Zhang-Jia-Jie, China, May 31-June 6, 2001.

Cheung, Chi-Yee（張志義）

1. Chi-Yee Cheung, *Quantum Bit Commitment can be Unconditionally Secure*, quant-ph/0112120, submitted to Physical Review Letters (2002).
2. Chi-Yee Cheung, Chien-Wen Hwang, and Wei-Min Zhang, *Summery Breakings in Strong and Electromagnetic Decays of Heavy Mesons*, Physical Review D, submitted (2002.

Chien, Lai-Chen（簡來成）

1. L. C. Chien, *Maxwell-Navier-Stokes Model on Material Process*, AIAA 2002-0759 (2002).
2. L. C. Chien, *Magnetic Effects on Convection of Liquid Encapsulated Floating Zone*, AIAA 2001-0617 (2001).
3. W. C. Chen and L. C. Chien, *Effect of Gravity on Solid/Liquid Boundary Layer Characteristics during Crystal Disssolution and Growth*, Intl. Astronautics Federation, IAF-01-J4.06 (2001).

Chou, Chung-Hsien（周忠憲）

1. Darwin Chang, We-Fu Chang, Chung-Hsien Chou and Wai-Yee Keung, *Large Two-Loop Contributions to g-2 from a Generic Pseudoscalar Boson*, Phys. Rev. D 63, 091301(R) (2001).
2. Chih-Lung Chou and Chung-Hsien Chou, *Tau polarizations in the three-body slepton decays with stau as the next lightest supersymmetric particle*, Phys. Rev. D 64, 075008 (2001).
3. Kingman Cheung, Chung-Hsien Chou, and Otto C.W. Kong, *Muon anomalous magnetic moment, two-Higgs-doublet model, and supersymmetry*, Phys. Rev. D 64, 111301(R) (2001).
4. Chung-Hsien Chou, Hsien-Hung Shih, Shih-Chang Lee and Hsiang-nan Li, *$\Lambda_b \to \Lambda J/\psi$ decay in perturbative QCD*, hep-ph/0112145, Phys. Rev. D, submitted (2002).

Hayryan, Shura

1. S. Hayryan, C.-K. Hu, S.-Y. Hu and R.-J. Shang., *Multicanonical parallel simulation of proteins with continuous potentials*, J. Comp. Chem. 22, 1287-1296 (2001).
2. F. Eisenmenger, S. Hayryan, and C.-K. Hu, *[SMMP] A modern package for simulation of proteins*, Computer Phys. Commu., 138, 192-212 (2001).
3. V. F. Morqzov, E. SH. Mamasakhlisov, Shura Hayryan, C.-K. Hu, *Helix-coil transtion in closed circular DNA*, Phys. Rev. E, submitted (2001).

Ho, L. –T（何侗民）

1. L. T. Ho, *Heating Effect on Silicon containing Magnesium and Oxygen*, Bull. Am. Phys. Soc. 46, 210 (2001).
2. L. T. Ho, *Room-Temperature Formation of Magnesium-Oxygen Complex Impurities in Silicon*, Physica B: Condensed Matter Vol 302, 197 (2001).
3. L. T. Ho, *Double Donor Behavior of Magnesium-Oxygen Complex Impurities in Silicon*, Int. J. of IR and MM Waves (2002).

Hou, Suen（侯書雲）

1. Belle collab., K. Abe et al., *Measurement of $B(\overline{B}^0 \to D+\ell-\overline{\nu})$ and Determination of $|V_{cb}|$*, BELLE-PREPRINT-2001-20, hep-ex/0111082, Nov. (2001).
2. Belle collab., K. Abe et al., *Observation of $B^+ \to \chi_c C_0 K^+$* , hep-ex/0111069, Nov. (2001).

3. Belle collab., K. Abe et al., *Determination of $|V_{cb}|$ using the semileptonic decay $\overline{B}^0 \to D^* + e - \overline{\nu}$* , BELLE-PREPRINT-2001-19, hep-ex/0111060, Nov. (2001).
4. Belle collab., K. Abe et al., *Observation of Cabibbo-suppressed and W-exchange Λ_c^+ baryon decays*, BELLE-PREPRINT-2001-17, hep-ex/0111032, Nov. (2001).
5. Belle collab., K. Abe et al., *A Measurement of Lifetime Difference in D^0 Meson Decays*, BELLE-PREPRINT-2001-18, hep-ex/0111026, Nov. (2001).
6. Belle collab., K. Abe et al., *Production of Prompt Charmonia in e^+e^- Annihilation at $\sqrt{s} \approx 10.6$ GeV*, BELLE-PREPRINT-2001-15, hep-ex/0110012, Oct. (2001).
7. Belle collab., K. Abe et al., *Observation of the Decay $B \to K \ell^+ \ell^-$*, Phys. Rev. Lett. 88, 021801 (2002), BELLE-PREPRINT-2001-13, hep-ex/0109026, Sep. (2001).
8. Belle collab., K. Abe et al., *Observation of Color-suppressed $\overline{B}^0 \to D^0\pi^0, D^{*0}\pi^0, D^0\eta$, and D_w^0 Decays*, BELLE-PREPRINT-2001-14, hep-ex/0109021, Sep. (2001).
9. Belle collab., K. Abe et al., *Measurement of the Branching Fraction for $B \to \eta' K$ and Search for $B \to \eta' \pi^+$*, Phys. Lett. B 517, 309 (2001).
10. Belle collab., K. Abe et al., *Observation of large CP violation in the neutral B meson system*, Phys. Rev. Lett. 87, 091802 (2001).
11. Belle collab., K. Abe et al., *Search for direct CP violation in $B \to K\pi$ decays*, Phys. Rev. D64, 071101 (2001).
12. Belle collab., K. Abe et al., *Observation of $B \to \phi K_1(1270)$*, Phys. Rev. Lett. 87, 161601 (2001).
13. L3 collab., P. Achard et al., *Study of the $W^+W^-\gamma$ Process and Limits on Anomalous Quartic Gauge Boson Couplings at LEP*, CERN-EP-2001-080, hep-ex/0111029, Nov. (2001).
14. L3 collab., P. Achard et al., *Double-Tag Events in Two-Photon Collisions at LEP*, CERN-EP-2001-075, hep-ex/0111012, Oct. (2001).
15. L3 collab., P. Achard et al., *$f_1(1285)$ Formation in Two-Photon Collisions at LEP*, CERN-EP-2001-073, hep-ex/0110073, Oct. (2001).
16. L3 collab., P. Achard et al., *Measurement of the Charged-particle multiplicity and inclusive momentum distributions in Z decays at LEP*, CERN-EP-2001-072, hep-ex/0110072, Oct. (2001).
17. L3 collab., P. Achard et al., *earch for R-parity Violating Decays of Supersymmetric Particles in e^+e^- Collisions at LEP*, Phys. Lett. B 524, 65 (2002) CERN-EP-2001-068, hep-ex/0110057, Oct. (2001).
18. L3 collab., P. Achard et al., *Inclusive π^0 and K_S^0 Production in Two-Photon Collisions at LEP*, Phys. Lett. B 524, 44 (2002), CERN-EP-2001-065, hep-ex/0109037, Oct. (2001).

19. L3 collab., P. Achard et al., *Bose-Einstein correlations of neutral and charged pions in hadronic Z decays*, Phys. Lett. B 524, 55 (2002), CERN-EP-2001-063, hep-ex/0109036, Oct. (2001).
20. L3 collab., P. Achard et al., *Measurement of the Topological Branching Fractions of the τ lepton at LEP*, Phys. Lett. B519, 189 (2001).
21. L3 collab., P. Achard et al., *Standard Model Higgs Boson with the L3 Experiment at LEP*, Phys. Lett. B517, 319 (2001).
22. L3 collab., P. Achard et al., *Search for Heavy Neutral and Charged Leptons in e^+e^- Annihilation at LEP*, Phys. Lett. B517, 75 (2001).
23. L3 collab., P. Achard et al., *Search for Heavy Isosinglet Neutrino in e^+e^- Annihilation at LEP*, Phys. Lett. B517, 67 (2001).
24. L3 collab., M. Acciarri et al., *Total Cross Section in $\gamma\gamma$ Collisions at LEP*, Phys. Lett. B519, 33 (2001).
25. L3 collab., M. Acciarri et al., *Study of the $e^+e^- \to Z\gamma\gamma \to q\bar{q}\gamma\gamma$ Process at LEP*, Phys. Lett. B505, 47 (2001).
26. L3 collab., M. Acciarri et al., *Measurement of the Tau Branching Fractions into Leptons*, Phys. Lett. B507, 47 (2001).
27. L3 collab., M. Acciarri et al., *Measurement of the Charm Production Cross Section in $\gamma\gamma$ Collisions at LEP*, Phys. Lett. B514, 19 (2001).
28. D0 collab., B. Abbott et al., *High-p_T Jets in $\bar{p}p$ Collisions at $\sqrt{s} = 630$ and 1800 GeV*, Phys. Rev. D64, 032003 (2001).
29. P. Baringer et al., *Cosmic ray tests of the DØ preshower detector*, Nucl. Instr. and Meth. A469, 295 (2001).
30. D0 collab., B. Abbott et al., *A Quasi-Model-Independent Search for New High p_T Physics at DØ*, Phys. Rev. Lett. 86, 3717 (2001).
31. D0 collab., B. Abbott et al., *A Quasi-Model-Independent Search for New Physics at Large Transverse Momentum*, Phys. Rev. D64, 012004 (2001).
32. D0 collab., B. Abbott et al., *Inclusive Jet Production in $p\bar{p}$ Collisions*, Phys. Rev. Lett. 86, 1707 (2001).
33. D0 collab., B. Abbott et al., *Differential Cross Section for W Boson Production as a Function of Transverse Momentum in $p\bar{p}$ Collisions at $\sqrt{s} = 1.8$ TeV*, Phys. Lett. B513, 292 (2001).
34. D0 collab., B. Abbott et al., *Measurement of the Angular Distribution of Electrons from $W \to e\upsilon$ Decays Observed in $p\bar{p}$ Collisions at $\sqrt{s} = 1.8$ TeV*, Phys. Rev. D63, 072001 (2001).
35. D0 collab., B. Abbott et al., *Ratios of Multijet Cross Sections in $p\bar{p}$ Collisions at $\sqrt{s} = 1.8$ TeV*, Phys. Rev. Lett. 86, 1955 (2001).

36. D0 collab., B. Abbott et al., *The Ratio of Jet Cross Sections at* $\sqrt{s} = 630$ *GeV and 1800 GeV*, Phys. Rev. Lett. 86, 2523 (2001).
37. D0 collab., B. Abbott et al., *Search for Large Extra Dimensions in Dielectron and Diphoton Production*, Phys. Rev. Lett. 86, 1156 (2001).
38. D0 collab., B. Abbott et al., *Search for Electroweak Production of Single Top Quarks in* $p\bar{p}$ *Collisions*, Phys. Rev. D63, 031101 (2001).
39. L3 collab., M. Acciarri et al., *Search for the Standard Model Higgs boson in* e^+e^- *collisions at* $\sqrt{s}$ *up to 202 GeV*, Phys. Lett. B508, 225 (2001).
40. L3 collab., M. Acciarri et al., *Search for Neutral Higgs Bosons of the Minimal Supersymmetric Standard Model in* e^+e^- *Interactions at* $\sqrt{s} = 192 - 202$ *GeV*, Phys. Lett. B503, 21 (2001).
41. L3 collab., M. Acciarri et al., *Measurements of the Cross Sections for Open Charm and Beauty Production in* $\gamma\gamma$ *Collisions at* $\sqrt{s} = 189 - 202$ *GeV*, Phys. Lett. B503, 10 (2001).
42. L3 collab., M. Acciarri et al., *Search for Excited Leptons in* e^+e^- *Interactions at* $\sqrt{s} = 192 - 202$ *GeV*, Phys. Lett. B502, 37 (2001).
43. L3 collab., M. Acciarri et al., *Search for R-parity Violating Decays of Supersymmetric Particles in* e^+e^- *Collisions at* $\sqrt{s} = 189$ *GeV*, Eur. Phys. J. C19, 397 (2001).
44. L3 collab., M. Acciarri et al., K_S^0 K_S^0 *Final State in Two-Photon Collisions and Implications for Glueballs*, Phys. Lett. B501, 173 (2001).
45. L3 collab., M. Acciarri et al., *Light resonances in* $K_S^0 K^{\pm}\pi^{\mp}$ *and* $\eta\pi^+\pi^-$ *final states in* $\gamma\gamma$ *collisions at LEP*, Phys. Lett. B501, 1 (2001).
46. L3 collab., M. Acciarri et al., *Study of Z Boson Pair Production in* e^+e^- *Interactions at* $\sqrt{s} = 192 - 202$ *GeV*, Phys. Lett. B497, 23 (2001).

Hu, Chin-Kun（胡進錕）

1. Zh.S. Gevorkian, C. P. Chen, C.-K. Hu, *New mechanism of X-ray radiation from a relativistic charged particle in a dielectric random medium*, Phys. Rev. Lett. 86, 3324-3327 (2001).
2. N. Sh. Izmailian and C.-K. Hu, *Exact universal amplitude ratios for two-dimensional Ising models and a quantum spin chain*, Phys. Rev. Lett. 86, 5160-5163 (2001).
3. V.B. Priezzhev, E.V. Ivashkevich, A.M. Povolotsky, and C.-K. Hu, *Exact phase diagram for an asymmetric avalanche process*, Phys. Rev. Lett. 87, 084301 (2001).
4. A. Silchenko and C.-K. Hu, *Multifractal charaterization of stochastic resonance*, Phys. Rev. E 63, 041105 (2001).
5. Z.E. Usatenko, M.A. Shpot, C.-K. Hu, *Surface critical behavior of random systems: ordinary transition*, Phys. Rev. E 63, 056102 (2001).

6. H.-P. Hsu, S.-C. Lin, and C.-K. Hu. *Universal scaling functions for bond percolation on planar random and square lattices with multiple percolating clusters*, Phys. Rev. E 64, 016127 (2001).
7. C.-Y. Lin, C.-K. Hu, and U. H.E. Hansmann, *Protein-like behavior of a spin system near the transition between ferromagnet and spin glass*, Phys. Rev. E. 64, 052903 (2001).
8. H. Watanabe, S. Yukawa, N. Ito, C.-K. Hu, C.-Y. Lin and W.-J. Ma., *Polydispersity effect and universality of finite-size scaling function*, J. Phys. Soc. Japan. 70, 1537-1542 (2001).
9. S. Hayryan, C.-K. Hu, S.-Y. Hu and R.-J. Shang., *Multicanonical parallel simulation of proteins with continuous potentials*, J. Comp. Chem. 22, 1287-1296 (2001).
10. F. Eisenmenger, S. Hayryan, and C.-K. Hu, *[SMMP] A modern package for simulation of proteins*, Computer Phys. Commu., 138, 192-212 (2001).
11. Y.-C. Tsai and C.-K. Hu, *Generalized antiferromagnetic Heisenberg spin ladders*, Physica B 305, 21-37 (2001).
12. Y.-H. Shiau and C.-K. Hu, *Pattern competition in photorefractive semiconductors*, J. Phys. Soc. Japan. 70, 3636-3640 (2001).
13. C.-K. Hu, *Low temperature properties of a spin model with varying ferromagnetic and antiferromagnetic couplings*, in NATO Workshop Proceedings, New Kinds of Phase Transitions: Transformations in Disordered Substances, edited by V. Brazhkin, S. V. Buldyrev, V. N. Ryzhov, and H. E. Stanley (Kluwer Academic Publishers, New York) (2001).
14. J.-A. Chen and C.-K. Hu, *Virtural laboratory for computational physics*, technical report of LSCP (http://www.sinica.edu.tw/~statphys/) (2001).
15. M. Weigel, W. Janke, C.-K. Hu, *Random-cluster multi-histogram sampling for the q-state Potts model*, Phys. Rev. E 65, in press (2002).
16. N. Sh. Izmailian and C.-K. Hu, *Exact amplitude ratio and finite-size corrections for the M X N square lattice Ising model*, Phys. Rev. E 65, in press (2002).
17. Z. E. Usatenko and C.-K. Hu, *Surface critical behavior of random systems at the special transition*, Phys. Rev. E 65, in press (2001).
18. Zh.S. Gevorkian and C.-K. Hu, *New phase transition in polymer solutions with multicomponent solvent*, Phys. Rev. Lett, submitted (2001).
19. Y.-H. Shiau, H.-P. Chiang, Y.-C. Cheng, and C.-K. Hu, *Multistability and high dimensional chaos in a semiconductor microwave device with time-delay feeback*, Phys. Rev. B, submitted for publication (2001).
20. Zh.S. Gevorkian and C.-K. Hu, *Correlation function of random heteropolymer solutions* submitted for publication (2001).

21. V. F. Morozov, E. SH. Mamasakhlisov, Shura Hayryan, C.-K. Hu, *Helix-coil transtion in closed circular DNA*, Phys. Rev. E, submitted (2001).
22. E. V. Ivashkevich, N.Sh. Izmailian, and C.-K. Hu, *Exact asymptotic expansion on torus*, Communications in Math. Phys., submitted (2001).
23. N. Sh. Izmailian, K. B Oganesyan and C.-K. Hu, *Exact finite-size corrections for the square lattice Ising model with Brascamp-Kunz boundary conditions*, Phys. Rev. E, submitted (2002).
24. M.-C. Wu and C.-K. Hu, *Exact partition functions of the Ising model on M X N planar lattices with periodic-aperiodic boundary conditions*, J. Phys. A, submitted (2002).
25. C.-Y. Lin and C.-K. Hu, *Renormalization group study of a sandpile model on planar lattices*, Phys. Rev. E, submitted (2002).

Hwang, Ing-Shouh（黃英碩）

1. J. Beben, I.-S. Hwang, T.-C. Chang, and T.T. Tsong, *Model for surfactant-Mediated Growth of Ge on Pb-Covered Si(111) Surfaces*, Physical Review B 63, 033304-1 (2001).
2. I.-S. Hwang, M.-S. Ho, and T.T. Tsong, *Scanning Tunneling Microscope Study of Dynamic Phenomena on Clean Si(111) Surfaces: Si Magic Clusters and Their Role*, Journal of Physics and Chemistry of Solids 62, 1655 (2001).
3. T.T. Tsong, C.-S. Chang, I.-S. Hwang, T.-Y. Fu, W.-B. Su, M.-S. Ho, and R.-L. Lo, *Electron and Atom Dynamics at Solid Surfaces and Relation to Epitaxy*, Journal of Physics and Chemistry of Solids 62, 1689 (2001).
4. R.-L. Lo, I.-S. Hwang, and T.T. Tsong, *Direct observation of atomic steps in dissociation of single water molecules and hopping motion of single oxygen atoms at silicon (111)-7x7 surfaces*, submitted to Physical Review Letters.
5. J. Beben, I.-S. Hwang, T.-C. Chang, and T.T. Tsong, *Analysis of Island Morphology in a Model for Pb-Mediated Growth of Ge on Si(111)*, to be published in Physical Review B.
6. I.-S. Hwang, M.-S. Ho, and T.T. Tsong, *Dynamic Behavior of Si Magic Clusters on Si(111) Surfaces*, to be published in Surface Science (2001).

Hwang, Robert R.（黃榮鑑）

1. W.C Yang, and R.R. Hwang, *Vertical buoyant jets in a linearly stratified ambient cross-flow*, Environmental Fluid Mechanics, Vol. 1, 235-256 (2001).
2. T.P. Chiang, T.W.H. Sheu, R.R. Hwang and A. Sau, *Spanwise bifurcation in plane-symmetric sudden-expension flows*, Physical Review E, Vol. 65, 016306 (2001).
3. Y.F. Peng, Y.H. Shiau, and R.R. Hwang, *Transition in a lid-driven cavity flow*, Computer and Fluids----In press (2001).

4. T.W.H. Sheu, T.P. Chiang, and R. R. Hwang, *Flow topology of Taylor-Gortler like vortices in a 3:1:1 lid driven cavity*, Physics of Fluids---In revision (2001).
5. T.P. Chiang, T.W.H. Sheu, and R.R. Hwang, *Three-dimensional flow details in suddenly contracted channels*, Physics of Fluids---In revision (2001).
6. Y.C. Sue, M.J. Chern and R.R. Hwang, *Interaction of nonlinear progressive viscous waves with a submerged obstacle*, Journal of Fluids and Structures,---Submitted (2001).
7. A. Sau, W. H. Sheu, R. R. Hwang, and W. C. Yang, *Three-dimensional simulation of square jets in cross-flow: The near field flow structure*, submitted to J. of Fluid Mechanics (2002).

Hwu, Yen-Kuang（胡宇光）

1. C.C. Kim, Y.K. Hwu, P. Ruterana, and J.H. Je, *Nanostructure of metal/semiconductor system by synchrotron x-ray scattering*, Mater. Phys. Mech. 4,1 (2001).
2. C.C. Kim, J.K. Kim, J.L Lee, J.H. Je, M.S. Yi, D.Y. Noh, Y. Hwu, P. Ruterana, *Au catalyzed structural and electrical evolution of Ni/Au contact to GaN*, Phys Status Solid A 188, 379 (2001).
3. C.C. Kim, J.K. Kim, J.L. Lee, J.H. Je, M.S. Yi, D.Y. Noh, Y. Hwu, and P. Ruterana, *Catalytic role of Au in Ni/Au contact on GaN(0001)*, Appl. Phys. Lett., 78, 3773 (2001).
4. Chong Cook Kim, Jong Kyu Kim, Jong-Lam Lee, Jung Ho Je, Min-Su Yi, Do Young Noh, Y. Hwu, P. Ruterana, *High-temperature structural behavior of Ni/Au Contact on GaN(0001)*, MRS Internet Journal of Nitride Semiconductor Research, 6,1 (2001).
5. C. J. Sun, G. M. Chow, E. W. Soo, J. P. Wang, Y.K.Hwu, T.S.Cho, J.H.Je, H. H. Lee, J. W. Kim, and D.Y.Noh, *Structural Effects of Ti Underlayer on CoCrPt Magnetic Films*, J. of Nanosci. and Nanotech., 1, 1 (2001).
6. H.J. Kim, J.O. Hong, K.H. Lee, H.J. Jung, E.K. Kim, J.H. Je, I.W. Kim, Y. Hwu, W.L. Tsai, et.al, *Phantom and animal imaging studies using PLS synchrotron x-rays*, IEEE Trans. Nucl. Sci., 48 (2001).
7. Y. Hwu, W.-L. Tsai, H.-H. Hsieh, Jung Ho Je, Hye-suk Kang, In-Woo Kim, Kyu-Ho Lee, Hee-Joung Kim, B. Lai, G. Margaritondo, *Collimation-Enhanced Micro-Radiography in Real-Time*, Nucl. Instrum. Meth. A, 467-468, 1294(2001).
8. Y. Hwu, W. L. Tsai, B. Lai, J. H. Je, G. H. Fecher, M. Bertolo, G. Margaritondo, *Using photoelectron emission microscope with hard-x-rays*, Surface Science 480, 188(2001).
9. F. Amy, H. Enriquez, P. Soukiassian, P.-F. Storino, Y. J. Chabal, A. J. Mayne, G. Dujardin, Y. K. Hwu, and C. Brylinski, *Atomic Scale Oxidation of a Complex System: O_2 α-SiC(0001)-(3 × 3)*, Phys. Rev. Lett. 86, 4342 (2001).

Izmailian, Nickolay

1. N. Sh. Izmailian and C.-K. Hu, *Exact universal amplitude ratios for two-dimensional Ising models and a quantum spin chain*, Phys. Rev. Lett. 86, 5160-5163 (2001).
2. N. Sh. Izmailian and C.-K. Hu, *Exact amplitude ratio and finite-size corrections for the M X N square lattice Ising model*, Phys. Rev. E 65, 1 February (2002).
3. E. V. Ivashkevich, N.Sh. Izmailian, and C.-K. Hu, *Exact asymptotic expansion on torus*, Communications in Math. Phys., submitted (2001).
4. N. Sh. Izmailian, K. B Oganesyan and C.-K. Hu, *Exact finite-size corrections for the square lattice Ising model with Brascamp-Kunz boundary conditions*, preprint.

Jan, Ming-Yie（詹明宜）

1. Ming-Yie Jan, Pin-Tsun Chao, Tse-Lin Hsu, Yuh-Yin Lin Wang, Wei-Kung Wang, *Using a laser-Doppler flowmetry to measure pulsatile microcirculation on the kidney in rats*, SPIE Proceeding, vol.4597, 1-6 (2001).
2. Ming-Yie Jan, Jeou-Jong, Pin-Tsun Chao, Yuh-Yin Lin Wang; Wei-Kung Wang, *Estimation of coherence between the pulsatile aortic blood pressure and the renal cortical flux in dogs*, Proceedings of the 23th Annual International Conference of the IEEE , 2001 Paper No. 560.
3. Pin-Tsun Chao, Ming-Yie Jan, Chi-Yu Huang, Yuh-Yin Lin Wang, Wei-Kung Wang, *Wavelet-based fluctuation analysis of laser doppler blood flux on renal cortex in rats*, Proceedings of the 23th Annual International Conference of the IEEE , 2001 Paper No. 1080.
4. Hsin Hsiu, Ming-Yie Jan, Yuh-Ying Lin Wang, Wei-Kung Wang, *Applying the resonance equation to the blood pressure waveform variation in aortic bending and renal ligation of rats*, Proceedings of the 23th Annual International Conference of the IEEE , 2001 Paper No. 730.
5. Hsin Hsiu, Ming-Yie Jan, Yuh-Ying Lin Wang, Wei-Kung Wang, *Influencing the heart rate of rats with weak external mechanical stimulation,* PACE, 2001, in revised.
6. Yuh-Ying Lin Wang, Ming-Yie Jan, Hsin Hsiu, Wei-Kung Wang, *Hemodynamics by a Total Energy Approach*, IEEE Transactions on Biomedical Engineering, 2001, *in review.*

Jen, Shien-Uang（任盛源）

1. S. U. Jen and C. M. Chung, *Intrinsic stress of $Co_{35}Pd_{65}$ alloy films*, J. Vac. Sci. Technol A19, 223(2001).
2. S. U. Jen, H. P. Chiang, C. M. Chung, and M. N. Kao, *Magnetic properties of Co-Fe-Ni films*, J. Magn. Magn. Mater. 236, 312 (2001).

3. S. U. Jen, J. Y. Lee, Y. D. Yao, and W. L. Chen, *The transverse field dependence of the planar Hall effect sensitivity in Permalloy films*, to appear in J. Appl. Phys. (2001).

Klik, Ivo（柯松仁）

1. I. Klik and Y. D. Yao, *The exact ac susceptibility of a superparamegnetic particle*, Proceedings of the 8th Asia Pacific Conference, page 409 (World Scientific, Singapore 2001).
2. I. Klik and Y. D. Yao, *Hysteresis and limiting cycles in a high frequency ac field*, J. Appl. Phys. 89, 7457 (2001).
3. I. Klik and Y. D. Yao, *Resonant activation in a system with deterministic oscillations of barrier height*, Phys. Rev. E 64, (1)012101 (2001).
4. I. Klik and Y. D. Yao, *Resonant activation in a driven magnetic system*, to appear in J. Magn. Magn. Mat.
5. I. Klik and Y. D. Yao, *The spectrum of a matrix Smoluchowski operator for resonant activation*, submitted to Phys. Rev. E (under revision).

Lee, Shih-Chang（李世昌）

1. I.M. Gregor, A.R. Weinberg, S.-C. Lee, M.L. Chu and P.K. Teng, *Optical Data Links for the ATLAS SCT and PIXEL Detector*, NIM A465, 131 (2001).
2. H.H. Shih, S.-C. Lee, and H.-n. Li, *Asymmetry Parameter in the Polarized $\Lambda_b \to \Lambda \ell \bar{\nu}$ Decay*, Chin J, Phys. 39, 328 (2001).
3. M.H. Huang, S.-C. Lee, P. Yeh, Z. Ren and Y.-L. Chuang, *Particle Trajectory Tracing in the Geomagnetic Field*, Chin J. Phys. 39, 1 (2001).
4. TEXONO Collaboration, *A CsI(Tl) Scintillating Crystal Detector for the Studies of Low Energy Neutrino Interactions*, NIM A459, 93 (2001).
5. D. Barancourt, F. Barao, G. Barbier, G. Barreira, M. Buenerd, G. Castellini, E. Choumilov, J. Favier, N. Fouque, A. Gougas, V. Hermel, R. Kossakowski, G. Laborie, G. Laurenti, S.-C. Lee, F. Mayet, B. Meillon, Y.-T. Oyang, V. Plyaskin, V. Pojidaev, C. Rossin, D. Santos, F. Vezzu, J.P. Vialle, *The AMS-01 Aerogel Threshold Cherenkov counter*, NIM A465, 306 (2001).

Lee, Shang-Fan（李尚凡）

1. C. H. Ho, M.-T. Lin, Y. D. Yao, S. F. Lee, Y. Liou, F. R. Chen, J. J. Kai, and C. C. Liao, *Enhanced Spin Polarization by An Extra Co or CoFe Layer in FM/Insulator/FM structures*, J. Magn. Soc. Japan 25, pp. 210-213 (2001).

2. S. F. Lee, T. M. Chuang, S. Y. Huang, W. L. Chang, and Y. D. Yao, *Two-dimensional to Three-dimensional Crossover and Magnetic Penetration Depth Study in NbTi/Co Multilayers*, J. Appl. Phys. 89, pp. 7493-7495.(2001).
3. W. C. Cheng, J. S. Tsay, Y. D. Yao, K. C. Lin, C. S. Yang, S. F. Lee, T. K. Tseng, *Magnetic Properties of Ultrathin Co/Ge(111) and Co/Ge(100) Films*, J. Appl. Phys 89, pp 7130-7132 (2001).
4. T. M. Chuang, S. F. Lee, Y. D. Yao, S. Y. Huang, W. C. Cheng, and G. R. Huang, *Anomalous Magnetic Moments in Co/Nb Multilayers*, Accepted in J. Magn. Magn. Mater.
5. W. C. Chen, C. H. Lai, S. F. Lee, Y. D. Yao, Y. T. Cheng, and W. D. Lee, *Structural Effects on Interlayer Coupling of Fe/Si/Fe Trilayer*, Accepted in J. Magn. Magn. Mater
6. C. C. Yu, C. Yu, Y. Liou, S. F. Lee, Y. D. Yao, D. C. Chen, and W. C. Cheng, *Crystal Structure and Magnetic Properties of Co Films on YSZ Substrates*, Accepted in J. Magn. Magn. Mater.
7. S. Y. Yang, W. L. Kuang, Y. Liou, S. F. Lee, W. S. Tse, and Y. D. Yao, *Magnetoresistance of $La_{0.7}Sr_{0.3}MnO_3$ Films at Room Temperature*, J. Magn. Magn. Mater. 226, pp. 690-692 (2001).
8. J. L. Tsai, Y. D. Yao, S. F. Lee, S. U. Jen, and C. Yu, *Temperature Dependence of the Magnetoresistance in a Zigzag Ultrathin Permalloy*, Accepted in J. Magn. Magn. Mater.
9. C. H. Ho, Minn-Tsong Lin, Y. D. Yao, S. F. Lee, C. C. Liao, F. R. Chen, and J. J. Kai. Magnetoresistance of spin-dependent tunnel junctions with composite electrodes. J. Appl. Phys. 90, pp 6222-6225 (2001).
10. Y. -R. Ma, C. Yu, Y. -D. Yao, Y. Liou, and S. -F. Lee, *Tip induced Local Anodic Oxidation on the Native SiO2 Layer of Si(111) Using and Atomic Force Microscope*, Phys. Rev. B 64, pp 5324-5328 (2001).
11. L. Horng, J. C. Wu, T. C. Wu, and S. F. Lee, *Flux pinning force in Nb thin films with periodic vortex pinning arrays*, Submitted to J. Appl. Phys.
12. J. L. Tsai, C. Yu, S. F. Lee, Y. D. Yao, and S. H. Liou, *Magnetoresistance study in ultrathin zigzag NiFe wires*, Accepted in J. Appl. Phys.
13. C. C. Yu, D. C. Chen, W. C. Cheng, Y. D. Yao, Y. Liou, and S. F. Lee, *Structure and magnetic properties of Co grown on YSZ substrates*, Accepted in J. Appl. Phys.
14. C. D. Chen, Y. D. Yao, S. F. Lee, and J. H. Shyu, *Magnetoresistance study in Co-Al-Co and Al-Co-Al double tunneling junctions*,. Submitted to J. Appl. Phys.
15. S. F. Lee, J. J. Liang, T. M. Chuang, S. Y. Huang, and Y. D. Yao, *Paramagnetic Meissner effect depending on superconducting penetration depth in Co/Nb multilayers*, Submitted to Phys. Rev. B.

16. C. Yu, S. F. Lee, Y. D. Yao, Y. Liou, Y. R. Ma, and C. R. Chang, *Magnetoresistance in micron size half-ring-in-series NiFe wires*, Submitted to Appl. Phys. Lett.
17. T. M. Chuang, W. L. Chang, H. W. Chang, Y. D. Yao, Y. Liou, and S. F. Lee, *Proximity Effect in NbTi/Co Thin Films*, Proceedings to the 8th Asia Pacific Physics Conference, World Scientific (2001).
18. C. D. Chen, Y. D. Yao, S. F. Lee and D. S. Chung, *Magnetoresistance Study in Ni-Al-Ni and Al-Ni-Al Tunneling Junction Systems*, J. Magn. Magn. Mater., in press (2001).

Lee, Ting-Kuo（李定國）

1. J.X. Li, C. Y. Mou, C. D. Gong and T. K. Lee, *Superconducting condensation energy and neutron resonance in High Tc superconductors*, Phys. Rev. B 64, 104518 (2001).
2. C. T. Shih, Y. C. Chen and T. K. Lee, *Revisit phase separation of the two-dimensional t-J model by the power-Lanczos method*, J. of Phys. and Chem. of Solids, 62, 1797 (2001).
3. Y. M. Nie, P. Y. Shiao, Y. F. Chiang and T. K. Lee, *Specific heat anomaly for a layer antiferromagnet*, Chinese J. of Physics 39, 606 (2001).
4. C.T. Shih, Y.C. Chen and T.K. Lee, *Phase separation in the two-dimensional t-J model*, Proceedings for the Third International Conf. On New Theories, Discoveries and Applications of Superconductors and Related Materials, ed. J. D. Fan, Physica C 364-365 (2001).
5. C. I. Chou and T. K. Lee, *Guided simulated annealing method for crystallography*, Acta Crystal A 58, 42 (2002).
6. W. C. Lee and T. K. Lee, *Low energy states in a quantum dot by the orbital integration method*, To appear in J. Physics: Condensed Matter (2002).
7. J. X. Li, C. Y. Mou and T. K. Lee, *Slave Boson approach to ARPES spectra in high Tc superconductors*, Proceedings for the Symposium on the Frontier of Physics at Millennium, p234, ed. Y. L. Wu and J. P. Hsu, World Scientific 2001.
8. C.I. Chou, I. Samoilenko, and T.K. Lee, *A new ab initio method for x-ray crystallography- guided simulated annealing method*, Proceedings for 2000 Sino-Japan Seminar on Crystallography, ed. by A. Wang.
9. S. D. Liang and T. K. Lee, *Magnetic polarization induced by nonmagnetic impurities in high Tc cuprates*, submitted (2002).
10. F. Hsieh, Y.C. Lan, M.H. Tsai, C.N. Chou, C.R. Hwang, S.B. Horng and T.K. Lee, *Exploring and reassembling patterns in female bean weevil's cognitive processing networks*, submitted.

Lee, Wolung（李沃龍）

1. Wo-Lung Lee and Li-Zhi Fang, *Time-dependent correlations of inflationary perturbations*, to appear in Europhysics Letters, Vol.56, No.5, 904 (2001).
2. Longlong Feng and Wolung Lee, *Gravitomagnetism and the Barry phase of photon in an rotating gravitational field*, Int. J. Mod. Phys. D. Vol. 10, 961 (2001).
3. Da-Shin Lee, Wo-Lung Lee, and Kin-Wang Ng, *Primordial magnetic fields from dark energy*, astro-ph/0109184, submitted to Phys. Lett. B (2002).

Leung, Kwan-tai（梁鈞泰）

1. K.-t. Leung, *Heuristic derivation of continuum kinetic equations from microscopic dynamics*, Phys. Rev. E 63, 016102 (2001).
2. K. -t. Leung, L. Józsa, M. Ravasz, and Z. Néda, *Spiral cracks without twisting*, Nature 410, 166 (2001).
3. K.-t. Leung, *Mesoscopic modeling of slow crack propagation*, Proceedings of the 3rd Joint Meeting of Chinese Physicists Worldwide, World Scientific (2001).
4. Z. Néda, K.-t. Leung, L. Józsa, M. Ravasz, *Spiral cracks in drying precipitates*, submitted for publication (2001).
5. K.-t. Leung and Z. Néda, *Statistical properties of quasi-static fracture: theory and simulation studies*, submitted for publication (2001).

Li, Hsiang-nan（李湘楠）

1. Y.Y. Keum, H.N. Li, and A.I. Sanda, *Fat penguins and imaginary penguins in perturbative QCD*, hep-ph/0004004, Phys. Lett. B 504, 6-14 (2001).
2. Y.Y. Keum, H.N. Li, and A.I. Sanda, *Penguins enhancement and $B\to K\pi$ decays in perturbative QCD*, hep-ph/0004173, Phys. Rev. D 63 054008 (2001).
3. Y.Y. Keum and H.N. Li, *Nonleptonic charmless B decays: factorization vs. perturbative QCD*, hep-ph/0006001, Phys. Rev. D 63 074006 (2001).
4. C.H. Chen and H.N. Li, *Final state interaction and $B\to KK$ decays in perturbative QCD*, hep-ph/0006351, Phys. Rev. D 63, 014003 (2001).
5. H.N. Li, *Perturbative QCD factorization of $\pi\gamma^*\to\gamma(\pi)$ and $B\to\gamma l\bar{\upsilon}$*, hep-ph/0012140, Phys. Rev. D64, 014019 (2001).
6. H.H. Shih, S.C. Lee, and H.N. Li, *Polarized $\Lambda_b\to\Lambda_c l\bar{\upsilon}$ decay in perturbative QCD*, NCKU-HEP-99-08 (hep-ph/9908370), Chin. J. Phys. 39, 328-335 (2001).
7. C.H. Chen, Y.Y. Keum, and H.N. Li, *Perturbative QCD analysis of $B\to\phi K$ decays and power counting*, hep-ph/0107165, Phys. Rev. D 64, 112002 (2001).

8. T. Kurimoto, H.N. Li, and A.I. Sanda, *Leading-power contributions to heavy-to-light form factors*, hep-ph/0105003, Phys. Rev. D 65 014007 (2001).

Li, Sai-Ping（李世炳）

1. S. P.. Li, and Huang Cheng, *Meson Propagators in spontaneously broken gauge theories*, Phys. Rev. D, submitted (2002).
2. S. P. Li, *A guided Monte Carlo method for optimization problems*, Europhysics Letters, submitted (2002).

Lin, Chai-Yu（林財鈺）

1. C.-Y. Lin, C.-K. Hu, and U. H.E. Hansmann, *Protein-like behavior of a spin system near the transition between ferromagnet and spin glass*, Phys. Rev. E. 64, 052903 (2001).
2. H. Watanabe, S. Yukawa, N. Ito, C.-K. Hu, C.-Y. Lin and W.-J. Ma., *Polydispersity effect and universality of finite-size scaling function*, J. Phys. Soc. Japan. 70, 1537-1542 (2001).
3. C.-Y. Lin and C.-K. Hu, *Renormalization group study of a sandpile model on planar lattices*, Phys. Rev. E, submitted (2002).

Lin, Simon C.（林誠謙）

1. Hsiao-Ping Hsu, Simon C. Lin, Chin-Kun Hu, *Universal Scaling Functions for bond Percolating on Planar-random and square lattices with multiple percolating clusters*, Physical Rev. E, volume 64, 016127 (2001).
2. Hsiao-Ping Hsu, Simon C. Lin and Ulrich H. E. Hansmann, *Structure determination of organic molecules from diffraction data by simulated annealing*, Physical Rev. E-16C (2001).
3. Hsiao-Ping Hsu, Simon C. Lin and Ulrich H. E. Hansmann, *Energy Landscape Paving for X-Ray Structure Determination of Macromolecules by Simulated Annealing,* (to submit Phys. Rev. E. April 18, (2001).
4. Ming-Chang Huang, Tsong-Ming Liaw, Simon C. Lin and Yen-Liang Chou, *Evolution of the Partition Function Zeros Distribution from a Circle to a Julia Set,* Physical Rev. E, submitted (2002).
5. Simon C. Lin and Tsong-Ming Liaw, *Space-time symmetry and algebra of the generators: a canonical approach,* Phtysical Rev. D, submitted (2002).
6. Tsong-Ming Liaw, Ming-Chang Huang, Simon C. Lin, *Renormalization-group calculations of Ising criticality on hierarchically decorated lattices*, Physical Rev. E, submitted (2002).

Lin, Shih-Yuin（林世昀）

1. Shih-Yuin Lin, *Classical Correspondence of Unruh Effect in Electrodynamics*, submitted to Annals of Physics (N.Y.).

Ng, Kin-Wang（吳建宏）

1. K.-W. Ng, *Complex visibilities of cosmic microwave background anisotropies*, Phys. Rev. D 63, 123001 (2001).
2. S.-Y. Wang, D. Boyanovsky, and K.-W. Ng, *Direct photons: A nonequilibrium signal of the expanding quark-gluon plasma at RHIC energies*, Nuclear Physics A (in press).
3. K.-W. Ng, *Photons from cosmic pseudo Nambu-Goldstone bosons, Proc. of the Meeting of the Division of Physics and Fields of the American Physical Society*, Columbus, Ohio, U.S.A., Aug., 2000(World Scientific, Singapore)(in press).
4. K. Y. Lo, T. H. Chiueh, R. N. Martin, Kin-Wang Ng, H. Liang, Ue-li Pen, and Chung-Pei Ma, *AmiBA: Array for Microwave Background Anisotropy*, Proc. of the IAU Symposium 201, Manchester, UK, Aug., 2000.
5. K.-W. Ng, *Interferometric observations of CMB polarization*, Proc. of the 8th Taipei Astrophysics Workshop: AMiBA 2001, Taipei, Taiwan, Jun., 2001, to be published in the Astronomical Society of the Pacific Conference Series.
6. Proc. of the 8th Taipei Astrophysics Workshop: AMiBA 2001, edited by L.-w. Chen, C.-P. Ma, 6. K.-W. Ng, and U.-L. Pen (Astronomical Society of the Pacific Conference Series).

Sau, Amalendu（邵瑪度）

1. A. Sau, T.W. Sheu and Robert Hwang, *Three-dimensional simulation of squire jets in a cross-flow: The near field flow structure*, J. Fluid Mech. submitted (2002).
2. A. Sau, T.W. Sheu and Robert Hwang, *Unsteady three-dimensional interaction and near-wall eruption for flow over a wall mounted rectangular block*, J. Fluid Mech. submitted (2002).
3. T.P. Chiang, T.W. Sheu, Robert Hwang, and A. Sau, *Spanwise bifurcation in plane symmetric sudden expansion flows*, Phys. Rev. E, Vol.65, 016306, 1-16 (2002).

Shiau, Bao-Shi（蕭葆羲）

1. Bao-Shi Shiau, and Yuan-Bin Chen, *Observation on Wind Turbulence Characteristics of Short Term Period at the Northeastern Coast of Taiwan*, Journal of Wind Engineering, Japan Association for Wind Engineering, No.89, pp.657-660 (2001).

2. Bao-Shi Shiau, *Wind Flow Turbulence Characteristics Around a Two-Dimensional Embankment with Different Slope Gradients*, Journal of Wind Engineering, Japan Association for Wind Engineering, No.89, pp.649-652 (2001).
3. Bao-Shi Shiau, and Yuan-Bin Chen, *In Situ Measurement of Strong Wind Velocity Spectra and Wind Characteristics at Keelung Coastal Area*, Atmospheric Research, Vo.57, pp.171-185 (2001).
4. Bao-Shi Shiau, *Experimental Observations on Bubble Plume in the Linearly Stratified Density of Water with a Cross Flow*, Proceedings of the 29th IAHR Congress, Theme B Environmental Hydraulics and Eco-Hydraulics, pp.219-225, Beijing, People's Republic of China (2001).
5. Bao-Shi Shiau, *Measurement of Turbulence Structure for the Wind over a Two-Dimensional Hill*, Proceedings of the 3rd European and African Conference on Wind Engineering, pp.569-577, Eindhvoen, The Netherlands (2001).

Singh, Venktesh

1. Adcox, et al. (For PHENIX Collaboration), *Suppression of Hadrons with Large Transverse Momentum in Central Au+Au Collisions at* $\sqrt{^8NN} = 130\ GeV$, Submitted to PRL 2001-07-05.
2. J. Velkovska et la., *Proceedings of Quark Matter Conference 2001*, To be Published in Nucl. Phys. A (2001)
3. W. Zajc et al., *Proceedings of Quark Matter Conference 2001*, To be Published in Nucl. Phys. A (2001)
4. Adcox, et al. (For PHENIX Collaboration), *Measurement of the Midrapidity Transverse Energy Distribution from* $\sqrt{^8NN} = 130\ GeV$ *Au-Au Collisions at RHIC*, Phys. Rev. Lett. 87, 052301 (2001)
5. Adcox, et al. (For PHENIX Collaboration), *Centrality Dependence of Charged Particle Multiplicity in Au-Au Collisions at* $\sqrt{^8NN} = 130\ GeV$, Phys. Rev. Lett. 86, 3500-3505 (2001)
6. M.I. Adamovich et al. (For MTKTLVG Collaboration), *Factorization of fragmentation cross-sections in heavy-ion collisions at 1 A GeV*, Europhys. Lett., 50 (4), 441-446 (2000)

Su, Wei-Bin（蘇維彬）

1. W. B. Su, S. H. Chang, W. B. Jian, C. S. Chang, L. J. Chen, Tien T. Tsong, *Correlation between Quantized Electronic States and Oscillatory Thickness relaxations of 2D Pb Islands on Si(111) 7×7 Surfaces*, Phys. Rev. Lett. 86, 5115 (2001).

2. W. B. Su, S. H. Chang, C. S. Chang, L. J. Chen, Tien T. Tsong, *Quantum Size Effects in the Low-Temperature Growth of Pb Islands on Si(111)7×7 Surfaces*, Jpn. J. Appl. Phys. 40, 4299 (2001).
3. Tien T. Tsong, C. S. Chang, I. S. Hwang, T. Y. Fu, W. B. Su, M. S. Ho, R. L. Lo, *Electron and atom Dynamics at Solid Surfaces and Relation to Epitaxy*, J. Chem. Phys. 62, 1689 (2001).
4. S. H. Chang, W. B. Su, W. B. Jian, C. S. Chang, L. J. Chen, Tien T. Tsong, *Electronic growth of Pb islands on Si(111) at low temperature*, Phys. Rev. B, submitted (2002).
5. B. Su, S. H. Chang, C. S. Chang, L. J. Chen, Tien T. Tsong, *The Growth of 2D Pb Islands on Si(111) 7×7 Surfaces at Low Temperatures*, APPC 8th(2000) (Proceeding), p370.

Teng, Ping-Kun（鄧炳坤）

1. CDF Collaboration, *Double Diffraction Dissociation at the Fermilab Tevatron Collider*, Phys. Rev. Lett. 87, 141802 (2001).
2. CDF Collaboration, *Measurement of $d\sigma/dM$ and Forward-Backward Charge Asymmetry for High Mass Drell-Yan e^+e^- Pairs from $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8 TeV*, Phys. Rev. Lett. 87, 131802 (2001).
3. CDF Collaboration, *Measurement of the Top Quark p_t Distribution*, Phys. Rev. Lett. 87, 102001 (2001).
4. CDF Collaboration, *Search for Neutral Supersymmetric Higgs Bosons in $p\bar{p}$ Collisions at $\sqrt{(s)}$=1.8TeV*, Phys. Rev. Lett. 86, 4472 (2001).
5. CDF Collaboration, *Production of χ_{c1} and χ_{c2} in $p\bar{p}$ Collisions at $\sqrt{(s)}$=1.8TeV*, Phys. Rev. Lett. 86, 3963 (2001).
6. CDF Collaboration, *First Measurement of the Ratio B(t→Wb)/(B(t→Wq) and Associated Limit on the CKM Element $|V_{tb}|$*, Phys. Rev. Lett. 86, 3233 (2001).
7. CDF Collaboration, *Observation of Orbitally Excited B Mesons in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8 TeV*, Phys. Rev. D 64, 072002 (2001).
8. CDF Collaboration, *Measurement of the W Boson Mass with the Collider Detector at Fermilab*, Phys. Rev. D 64, 052001 (2001).
9. CDF Collaboration, *Measurement of the $t\bar{t}$ Production Cross Section in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8 TeV*, Phys. Rev. D 64, 032002 (2001).
10. CDF Collaboration, *Measurement of the Inclusive Jet Cross Section in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8 TeV*, Phys. Rev. D 64, 032001 (2001).
11. CDF Collaboration, *Measurement of the Two-Jet Differential Cross Section in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1800 GeV*, Phys. Rev. D 64, 012001 (2001).

12. CDF Collaboration, *Search for Supersymmetric Partner of the Top-Quark in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8 TeV*, Phys. Rev. D 63, 091101 (2001).
13. CDF Collaboration, *Tests of Enhanced Leading Order QCD in W Boson plus Jets Events from 1.8 TeV $p\bar{p}$ Collisions*, Phys. Rev. D 63, 072003 (2001).
14. CDF Collaboration, *Measurement of the Top Quark Mass with the Collider Detector at Fermilab*, Phys. Rev. D 63, 032003 (2001).
15. CDF Collaboraiton, *Measurement of $d\sigma/dy$ for High Mass Drell-Yan e^+e^- Pairs from $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8TeV*, Phys. Rev, D 63, 011101(R) (2001).

To, Kiwing（杜其永）

1. Kiwing To, *Coexistence curve exponent of a binary mixture with a high molecular weight polymer*, Phys. Rev. E 63, 26108 (2001).
2. Kiwing To, Pik-Yin Lai and H.K. Pak, *Jamming of granular flow in a two-dimensional hopper*, Phys. Rev. Lett. 86, 71 (2001).
3. Jui-Hung Hsu, Wunshain Fann, Hsin-Fei Meng, En-Shi Chen, En-Chung Chang, Shaw-An Chen, Ki-Wing To, *Decay dynamics of interchain excited states in luminescent conjugated polymer CN-PPV*, Chem. Phys. 269, 367 (2001).
4. H. J. Choi, J. W. Kim, M. S. Suh, M. J. Shin, K. To, *Synthesis and viscoelastic behaviors of poly (aniline-co-o-ethoxyaniline) particles suspended electrorheological fluid*, Inter. J. Mod. Phys. B15, 649 (2001).

Tsai, Jai-Lin（蔡佳霖）

1. Jai-Lin Tsai, Tsung-Shune Chin, Yeong-Der Yao, H. Kronmüller, *Microstructure of Nd-Fe-B films*, IEEE. Trans. Magn. Vol. 37, 2582-2585 (2001).
2. Jhy-Chao Shih, Hsin-Hsin Hsiao, Jai-Lin Tsai, Tsung-Shune Chin, *Low-Temperature In-situ Growth of High-Coercivity Fe-Pt Films*, IEEE. Trans. Magn. Vol. 37, 1280-1282 (2001).
3. Shi-Kun Chen, G. Y. Wu, Jai-Lin Tsai, and Tsung-Shune Chin, *Effect of Cr Underlayer on Microstructure and Magnetic Properties of Sm_2Co_{17} Thin Films*, IEEE. Trans. Magn. Vol. 37, 2593-2595 (2001).

Tseng, Chung-Yi（曾忠一）

1. 曾忠一,張博雄, *半拉格朗日格式特徵線法和雲模式中的地形效應*. 第七屆全國大氣科學學術研討會,2001 年 9 月 25~27 日,台北市.
2. 曾忠一, 黃炳程, *利用 GMS 衛星資料決定雲參數*. 天氣預報與分析,166 期,1-14 (2001)

Tsong, Tien T.（鄭天佐）

1. J. Beben, I-S Hwang, T-C Chang and T. T. Tsong, *Model for, Surfactant-Mediated Growth of Ge on Pb-covered Si(111) Surfaces*, Phys. Rev. B6303, 3304-1 to –4 (2001).
2. W. B. Su, S. H. Chang. C. S. Chang, L. J. Chen and T. T. Tsong, *Quantum Size Effects in the Low-Temperature Growth pf Pb Islands on Si(111)-7x7 Surfaces*, Jpn. J. Appl. Phys. 40, 4299-4303 (2001).
3. W. B. Su, S. H. Chang, W. B. Jian, C. S. Chang, L. J. Chen and T. T. Tsong, *Correlation between Quantized Electronic States and Oscillatory Thickness Relaxations of 2D Pb Islands on Si(111)-(7x7) Surfaces*, Phys. Rev. Lett. 86, 5116-5119 (2001).
4. I. S. Hwang, M. S. Ho and T. T. Tsong, *Scanning Tunneling Microscope Study of Dynamic Phenomena on Clean Si(111) Surfaces: Si Magic Clusters and Their Role*, J. Phys. Chem. Solids 62, 1655-1671 (2001).
5. T. Y. Fu, L. C. Cheng, C. H. Nien and T. T. Tsong, *Mechanism and Method of Single Atom Pyramidal Tip Formation from a Pd Covered W Tip*, Phys. Rev. B 64, 113401 (2001).
6. T. Y. Fu and T. T. Tsong, *Structure and Diffusion Mechanism of Ir and Rh Tetramers on Ir(001) Surfaces*, Surf. Sci., 482/485, 1249-1254 (2001).
7. T. T. Tsong, C. S. Cheng, I. S. Hwang, T. Y. Fu, W. B. Su, M. S. Ho and R. L. Lo, *Electron and Atom Dynamics at Solid Surfaces and Relation to Epitaxy*, J. Phys. Chem. Solids 62, 1689-1730 (2001).

Wang, Chang-Ren（王昌仁）

1. C.R. Wang, Y.Y. Chen, Y.D. Yao, C.L. Chang, Y.S. Weng, and C.Y. Wang, *Magnetic Properties and Superconductivity in $CeCo_2$ Nanoparticle* , accepted for publication in J. Magn. Magn. Mater (2001)
2. Chuan-Yi Wu, Hong-Ming Lin, Hsin-Fu Lin, Ming-Fong Tai, Chang-Ren Wang, Chung-Kwei Lin, and P. Y. Lee, *Preparation and characterization of nanocrystalline Nb_3Al alloy* , Scripta mater.44, 1967 (2001).
3. T. I. Su , C. R. Wang , S. C. Lee , S. T. Lin and R. Rosenbaum, *Temperature dependence of the magnetoresistance of an insulating $Al_{70}Pd_{22.5}Re_{7.5}$ quasicrystal*, J. of alloys and Compounds, in press (2002) .
4. J. M. Lee , C. Jan , J. W. Chiou , W. F. Pong , M. H. Tsai, Y. K. Chang , Y. Y. Chen , C. R. Wang , J. F. Lee T. Yang , Z. Lu, W. Y. Lai , Z. H. Mai, *Effect of the annealing temperature on the electric and atomic structures of exchange-biased NiFe-FeMn bilayers*, App. Phys.Lett., submitted (2002).

5. Y.Y. Chen, C.R. Wang, Y.D. Yao and S.Z. Xu, *Size effects on superconductivity and magnetism in $CeCo_2$*, Phys. Rev. Lett., submitted (2002).
6. Y. Y. Chen , Y. D. Yao, C. R. Wang , S. H. Lin , A. Czopnik and J. C. Ho, *Calorimetic evauation of magnetic ordering and spin reorientation in $ErGa_3$*, Phys. Rev. B, submitted (2002).

Wang, Ming-Jer（王明哲）

1. CDF Collaboration, *Observation of Orbitally Excited B Mesons in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8 TeV*, Phys. Rev. D 64, 072002 (2001).
2. CDF Collaboration, *Measurement of the W Boson Mass with the Collider Detector at Fermilab*, Phys. Rev. D 64, 052001 (2001).
3. CDF Collaboration, *Measurement of the $t\bar{t}$ Production Cross Section in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8 TeV*, Phys. Rev. D 64, 032002 (2001).
4. CDF Collaboration, *Measurement of the Inclusive Jet Cross Section in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8 TeV*, Phys. Rev. D 64, 032001 (2001).
5. CDF Collaboration, *Measurement of the Two-Jet Differential Cross Section in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1800 GeV*, Phys. Rev. D 64, 012001 (2001).
6. CDF Collaboration, *Search for Supersymmetric Partner of the Top-Quark in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8 TeV*, Phys. Rev. D 63, 091101 (2001).
7. CDF Collaboration, *Tests of Enhanced Leading Order QCD in W Boson plus Jets Events from 1.8 TeV $p\bar{p}$ Collisions*, Phys. Rev. D 63, 072003 (2001).
8. CDF Collaboration, *Measurement of the Top Quark Mass with the Collider Detector at Fermilab*, Phys. Rev. D 63, 032003 (2001).
9. CDF Collaboraiton, *Measurement of $d\sigma/dy$ for High Mass Drell-Yan e^+e^- Pairs from $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8TeV*, Phys. Rev, D 63, 011101(R) (2001).
10. CDF Collaboration, *Double Diffraction Dissociation at the Fermilab Tevatron Collider*, Phys. Rev. Lett. 87, 141802 (2001).
11. CDF Collaboration, *Measurement of $d\sigma/dM$ and Forward-Backward Charge Asymmetry for High Mass Drell-Yan e^+e^- Pairs from $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8 TeV*, Phys. Rev. Lett. 87, 131802 (2001).
12. CDF Collaboration, *Measurement of the Top Quark p_t Distribution*, Phys. Rev. Lett. 87, 102001 (2001).
13. CDF Collaboration, *Search for Neutral Supersymmetric Higgs Bosons in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8TeV*, Phys. Rev. Lett. 86, 4472 (2001).
14. CDF Collaboration, *Production of χ_{c1} and χ_{c2} in $p\bar{p}$ Collisions at $\sqrt{(s)}$ =1.8TeV*, Phys. Rev. Lett. 86, 3963 (2001).

15. CDF Collaboration, *First Measurement of the Ratio B(t→Wb)/(B(t→Wq) and Associated Limit on the CKM Element $|V_{tb}|$*, Phys. Rev. Lett. 86, 3233 (2001).

Wei, Ching-Ming（魏金明）

1. C. M. Chang, C. M. Wei, J. Hafner, *Self-diffusion of adatoms on Ni(100) surfaces,* J. Phys. Condens Matter 13, L321-L328, (2001).
2. H. Ahn, C.-L. Wu, S. Gwo, C. M. Wei, and Y. C. Chou, *Structure Determination of the Si_3N_4/Si(111)-(8 × 8) Surface: A Combined Study of Kikuchi Electron Holography, Scanning Tunneling Microscopy, and ab initio Calculations,* Phys. Rev. Lett. 86, 2818 (2001).

Wong, Henry Tsz-king（王子敬）

1. H.-B. Li et al., TEXONO Collaboration, *A CsI(T1) Crystal Scintillator for the Studies of Low Energy Neutrino-Electron Scatterings*, hep-ex/0001001, Nucl. Instrum Methods A 459, 93 (2001).
2. W. P.Lai et a1., TEXONO Collaboration, *The Electronics and Data Acquisition Systems of a CsI(T1) Scitillating Crystal Detector for Low Energy Neutrino Experiment*, hepex/0010021, Nucl. Instrum. Methods A 465, 550 (2001).
3. S.C.Wang et a1., *Measurement of Intrinsic Radioactivity in a GSO Crystal*, hep-ex/0009014,Nucl. Instrum. Methods A, in press (2001).
4. Y.Liu et al.,TEXONO Collaboration, *Studies of Prototype CsI(Tl) Scintillating Crystal Detector for Low-Energy Neutrino Experiments*, hep-ex/0105006, Nucl. Instrum. Methods A, in press (2001).
5. J. Li et al., *The CsI(Tl) Crystal Detector in TEXONO Low Energy Neutrino Experiment*, (Chinese), High Energy Physics and Nuclear physics, in press (2001).
6. Q.Yue et a1., *Energy Calibration of CsI(T1) Crystal for Quenching Factor Measurement in Dark Matter Search*, (Chinese), High Energy Physics and Nuclear Physics, in press (2001).
7. D. L Chen et al., *Monte Carlo Study on the Effect of Shielding in TEXONO Neutrino Experiment*, (Chinese), High Energy Physics and Nuclear Physics, in press(2001).
8. M. Z. Wong et al., *Nuclear Recoil Measurement in CsI(Tl) Crystal for Cold Dark Matter Detection*, nucl-ex/0110003, submitted to Phys. Rev. C (2001).
9. H. -B. Li and H. T. Wong, *Sensitivities of Low Energy Reactor Neutrino Experiments*, hep-ex/0111002, submitted to Astropart Phys. (2001).
10. H. S.Chen et al., *Prospect of a Very Long Baseline Neutrino Oscillation Experiment:HIPA to Beijing*, hep-ph/0104266 (2001).
11. Y. Liu et a1., *Applications of (α, γ) Discrimination in the Measurements of Intrinsic Radio-purity in CsI(T1) Scintilladting Crystal*, (Chinese), Nucl. Tech. 24, 497 (2001).
12. H.T.Wong and Jin Li, *Scintillation Crystal Detector for Low Energy Neutrino and Astropartick Physics*, in Procs. Of the 7th Taiwan Astrophysics Workshop, ed. C. M. Kao, ASP Conf. Series 241, 123 (2001).
13. H. T. Wong, *Neutrino Experiments :Highlights*, hep-ex/0101018, in Procs. of the 5th Int. Workshop on Part. Phys. Phen., eds. H. N. Li and W. M. Zhang, World Scientific, 196 (2001).
14. Z.Y. Zhang et al., *Development of Charge-Sensitive Pre-amplifiers for the Readout of CsI(TI) crystals with Silicon Photo-diodes*, (Chinese), Nuclear Electronics, in press (2001).
15. E. Eskut et a1., *New Limits on $\nu_\mu \to \nu_\tau$ and $\nu_\mu \to \nu_e$ Oscillation from the CHORUS Experiment*, CHORUS Coll., CERN--EP/2000-147 Phys. Lett. B 497,8 (2001).
16. E Eskut et al., *Observation of Weak Neutral Current Neutrino Production of J/ϕ, CHORUS Coll.*,CERN-EP/2000-154, Phys. Lett. B 503, 1 (2001).
17. A. Artamonov et al, *The data acquisition system of the CHORUS experiment*, CERN-EP/2000-121, Nuc1. Instrum. Methods A, in press (2001).

Wu, Ming-Chya（吳明佳）

1. M.-C. Wu and C.-K. Hu, *Exact partition functions of the Ising model on M X N planar lattices with periodic-aperiodic boundary conditions*, J. Phys. A, submitted (2002).

Yang, Wen-Chang（楊文昌）

1. W. C. Yang and R. R. Hwang, *Vertical Buoyant Jets in Linear Stratified Ambient with Crossflow*, Environmental Fluid › Mechanics, Vol. 1, pp. 235-256 (2001).
2. A Sau, W.H. Sheu, R.R. Hwang and W.C. Yang, *Three-dimensional simulation of square jets in cross-flow: The near field flow structure*, J. Fluid Mechanics, submitted (2002).

Yao, Yeong-Der（姚永德）

1. I. Klik and Y. D. Yao, *Resonant activation in a system with deterministic oscillations of barrier height*, Phys. Rev. E, 64, 012101 (2001).
2. C. H. Ho, M. T. Lin, Y. D.Yao, S. F. Lee, Y. Liou, F. R. Chen, J. J. Kai, and C. C. Liao, *Enhanced Spin Polarization by An Extra Co or CoFe layer in FM/Insulator/FM Structures,* J. Magn. Soc. Japan, 25, 210 (2001).
3. C. Y. Wu, Y. D. Yao, Y. C. Juang, R. P. Chen, and D. R. Huang, *Study of Crystalization Kinetics in GeSbTeSeM (M = Cu, Co, Ni, Pb) Phase Change Materials*, J. Magn. Soc. Japan, 25, 429 (2001).

4. J. S. Tsay, Y. D. Yao, J. Y. Lin, and C. S. Yang, *Oscillation of the coercive force for ultrathin Ag/Co/Cu(111) films,* J. Appl. Phys., 89, 7377 (2001).
5. K. T. Wu, P. C. Kuo, Y. D. Yao, and E. H. Tsai, *Magnetic & Optical Properties of Fe_3O_4 Nanoparticle Ferrofluids Prepared by Coprecipitation Technique*, IEEE Trans. Magn., 37, 2651 (2001).
6. W. C. Cheng, J. S. Tsay, Y. D. Yao, K. C. Lin, C. S. Yang, S. F. Lee, T. K. Tseng, and H. Y. Nieh, *Magnetic Properties of Ultrathin Co/Ge(111) and Co/Ge(100) Films*, J. Appl. Phys., 89, 7130 (2001).
7. S. F. Lee, T. M. Chuang, S. Y. Huang, W. L. Chang, and Y. D. Yao, *Two-dimensional to Three-dimensional Crossover and Magnetic Penetration depth Study in NbTi/Co Multilayers*, J. Appl. Phys., 89, 7493 (2001).
8. L. R. Sung, S. H. Huang, Y. D. Yao, and W. H. Lee, *Magnetic relaxation behavior of $(Tl_{0.5}Pb_{0.5})(Sr_{1.84}Nd_{0.16})CaCu_2O_7$ superconducting material*, Jpn. J. Appl. Phys, 40, L262 (2001).
9. L. R. Sung, Y. D. Yao, W. H. Lee, and Y. Y. Chen, *Spin-glass freezing above the ordering temperature for the Kondo antiferromagnet $CeNi_2Sn_2$*, Jpn. J. Appl. Phys, 40, L154 (2001).
10. J. S. Tsay, J. Y. Lin, C. S. Yang, Y. D. Yao and Y. Liou, *Effects of an Ag Overlayer on the Magnetic Properties of Ultrathin Co/Cu(111) Films*, Surf. Sci. 482-485, 1040 (2001).
11. M. T. Lin, C. H. Ho, C. R. Chang, and Y. D. Yao, *Thermally assisted oscillatory interlayer exchange bias coupling*, Phys. Rev. B, 63, 100404 (R) (2001).
12. J. L. Tsai, T. S. Chin, Y. D. Yao, Z. G. Sun, B. G. Shen, and H. Kronmuller, *Microstructure of Nd-Fe-B Films*, IEEE Trans. Magn., 37, 2582 (2001).
13. S. H. Liou, R. F. Sabiryanov, S. S. Jaswal, J. C. Wu, and Y. D. Yao, *Magnetic Domain Patterns of Rectangle and Ellipse Arrays of Small Permalloy Elements*, J. Magn. Magn. Mater., 226-230, 1270 (2001).
14. M. T. Lin, C. H. Ho, C. R. Chang, and Y. D. Yao, *Temperature-dependence of interlayer exchange bias coupling in NiO/Cu/NiFe*, J. Appl. Phys., 89, 7540 (2001).
15. Klik and Y. D. Yao, *Hysteresis and limiting cycles in a high frequency ac field*, J. Appl. Phys., 89, 7457 (2001).
16. J. L. Tsai, Y. D. Yao, T. S. Chin, and H. Kronmuller, *Spacer Layer Effect on Multi-Layer $[NdFeB/(Nb)]_n$ Films*, J. Magn. Magn. Mater., accepted (2001).
17. S. J. Xiong, and Y. D. Yao, *Andreev Reflection and Kondo effect in Tunneling through a Superconducting Grain*, J. Phys.: Condensed Matter, 13, 7371 (2001).
18. C. C. Yu, C. Yu, Y. Liou, S. F. Lee, and Y. D. Yao, D. C. Chen and W. C. Cheng, *Crystal Structure and Magnetic Properties of Co Films on YSZ Substrates*, J. Magn. Magn. Mater. accepted (2001).

19. J. J. Liang, C. Yu, S. F. Lee, Y. D. Yao, C. C. Wu, and S. G. Shyu, *Magnetotransport Study of Granular Chromium Dioxide Thin Films Prepared by CVD Technique*, J. Magn. Magn. Mater. accepted (2001).
20. C. D. Chen, Y. D. Yao, S. F. Lee and D. S. Chung, *Magnetoresistance Study in Ni-Al-Ni and Al-Ni-Al Tunneling Junction Systems*, J. Magn. Magn. Mater., in press (2001).
21. J. L. Tsai, S. F. Lee, Y. D. Yao, and C. Yu, *Temperature Dependence of the Magnetoresistance in a Zigzag Ultrathin Permalloy wire*, J. Magn. Magn. Mater., accepted (2001).
22. C. R. Wang, Y. Y. Chen, Y. D. Yao, C. L. Chang, Y. S. Weng, and C. Y. Wang, *Magnetic Property and Superconductivity in $CeCo_2$ Nanoparticle*, J. Magn. Magn. Mater., accepted (2001).
23. Y. R. Ma, C. Yu, Y. D. Yao, and Y. Liou, *Tip-induced Local Anodic Oxidation on the Native SiO_2 Layer of Si(111) Using an Atomic Force Microscope*, Phys. Rev. B, accepted (2001).
24. Y. D. Yao, Y. Y. Chen, S. F. Lee, W. C. Chang, and H. L. Hu, *Magnetic and Thermal Studies of Nano-sized Co and Fe particles*, J. Magn. Magn. Mater., accepted (2001).
25. C. C. Liao, C. H. Ho, R. T. Huang, F. R. Chen, J. J. Kai, L. C. Chen, M. T. Lin, and Y. D. Yao, *Thermal Stability Study of the Insulator Layer in NiFe/CoFe/Al_2O_3/Co Spin-dependent Tunnel Junction*, J. Magn. Magn. Mater, accepted (2001).
26. C. H. Lai, Y. H. Wang, C. R. Chang, J. S. Yang, and Y. D. Yao, *Exchange-bias-induced double-shifted magnetization curves in Co biaxial films*, Phys. Rev. B, 64, 094420 (2001).
27. J. S. Tsay, Y. D. Yao, K. C. Wang, W. C. Cheng, and C. S. Yang, *Effect of Annealing on the Magnetic Properties of the Ultrathin Co/Ge(111) Films*, Surf. Sci., accepted (2001).
28. S. J. Xiong, and Y. D. Yao, *Structure Dependence of Tunnel Magnetoresistance in Junctions with three Ferromagnetic Layers*, J. Phys.: Condensed Matter, 13, 9691 (2001).
29. C. H. Ho, M. T. Lin, Y. D. Yao, S. F. Lee, C. C. Liao, F. R. Chen, and J. J. Kai, *Influence of Composite Electrode on Magnetoresistance in Spin-dependent Tunnel Junctions*, J. Appl. Phys., 91, Jan. (2002).
30. C. C. Yu, J. C. A. Huang, and Y. D. Yao, *Step surface induced unidirectional exchange anisotropy in PtMn/Ni80Fe20 on Mo(001)*, J. Appl. Phys., accepted (2002).
31. C. D. Chen, Y. D. Yao, S. F. Lee and J. H. Shyu, *Magnetoresistance Study in Co-Al-Co and Al-Co-Al Double Tunneling Junction Systems*, J. Appl. Phys., accepted (2002).
32. J. S. Tsay, Y. D. Yao, K. C. Wang, W. C. Cheng, and C. S. Yang, *Magnetic Properties of Ultrathin Cobalt Films Grown on Ge(111) and Si(111) Substrates*, J. Appl. Phys. accepted (2002).

33. C. C. Yu, D. C. Chen, W. C. Cheng, Y. D. Yao, S. F. Lee, and Y. Liou, *Structure and Magnetic Properties of Co Grown on YSZ Substrate*, J. Appl. Phys., under revision (2002).
34. J. L. Tsai, S. F. Lee, Y. D. Yao, C. Yu, and S. H. Liou, *Magnetoresistance Study in Thin Zigzag NiFe Wires*, J. Appl. Phys., accepted, (2002).
35. I. Klik and Y. D. Yao, *Resonant Activation in a Driven Magnetic System*, J. Appl. Phys., accepted (2002).
36. A. C. Sun, and C. C. Chiang, *Microstructure and Magnetic Properties of Nano-composite FePtCr-SiN Thin Films*, J. Appl. Phys. under revision (2002).
37. Y. Li, C. R. Chang, and Y. D. Yao, *Effect of Disorder on the Tunnel Magnetoresistance: Lattice Green's Function Method*, J. Appl. Phys., under revision (2002).
38. J. L. Tsai, T. S. Chin, Y. D. Yao, and H. Kronmuller, *Microstructure and Magnetic Properties of Multi-layer [Nd2Fe14Bx/(Nb, Cr)z]n Films*, J. Appl. Phys., accepted, (2002)
39. M. T. Lin, C. H. Ho, Y. D. Yao, R. T. Huang, C. C. Liao, F. R. Chen, and J. J. Kai, *Interface Characterization and Thermal Stability in Co/AlO/CoFe Spin-dependent Tunnel Junctions*, J. Appl. Phys., accepted, (2002).
40. 發明專利：Japanese Patent Number: 3,156,665 Date of Patent：February 9, 2001, Stator of and Arc Shaping Method for Brushless Motor, Inventors：Yeong-Der Yao，Jain-Chang Wang，Chin-Po Liao

Sungkit Yip（葉崇傑）

1. S. K. Yip, *Collective Modes of a Dilute Bose-Fermi Mixture*, Phys. Rev. A 64, 023609 (2001).
2. S. K. Yip, *Absorption Line Shape of a One-Dimensional Bose Gas*, Phys. Rev. Lett. 87, 130401 (2001).
3. S. K. Yip, *Optical Absorption in a Degenerate Bose Gas*, physics/0105091, Phys. Rev. A, in press (2002).
4. S. K. Yip, *2D Superconductivity with Strong Spin-Orbit Interaction*, cond-mat/0110140, Phys. Rev. Lett., submitted (2002).

Yu, Chin-Chung (余進忠)

1. J. C. A. Huang, C. C. Yu, C. M. Fu, C. H. Lee, *Epitaxial growth, structure, and magnetism of epitaxial $Ni_{80}Fe_{20}$ single-crystal, bicrystal, and quad-crystal films*, Phys. Rev. B 64, 174422 (2001).
2. C.C. Yu, D.C. Chen, W.C. Cheng, Y.D. Yao, S.F. Lee, Y. Liou, *Structure and magnetic properties of Co grown on YSZ substrates*, to be published in J. Appl. Phys.

3. C.C. Yu, J.C.A. Huang, Y.D. Yao, *Step surface induced unidirectional exchange anisotropy in PtMn/Py on Mo(001)*, to be published in J. Appl. Phys.
4. C.C. Yu, W.C. Cheng, D.C. Chen, Y.D. Yao, Y. Liou, S.F. Lee, *Crystal structure and magnetic properties of fcc Co films on YSZ (001) substrates*, J. Magn. Magn. Mater., 239, 321 (2002).
5. C. M. Fu, P. C. Kao, M. S. Tsai, H. S. Hsu, C. C. Yu and J. C. A. Huang, *Magnetic anisotropy of permalloy thin film on Mo stepped surface*, to be published in J. Magn. Magn. Mater.
6. C.C. Yu, J.C. A. Huang and Y.M. Hu, *Magnetic anisotropy of permalloy films grown on Mo(001) step surface*, J. Appl. Phys. 89, 7380 (2001).

Yu, Hoi-Lai（余海禮）

1. H. L. Yu, *Dynamical renormalization group approach to the Altarelli-Parisi equations*, Phys. Rev. D, in press (2002).
2. H. L. Yu, *Nonequilibrium relaxation of Bose-Einstein condensates: Real-time equations of motion and Ward identities,* Phys. Rev. B, submitted (2002).
3. H. L. Yu, *Twist-3 and Quark Mass Contributions to the Polarized Nucleon Structure Function $g_2(x,Q^2)$*, J. Rev. Mod. Phys, in press (2002).

Yu, Yuen-Chung（余岳仲）

1. Y.C. Yu, E.K. Lin, C.W. Wang, and J.W. Chiou, *M-shell ionization in rare-earth elements by lithium ions*, Proc. of the first seminar on application of accelerator radiation, 27(2001)
2. J.J. Wu, K.H. Chen, C.Y. Wen, L.C. Chen, Y.-C. Yu, C.-W. Wang, E.-K. Lin, *Effect of dilution gas on SiCN films growth using methylamine*, Materials Chem. and Phys. 72, 240 (2001).
3. C.C. Chen, S.J. Liaw, Y.J. Yang, Y.C. Yu, and C.Y. Lin, *High power stable single-fundamental mode vertical cavity surface-emitting lasers with a zinc diffused absorber,* to be published (2001).

V

Supporting Facilities

Computing Facilities

The past year has been a very exciting period for the development of the computing facilities in the Institute of Physics. With the full installation of the firewall and the virus filter on our network, the institute is now enjoying a well-protected network and the service of a supporting team of knowledgeable and competent technical staffs, thanks to the help from all the members of the Committee for Computing Facilities.

In the past year, the Committee for Computing Facilities has set the following goals to be achieved within the next few years: (i) to provide high-speed computing environment for research using numerical simulations and symbolic manipulations, (ii) to maintain a well-protected and reliable network connection inside the institute and to the internet, (iii) to maintain automation in the administration office and library and to develop an online administration system within the institute and, (iv) to include multimedia presentation both on the institute web page and in the institute publications. Some of these goals have already been achieved, while steady and significant progress has been made in others.

One of the missions of the Committee is to provide enough computing facilities for the researchers of our institute who need high computing power in their research. Over the years, our computing facilities have been growing steadily. At present, the computing facilities of the institute include:

- 10 SUN workstations (2 SPARC10 and 8 UltraSPARC workstations)
- 3 IBM RISC 6000 workstations.
- 3 PC Farm clusters.

With the new network facility, each office in the New Physics Annex is equipped with 3 network sockets for twisted pair cables with speed up to 100 Mbits per second. The star topology was chosen in the design in order to minimize inter-dependency of network connectivity among different offices and laboratories. More ports are being installed in the laboratories. All sockets are connected to hubs located in B1 or 4F with category 5 twisted pair cables, which are in turn connected to the gateway of the institute to the campus network, a Cisco 5509 router switch.

The network of the old building was also upgraded, with help and guidance from

network experts in the Computing Center of the Academia Sinica. A similar network with star topology has replaced the old RG-58 cable in the old building. The sockets in each building are connected to the IBM 8275 switches purchased by the computing center. The IBM 8275 switches are also connected to the Cisco router switch through an IBM 8274 switch. The network topology is depicted in Figure 1.

The computer room staffs also installed three PC Farm clusters in the past two years. The first cluster was built in August 2000 with a total of 30 K7-700MHz PC's. The second cluster was installed in August 2001, with a total of 12 Pentium IV-1.4GHz PC's. The third cluster consists of 16 Pentium IV 1.4GHz PC's, also installed in August 2001, is mainly for people to run parallel computing jobs. This third cluster is owned by one of the research members of the institute, Professor Lee, Ting-Kuo who decided to share this cluster with any research workers in the institute who need to run parallel computing jobs. These three PC Farm clusters form an independent network and a separate account is needed in order for one to run his/her jobs on these PC Farm clusters. The inter-connection between the three PC Farm clusters is depicted in Figure 2. While this has seemingly satisfied the computing needs of our institute at the present moment, the Committee is keeping a close look at the use of our computing facilities and will put an effort to add new computing facilities whenever it is necessary.

In order to protect our network from the intrusion of hackers and annoyance of computer viruses, the Committee decided to install a firewall onto our network in the beginning of the year. As one might expect, this is not an easy task, both technological and administrative. On the technological side, we had to shop around and compare products from different companies that fitted our needs the most. The final decision was based on the following requirements: simple to use, easy to manage and reliable. We were furthermore constrained by the budget available. On the administrative side, we had to convince everybody of our institute that such measures were necessary in order to protect all users from hackers and virus annoyance. A couple of meetings were held in order to compromise different opinions and a total time span of three months was used to solve all the related issues. The Committee finally picked the firewall of SONICWALL (which cost us a little less than NT$200K) and had the installation in February 2001. This firewall system has the advantage of supporting an unlimited number of ports and can be monitored on screen and has basically satisfied all of our requirements. Even with the installation of this firewall, our network was still vulnerable to virus attacks through e-mails, ftp and web site downloads. The next step that the Committee had to take was to put a virus filter onto our mail and file servers. This was done in November 2001, when we purchased the TRENDMICRO virus filter.

The effect of all these measures was immediate and noticeable. Our network has been well protected from the intrusion of hackers since its installation and the virus filter help us screen practically all viruses since November 2001.

The decision to have an online administration system in the Physics institute was made back in 1999 by the administration of our institute. Such a decision is natural when considering the fact that the Academia Sinica has been slowly moving toward an online proposals and documents system among all its institutes. However, the administration of our institute at that time also decided not to pay for an outside company to develop such an online administration system. The decision was based on two reasons. First is the budget consideration. It would cost at least several million NT dollars to ask a company to develop a workable online administration system for the institute when the institute indeed did not have such a budget available. Second, it would be very time consuming to have some of the institute members to hold frequent meetings with the company, to monitor and to make suggestions during the development of such an online system. Our institute director therefore asked the Committee to provide the necessary help in order to fully implement such a policy. To make this vision possible is not an easy task. It involves again both technological and administrative considerations. On the administrative side, we need to convince the people in the administration that to have such an online administration system in our institute is both necessary and natural. Moreover, we also need to know very clearly all the bureaucratic procedures involved in order for the Committee to develop a workable online administration system. On the technical side, we need to look for somebody who is competent enough to take on such an enormous challenge. It was only in the beginning of 2001 that the Committee decided to go ahead and took this challenge. The first step in achieving such a goal is to build a new database, which contains data of each employee of the institute. It is our luck that we indeed had a very competent computer room assistant who could develop such a huge database all by himself even when he could allocate part of his office hour to do so. By the end of the summer, new employees could already filled out their personal data online when they first reported to their work. In the beginning of 2002, the system could also provide online service to those who needed to renew their contract or those who needed to terminate their employment with the institute. In addition, the system can now provide online service to our research fellows who need to update the accounting balance of their NSC grants. A diagrammatic illustration of the online administration system is shown in Figure 3. At present, the system is still under development and we are hoping that we can slowly put most daily functions of the administration online and to

integrate our online administration system with the online system of the Academia Sinica, and will eventually lead to a saving of manpower and reduction of human errors.

It was back in May 2001 that the institute decided to make a short presentation of the institute for the annual Open Day of Academia Sinica on October 13, 2001, when the form of the presentation was not yet decided. Dr. Leung, K-T of our institute was appointed as the person in charge of the production during that meeting. Also a member of the Committee for Computing Facilities, Dr. Leung turned to the Committee for help. After several intense meetings in July, we decided to use "FLASH" to make a multimedia presentation for the Open Day. The workload was enormous. Dr. Leung had to spend two months working full time with two of our computer room assistants in order to finish the project on time. It was a 15-minute presentation and turned out to be a success. This in turn spurred the desire for the institute to put our institute web page in such a multimedia format and also to have multimedia CDs about our institute and/or research groups. At present, the computer room assistants are still working on this multimedia project and we are hoping that the first phase of the multimedia project will be finished before this coming summer.

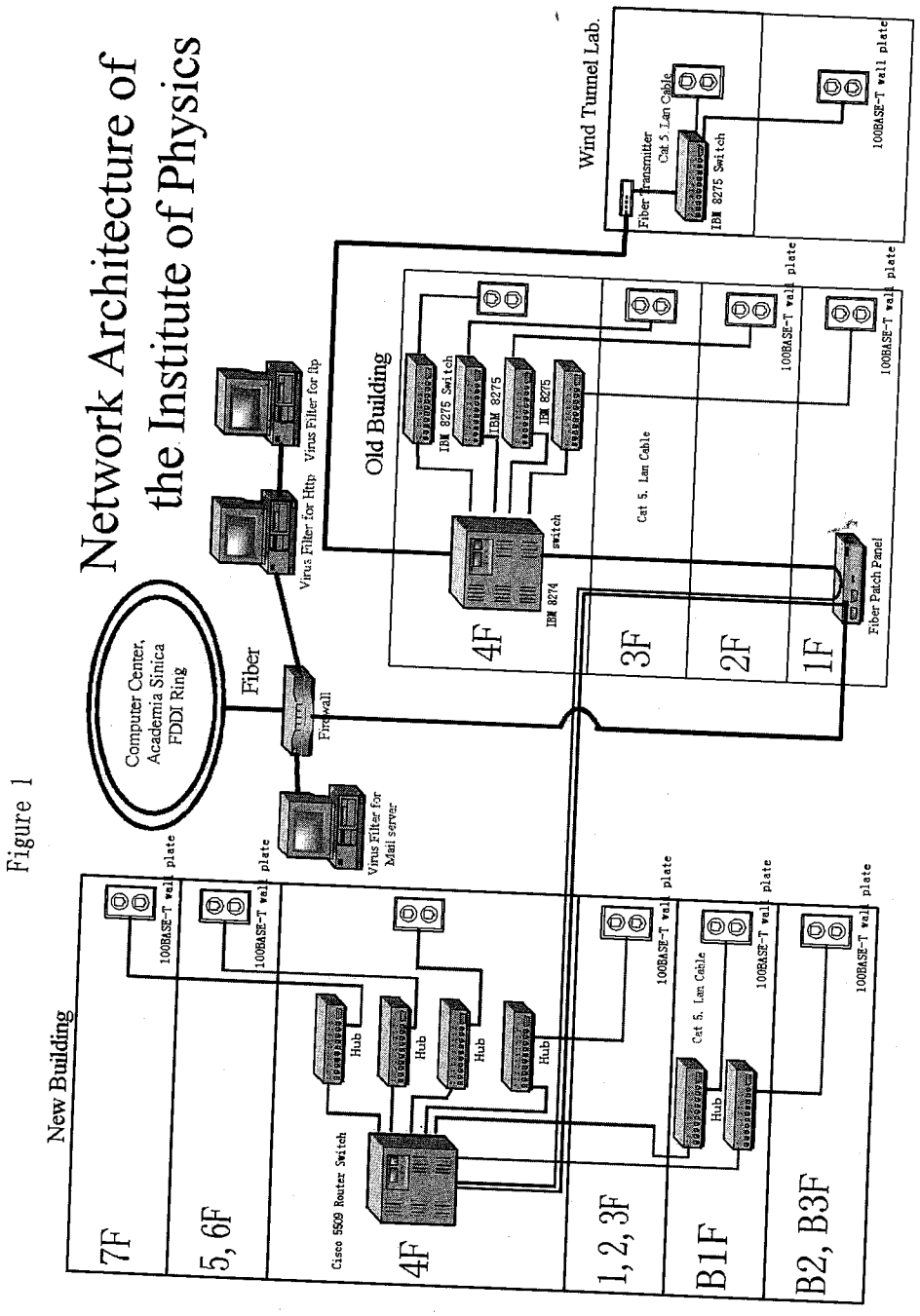


Figure 1

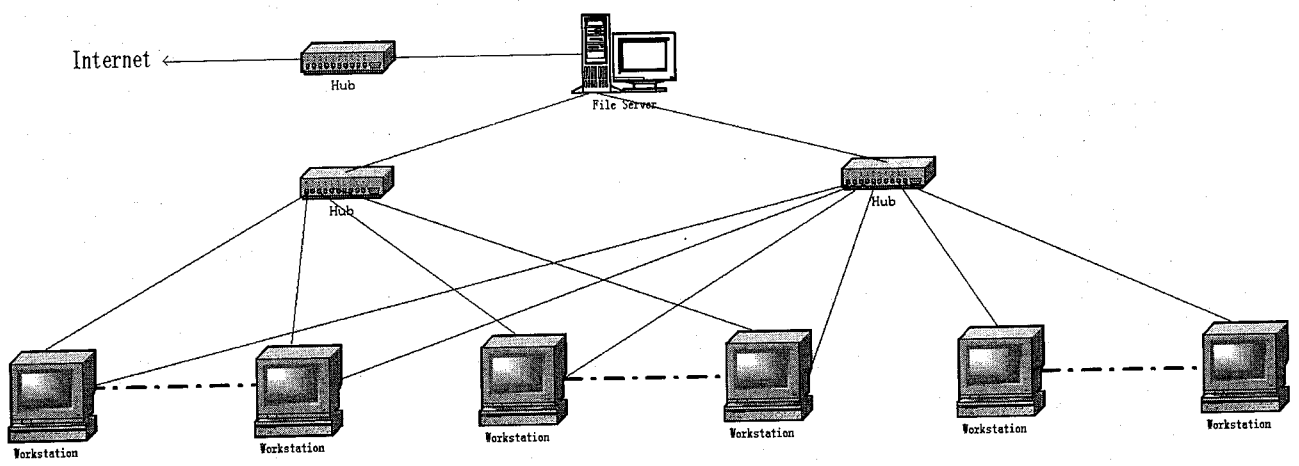
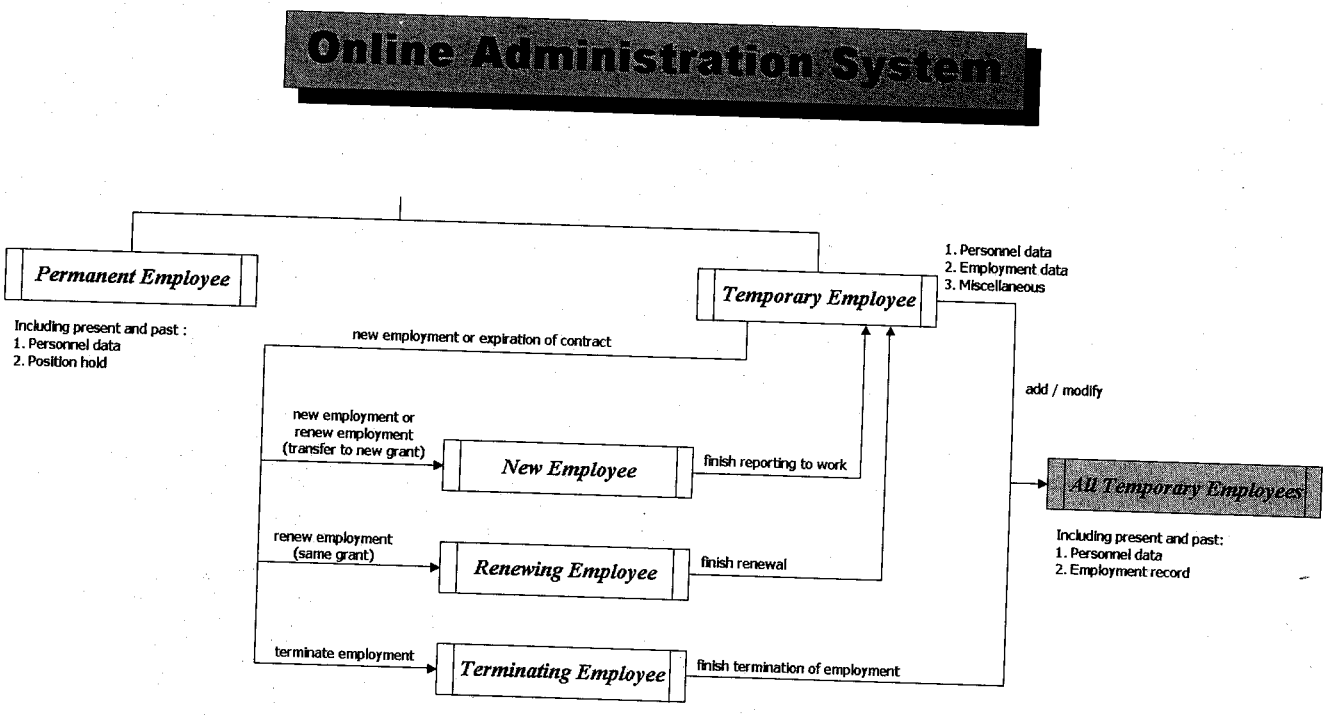


Figure 2



Digrammatic Illustration of the Online Administration System

Figure 3

Library

INTRODUCTION

The physics library was founded in 1962 as an academically specialized library. Its mission is to provide a perfect research environment for colleagues who are affiliated with the institute and scholars from the physics community in Taiwan.

There are over 30,000 library books (including more than 15,000 bound volumes of journals) and about 300 journals. The subscribed journals cover a wide range of areas in physics, mathematics and applied sciences.

SERVICE

These include:

---All library materials such as books, journals, CD-ROMs are open to the public. Members of the institute can check out most materials with a library card. Users not belong to the institute are limited to the use of these materials within the library.

---Library users can consult the librarians either on-site, through telephone, fax or by mail.

---Inter-library cooperative services. The Physics Library is a member of the "Interlibrary Cooperation Association". Besides assisting our institute colleagues to get the scientific papers from other libraries, we also provide our library materials to other libraries through the "Inter-Library Cooperative Services".

---DDS (Document Delivery Service) is available. Users can obtain the research papers they need through the internet.

---Photocopying services. There are two photocopiers and one "reader/printer" machine. Library user can photocopy materials he/she needs as long as it does not violate the copyright law of the R.O.C.

---There are now more and more journals which have "on-line" versions. Examples are: Physical Review A-E and Letters (started1985), Nuclear Physics A, B and Nuclear Physics B Supplement etc. The Physics Library has made subscriptions of all the above mentioned "on-line" journals and will continue to do so whenever new "on-line" versions of other subscribed journals are available.

---All library news are now sent to the library users through their e-mail account.

Machine Shop

We have a machine shop in our institute for supporting our research activities. The machine shop provides the following services: (1) fabrication and assembly of mechanical parts; (2) making sample cells and testing tools; (3) support of vacuum facilities; (4) management and supplies of gases and liquids; (5) operation and maintenance of complex and specialized research facilities; and (6) management and handling of radioactive materials. It has been eight years since the machine shop was established. At the present we have two technicians and one assistant working in the workshop. In order to meet the increasing need of our institute, we have to expand the number of technical staff in the workshop by hiring a work-student. In these years, we purchased a lathe (Yang CL-4070G made in Taiwan), a Milling and Drilling machine (Fehlmann PICOMAX 54 TOP made in Swiss) and a Wire cut electric discharge machine (Fanuc Robocut α-0iA made in Japan). For these years, we have designed and made numerous parts that worth more than two million N.T. dollars. In addition we also helped our research faculties to solve their problems in various laboratories of our institute. We also have upgraded our technical support for vacuum systems. These include design, fabrication and assembly of vacuum chambers, maintenance and repair works of vacuum pumps. We are improving our stock for commonly used vacuum parts and materials especially those used in UHV system. The staffs in the mechanical workshop are always service-oriented and work under safety-first guidelines. We hope that we can support our research staff and improve ourselves towards the goal of high precision and high efficiency.

In general, the work in the machine shop has been heavy and high-tech related. We are still evolving towards maturity and the main hurdle is the lack of manpower. However, under the present regulations, it is rather difficult to recruit the right technical personnel. We are glad that the Academia Sinica has recognized this problem and has been working to improve the salary and promotion system for the technical staff. In the meantime, we are trying to train our technical personnel by giving them chances to practice in famous laboratories abroad.

Electronic Workshop

The main purpose of the electronic workshop at present is to provide service to maintain and repair the electronic instruments of the Institute. We provide the first aid to malfunctioning apparatus to minimize the led time of shutdown of experiment. And responsible for the regular maintenance work of the 3MV Tandem Van der Graaff Accelerator of the nuclear physics group.

Service for PC board fabrication is also supported. A good relationship with Chung-Shan Institute of Science and Technology has been established to provide service for high quality PCB layout and fabrication.

To further improve the service to our colleagues, a computer controlled drilling machine made by Bungard Elektronik has been purchased and installed recently. The machine is determined for drilling and milling printed circuit boards and for milling (routing) and engraving aluminum plates.

Protel 99 for Windows NT/98/95 is also available. It includes the complete package of

a. Advanced Schemiatic,

b. Advanced PCB Design,

c. Advanced Routing,

d. Advanced Simulation,

e. Advanced PLD.

VI

Academic Activities

Attendance in International Conferences

中研院物理所九十年度出席國際會議表

（2001年1月～2001年12月）

會議名稱	會議期間	舉辦地點	出席人員	經費來源
第八屆國際聯合磁性會議	2001.01.07-2001.01.11	美國德州	任盛源	本所
第八屆國際聯合磁性研討會	2001.01.07-2001.01.11	美國德州	蔡佳霖	本所
第八屆國際磁學及磁性材料聯合研討會	2001.01.07-2001.01.11	美國德州	姚永德	本院
第八屆國際磁學及磁性材料聯合研討會	2001.01.07-2001.01.11	美國德州	柯松仁	本院
第三十九屆美國航空太空年會	2001.01.08-2001.01.11	美國雷諾	簡來成	自理
第十屆計算材料研討會	2001.01.11-2001.01.13	義大利 Trieste	邢正蓉	本院
第十五屆超高速原子核-原子核碰撞國際研討會	2001.01.14-2001.01.20	美國紐約	顏迪佑	本所
第三屆關於超導體材料、理論及應用國際會議	2001.01.14-2001.01.21	美國夏威夷	李定國	自理
COE 研討會-前峰奈米科學與技術	2001.03.06-2001.03.08	日本大阪	鄭天佐	本所
美國物理學 2001 年年會	2001.03.12-2001.03.16	美國西雅圖	姚永德	本所 + 國科會
美國物理學 2001 年年會	2001.03.12-2001.03.16	美國西雅圖	何侗民	本所
2001 年美國物理學會三月會議	2001.03.12-2001.03.16	美國西雅圖	李定國	國科會
2001 年美國物理學會三月會議	2001.03.12-2001.03.16	美國西雅圖	黃英碩	其他
2001 年美國物理學會三月會議	2001.03.12-2001.03.16	美國西雅圖	陳洋元	國科會
Swiss-Korean Workshop on Novel Coherence-Based Radiology Techniques	2001.03.27-2001.03.31	瑞士	蔡文立	其他
量子計算與訊息研討會	2001.04.02-2001.04.06	新加坡	張志義	本所
第八屆國際粒子、弦論及宇宙論研討會	2001.04.10-2001.04.15	美國 Chapel Hill	江祖永	本院+其他
第二屆泛太平洋微重力科學會議	2001.05.01-2001.05.04	美國加州	簡來成	自理
北大西洋公約組織高級研究研討會	2001.05.24-2001.05.28	俄國莫斯科	胡進錕	本所

會議名稱	會議期間	舉辦地點	出席人員	經費來源
Theory of Quantum Gases and Quantum Coherence	2001.06.03-2001.06.05	義大利	葉崇傑	國科會
國際味物理會議	2001.05.31-2001.06.06	湖南張家界	鄭海揚	本所
圖像及自發性非線性複合系統國際會議	2001.06.11-2001.06.15	大陸北京	杜其永	本所
圖像及自發性非線性複合系統國際會議	2001.06.11-2001.06.15	大陸北京	陳志強	國科會
圖形形成統計物理國際會議	2001.06.11-2001.06.15	大陸北京	梁鈞泰	國科會
第九屆超對稱及基本交互作用之統合國際會議	2001.06.11-2001.06.17	俄國都伯那	江祖永	本院
中波雙邊奈米材料研討會	2001.06.09-2001.06.17	波蘭華沙	魏金明	國科會
ES2001-Thirteenth Annual Workshop on Recent Developments in Electronic Structure Algorithms	2001.06.15-2001.06.18	美國	魏金明	國科會
太空反物質磁譜儀研製進度檢討會議	2001.06.18-2001.06.22	瑞士日內瓦	李世昌	國科會
第三屆非加速器國際會議	2001.06.19-2001.06.23	俄國都伯那	江祖永	本院
Fundamental Issues in Quantum Gases	2001.06.19-2001.06.30	美國	葉崇傑	本所 + 國科會
2001 年尖端科技材料國際會議	2001.07.01-2001.07.06	新加坡	黃英碩	本所+本院
原子核多體問題及核內亞核子自由度國際研討會	2001.07.02-2001.07.08	大陸吉林	曾詣涵	本所
ICMAT2001 會議	2001.07.02-2001.07.08	新加坡	胡宇光	國科會
原子控制的表面、介面及奈米結構研討會	2001.07.09-2001.07.12	美國加州	鄭天佐	本所
2001 國際歐洲物理高能會議	2001.07.10-2001.07.18	匈牙利 布達佩斯	鄭海揚	國科會
第十一屆國際掃描穿隧顯微術會議	2001.07.15-2001.07.20	加拿大	張嘉升	本所
第十五屆國際離子束分析會議	2001.07.15-2001.07.20	澳洲	余岳仲	國科會
2001 年掃描穿隧顯微術國際會議	2001.07.15-2001.07.20	加拿大 溫哥華	黃英碩	本院
第二十一屆 IUPAP 統計物理國際會議	2001.07.16-2001.07.20	墨西哥坎昆	梁鈞泰	本所 + 國科會

會議名稱	會議期間	舉辦地點	出席人員	經費來源
第二十一屆 IUPAP 統計物理國際會議	2001.07.16-2001.07.20	墨西哥坎昆	胡進錕	本院
第二十一屆 IUPAP 國際統計物理會議	2001.07.15-2001.07.21	墨西哥坎昆	陳志強	本所 + 國科會
第二十一屆 IUPAP 國際統計物理會議	2001.07.15-2001.07.21	墨西哥坎昆	杜其永	本所 + 國科會
第九屆國際磁性流體會議	2001.07.23-2001.07.27	德國 Bremen	楊謝樂	其他
第二十屆國際高能輕光子作用會議	2001.07.23-2001.07.28	義大利羅馬	余海禮	國科會
宇宙扭度研討會 Cosmic Shear Workshop 會議	2001.07.26-2001.07.28	英國劍橋	吳建宏	本所
國際動力系統會議	2001.07.27-2001.07.31	加拿大	黃榮鑑	本所
第四屆 ICBP 國際生物科技會議	2001.07.30-2001.08.03	日本京都	杜其永	本所
第四屆國際生物物理會議	2001.07.30-2001.08.03	日本京都	鄒忠毅	本院
第四屆國際生物物理會議	2001.07.30-2001.08.03	日本京都	李定國	本院 + 國科會
第四十七屆國際場發射研討會	2001.07.28-2001.08.05	德國柏林	鄭天佐	本所
第二十七屆國際宇宙線會議	2001.08.07-2001.08.15	德國	黃明輝	本院 + 國科會
第十屆數值分析及電腦科學國際研討會會後參加 The Twelfth Colloquium on Differential Equations	2001.08.12-2001.08.17	保加利亞	柯松仁	本院
兩岸合辦之奈米與技術學術研討會	2001.08.18-2001.08.25	新疆 烏魯木齊	姚永德 等六人	本所
第二屆國際複雜科學與經濟物理學研討會及會議	2001.08.21-2001.08.27	廣西桂林	胡進錕	國科會
磁電阻效應物理學國際研討會	2001.08.27-2001.09.02	北京	姚永德	本所
第二十屆歐洲奈米科學會議	2001.09.04-2001.09.07	波蘭	畢本	本所
2001 歐盟應用科學計算流體力學會議	2001.09.04-2001.09.07	英國威爾斯	黃榮鑑	國科會
粒子與弦光錐物理研討會	2001.09.03-2001.09.11	美國	李湘楠	本所
亞太風工程研討會	2001.09.03-2001.09.13	日本	蕭葆羲	本所

會議名稱	會議期間	舉辦地點	出席人員	經費來源
葉里溫物理研究所出席會議	2001.09.23-2001.09.25	亞美尼亞	伊士麥林尼可	自理
第五屆亞太重力及天文物理國際會議	2001.09.29-2001.10.07	莫斯科	歐迪瑪	自理
第五十二屆國際太空聯盟年會	2001.09.28-2001.10.07	法國	簡來成	本院
交通與顆粒流會議	2001.10.15-2001.10.07	日本名古屋	杜其永	本所
第三屆高能自旋物理研討會	2001.10.07-2001.10.14	中國	李湘楠	國科會
第三屆高能自旋物理研討會	2001.10.08-2001.10.14	中國北京	陳泉宏	本所
第三屆高能自旋物理研討會	2001.10.08-2001.10.14	中國北京	周忠憲	本所
第三屆高能自旋物理研討會	2001.10.08-2001.10.14	中國北京	余海禮	自理
第一屆日本、美國聯合核子物理學會	2001.10.17-2001.10.20	美國夏威夷	章文箴	國科會
赴中國及韓國出席會議及短期訪問	2001.10.04-2001.10.21	中國及韓國	胡進錕	國科會
第二十三屆國際電子電機協會	2001.10.23-2001.10.31	土耳其	詹明宜	本院
第十五屆國際真空聯盟會議	2001.10.28-2001.11.02	美國	傅祖怡	本所
美國真空學會第四十八屆國際學術會議	2001.10.28-2001.11.05	美國	張嘉升	本所 + 國科會
第四十六屆國際磁性研討會	2001.11.12-2001.11.16	美國	蔡佳霖	其他
第四十六屆磁學及磁性材料會議	2001.11.12-2001.11.16	美國西雅圖	余進忠	本院
亞馬達國際會議	2001.11.13-2001.11.17	日本 Tsukuba	黃英碩	國科會 + 自理
第四十六屆磁性及磁性材料年會	2001.11.11-2001.11.18	美國西雅圖	姚永德	國科會
第五屆 KEK 主題研討會	2001.11.18-2001.11.23	日本	李湘楠	國科會
第一屆東亞地區超導電子元件會議	2001.11.26-2001.11.28	日本仙台市	陳啓東	本所
國際光學工程學會	2001.11.26-2001.11.30	新加坡	詹明宜	其他
材料研究學會	2001.11.24-2001.12.02	美國波士頓	黃英碩	國科會 + 自理
複雜系統研究新展望	2001.12.05-2001.12.08	義大利	胡進錕	本所+自理
第十一屆全國光散射學術會議及會後訪問	2001.12.04-2001.12.27	大陸廈門	謝雲生	自理

Institute Sponsored Meetings

Institute Sponsored Meetings

會議名稱
The 24th Academia Sinica Workshop on Statistical Physics and Numerical Simulation: Numerical Approach to Critical Systems (第二十四次統計物理與數值模擬研討會：數值方法在臨界系統之應用)
Workshop on Interface of Statistical Physics and Mathematics (統計物理與數學之介面研討會)
第四屆超晶格物理特性研討會
International Symposium on Physics of Magnetic Materials/International Symposium on Advanced Magnetic Technologies (國際磁性材料物理暨尖端科技技術研討會)
中華民國磁性技術協會年會
The 25th Academia Sinica Workshop on Statistical Physics and Numerical Simulation: Properties of Classical and Quantum Systems (第二十五次統計物理與數值模擬研討會：古典與量子系統之性質)
第二屆兩岸磁性產業技術研討會
第二十六次統計物理與數值模擬研討會：心跳訊號的分析及其臨床研究
海峽兩岸“納米科學與技術”研討會
第二次非線性動力學研討會：從物理到醫學
Workshop on Quantum Transport in Nanoscopic and Mesoscopic Structures (奈米尺度結構之量子傳輸研討會)
The 27th Academia Sinica Workshop on Statistical Physics and Numerical Simulation: Nonlinear Dynamics and Turbulence (第二十七次統計物理與數值模擬研討會：非線性動力學與湍流) http://www.sinica.edu.tw/~statphys/
軟凝態物理研討會 http://www.vac.gov.tw/dept4/newvac/topic4/chilanhtm/index-m.htm

Institute Sponsored Meetings

會議期間	舉辦地點	聯絡人
2001.02.15	中研院物理所	胡進錕
2001.03.08-2001.03.09	中研院物理所	胡進錕
2001.04.27-2001.04.28	高雄師範大學	姚永德
2001.05.13-2001.05.16	台北圓山飯店	姚永德
2001.05.15	中研院物理所	姚永德
2001.08.02	中研院物理所	胡進錕
2001.07.16	台北福華飯店	姚永德
2001.08.02	中研院物理所	胡進錕
2001.08.20-2001.08.26	新疆烏魯木齊	姚永德
2001.10.27	中研院物理所	胡進錕
2001.11.09-2001.11.10	交通大學 中研院物理所	姚永德
2001.11.15	中研院物理所	胡進錕
2001.11.17-2001.11.18	宜蘭縣明池山莊	陳志強

Seminars

中央研究院物理所九十年度演講一覽表

（2001 年 1 月-2001 年 12 月）

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Raman Scattering by Phonon in Wide Gap Ⅱ-Ⅵ Semiconductors	梁君致	University of Wurzburg, Germany	2001/01/03
Inclusive Cross Section for the Production of Antiprotons in p+A Collisions	黃慶元	Insititut des Sciences Nucleaires	2001/01/05
The legacy of G. I. Taylor, an extraordinary 20th century physicist	Harry Swinney	University of Texas at Austin	2001/01/10
Noncommutative Soliton and Tachyon Condensation in String Theory – Review Talk	林豐利	Seoul National University	2001/01/12
Classical Correspondence of Unruh Effect	林世昀	中央研究院物理所	2001/01/17
Cosmic High-energy Neutrinos: From Production to Detection	Athar Hussian	國家理論科學中心	2001/01/19
Exact Velocity of Dispersive Flow in the Asymmetric Avalanche	E. V. Ivashkevich	中央研究院物理所	2001/02/06
Filling Carbon Nanotubes with Fullerences	Sumio Iijima	Meijo University & NEC Fundamental Labs	2001/02/09
Light Emission from Indirect-bandgap: Si as an example	林清富	國立台灣大學電機所/光電所	2001/02/14
Multicanonical Monte Carlo Simulations: Basic Concepts and Open Problems	Wolfhard Janke	Institut fur Theoretishce Physik, Universitat Leipzig, Germany	2001/02/15
Multi-Overlap Simulations of Free-Energy Barriers in Spin Glasses	Wolfhard Janke	Institut fur Theoretishce Physik, Universitat Leipzig, Germany	2001/02/15
Universal Amplitudes in the FSS of Three-dimensional Spin Models	Martin Weigel	Institut fur Theoretishce Physik, Universitat Leipzig, Germany	2001/02/15

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Pattern Formation of Crack Paths	梁鈞泰	中央研究院物理所	2001/02/15
Renormalization Group Study of Sandpile Model on Planar Lattices	林財鈺	中央研究院物理所	2001/02/15
Study of Nucleon Resonance via Kaon and Eta Photoproduction	江文泰	國立台灣大學	2001/02/16
科幻與科學共舞	葉李華	天下文化科幻系列總策劃	2001/02/21
前瞻性電子元件與材料	曾俊元	交通大學電子工程所	2001/02/22
Higgs Boson and Neutrino in the Randall-Sundrum Model	張嘉泓	國立台灣師範大學	2001/02/23
Bridging the Gap Between Two Limiting Approaches of Protein Folding: Structure and Dynamics	陳啓明	國立台灣師範大學物理系	2001/02/26
Large T-odd Observable in $\Lambda_b \to \Lambda \ell^+\ell^-$ Decays with Polarized Λ	陳泉宏	國立成功大學	2001/03/02
Contact Motion:A Statistical Physicist's Point of View	陳宣毅	University of California, Santa Barbara	2001/03/02
Statistical Physics and Soft-matter Journal Club: Attraction of Minute Particles to Invariant Regions of Volume Preserving Flows by Transients	孫富國	國立中央大學	2001/03/05
Unconventional Isotope Effects in the High-temperature Superate Supercnductors and Colossal Magnetoresistive Manganites	Guo-Meng Zhao	University of Zurich	2001/03/07
ATTA- Atom Trap Trace Analysis	陳春燕	中研院地球科學研究所	2001/03/07
Statistical Physics and Soft-matter Journal Club: Defects Induced Phase Separation in Dipolar Fluids	陸駿逸	國立中央大學物理系	2001/03/12

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Statistical Physics and Soft-matter Journal Club: Rayleigh-Taylor Instabilities in Thin Films of Tapped Powder	梁鈞泰	中央研究院物理所	2001/03/16
Characteristics of Magnetic Transport of Quasiparticles in Semiconductor-Superconductor Microjunctions	顧本源	中國科學院物理所	2001/03/23
Statistical Physics and Soft-matter Journal Club: Knots and Random Walks in Vibrated Granular Chains	杜其永	中央研究院物理所	2001/03/26
Stochastic Resonance	胡　崗	北京大學物理系	2001/03/28
QCD Factorization for Hadronic B Decays	鄭海揚	中央研究院物理所	2001/03/30
Є'/ Є and Kaon Peuguin Matrix Elements	Stephan Narison	國家理論科學研究中心	2001/04/02
A Physicist's Approach to Protein Folding and Misfolding: The Hydrophobic Driving Force and Its Anti-cooperativity	Hue Sun Chan	Dept. of Biochemistry, Faculty of Medicine, U of Toronto	2001/04/02
Energetic Components of Cooperative Protein Floding	Hue Sun Chan	Dept. of Biochemistry, Faculty of Medicine, University of Toronto	2001/04/02
搖頭丸與心跳訊號分析	蕭又新	國家理論科學研究中心	2001/04/10
Radiation Reaction Reconsidered	James M. Nester	國立中央大學	2001/04/12
A Novel State Induced by the Discreteness of Molecules in an Autocatalytic Reaction Loop with Diffusion	龐寧寧	台灣大學物理系	2001/04/16

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Study of Magnetic Domains and Magnetic Force Microscopy	韓寶善	北京中科院物理所	2001/04/16
Fatal Attraction: Attraction Between Nanoparticles Induced by End-grafted Homopolymers in Good Solvent	阮俊人	中央研究院物理所	2001/04/17
Studies of Nanostructures with Scanning Probe Microscopy	蘇維彬	中央研究院物理所	2001/04/17
Nano- and Atom-Photonics by Optical Near Field	Motoichi OHTSU	Tokyo Institute of Technology	2001/04/18
Current Status of Magnetic Fusion Energy Research	林留玉仁	國立東華大學物理系	2001/04/18
Cosmic Rays and Atmospheric Neutrinos	吳建宏	中央研究院物理所	2001/04/20
BBN for Pedestrians	林文隆	國立台灣大學	2001/04/20
Cosmological Implications of Degenerate Neutrinos	何小綱	台灣師範大學	2001/04/20
Making a Chiral Elastomer-A Theory of Chiral Imprinting	毛甬	Dept. of Physics, University of Cambridge	2001/04/23
Novel Superconductivity in Ru-based Double Perovskite	吳茂昆	國科會	2001/04/24
Luminescent Silicon Nitride Thin Films: Some Interesting Observations	蕭錫錬	Dept. of Physics, Tunghai University	2001/04/26
An Attempt to Unclerstaud AMS Helium Results	S. A. Stephens	Visiting Scholar, Academia Sinica ; Tata Institute, India	2001/04/27
Experimental Observations of Frictional-Collisionalm Flows of Liquid-Granular Mixtures	Herve Capart	Hydrotech Research Institute, National Taiwan University	2001/04/30
Medium Effects in Nuclear Reactions with Pions and Kaons	Sabit Kalmolov	Lab. of Theoretical Physics, JINR Dubna, Russia	2001/05/03

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Geometry and Dynamics of The Brane World	陳江梅	國立台灣大學	2001/05/04
Low Frequency Motion in Complex Systems	馬文忠	中央研究院數學研究所	2001/05/07
Cosmology Program in Taiwan: The AMiBA Sciences	闕志鴻	國立台灣大學	2001/05/09
Chiral Dynamics in Light-Front QCD	張爲民	國立成功大學	2001/05/11
Statistical Physics and Soft-Matter Journal Club: How to Produce a Solitary Wave	陳培亮	國立中央大學物理研究所	2001/05/14
On Continuous Writhing of Intrinsically Curved DNA	胡鍇	Dep. of Allied Mathematics National Dong Hwa Univ.	2001/05/15
Introduction to Self-Consistent Field Theory for Polymers	阮俊人	中央研究院物理所	2001/05/15
Kondo Effect in an Artificial Quantum-Dot-Molecule	Albert M. Chang	Purdue University	2001/05/16
Frontiers in Bio-Agricultural Sciences	楊寧蓀	中央研究院生農所	2001/05/16
Monopole Harmonics	馮明光	國立師範大學	2001/05/18
Ultrathin Magnetic Films and Mesoscopic	J. Kirschner	Director of Max-Planck Institute of Microstructure Physics at Halle, Germany	2001/05/18
Local Nanoscale Measurements of Magnetostriction and Magnetic domain Mapping of Magnetic Dots, and Patterned Media Using Modified Atomic Force Microscopy	K. V. Rao	Dept. of Materials Science-Tmfy-MSE, Royal Inst. of Technology, Stockholm, Sweden	2001/05/18
Dynamic Pattern Formation in A Vesicle-Generating Microfluidic Device	賈魯強	國立中央大學物理研究所	2001/05/21

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Real Time Phase Contrast X-Ray Micro-Radiology with Live Animals	胡宇光	中央研究院物理所	2001/05/23
Some Games One Play with Extra Dimensons	張達文	國立清華大學	2001/05/28
Status of Milagro Detetcor for Cosmic Ray Physics	Greg Sullivan	University of Maryland	2001/05/28
統計生物座談會	P. K. Sen	Dept. of Biostatistics & Statistics, University of North Carolina	2001/05/28
Nonexponential Relaxation in Protein Folding Dynamics	Chi-iun Lee	美國紐約大學石溪分校	2001/05/28
Solar Neutrinos from The Super-Kamiokande Experiment	Greg Sullivan	University of Maryland	2001/05/30
Nonlinear Dynamics and Quantum Features in Microchip Solid State Lasers	陳志隆	國立成功大學物理系	2001/05/30
An Effective Operator Guide to Neutrino Mass Models	C. N. Leung	University of Delaware	2001/06/05
非線性光學材料的太空與地實驗室晶體生長研究	陳萬春	中國科學院物理研究所	2001/06/06
Electromagnetic Properties of Heavy Mesons in Heavy Quark Limit	黃建文	國立清華大學	2001/06/07
Magnetic Domain Images of Nanostructured Film Magnetic Force Microscopy	劉思煌	University of Nebraska	2001/06/08
Pseudo-Hall Effect in Spin-Valve Multilayers	賴武彥	中國科學院物理所	2001/06/13
Interfacial Adhesion Measurements in Film-On-Substrate Systems : Fundamentals Experimental Techniques, Example of Bulge-and-Blister Test	Michel Dupeux	Université de Grenoble	2001/06/14

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Morphological Control of GaN Layers Grown by MBE	Ig. Tsong	Arizona State University	2001/06/14
Electric Dipole Moments of Leptons	耿朝強	國立清華大學	2001/06/15
Scaling Analysis of Magnetic Field Tuned Phase Transitions in One-Dimensional Josephson Junction Arrays	陳啓東	中央研究院物理所	2001/06/15
Nonequilibrium Relaxation and Its Application	Nobuyasu Ito	Dep. of Applied Physics , School of Engineering, The University of Tokyo	2001/06/15
The Second Law of Steady State Thermodynamics in Nonequilibrium Quantum Dynamics	Satoshi Yukawa	Dep. of Applied Physics ,School of Engineering, The University of Tokyo	2001/06/15
Simulational Study and Phenomenological Approach on Two-Dimensional Phase Transitions	Hiroshi Watanabe	Dept. of Applied Physics, School of Engineering, The University of Tokyo	2001/06/15
Correlation Function of Random Heteropolymer Solutions	Zhyrair Gevorkian	中央研究院物理所	2001/06/15
The Quantum Hall Fluid and Non-Commutative Chern-Simons Theory	高賢忠	淡江大學物理系	2001/06/22
Experiments on Convection in Two-Layered Fluids a Century After Bénard	Stephen Morris	University of Toronto	2001/06/22
Scheme Independent Perturbation Theory	Virendra Cupta	國立台灣大學	2001/06/29
高溫超導中的能隙對稱性	龔昌德	南京大學物理系	2001/07/20
Structure Functions of the Nucleon and High Energy Neutrino Telescopes	G. Parente	Univ. of Santiago de Compostela, Spain	2001/07/26

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Phase-Field Model and Application in Crystal Growth	陳萬春	中國科學院物理研究所	2001/08/01
What Debye and Onsager might say about fluid flow in rock formations?	Po-Zen Wong	Dept. of Phys., Univ. of Massachusetts, Amherst, USA	2001/08/02
Roughening, pinning and stick-slip motion of moving interfaces	Po-Zen Wong	Dept. of Physics University of Massachusetts, Amherst, USA	2001/08/06
Radiative Decays of Neutrinos	Francois Vannucci	Dept. of Physics, Univ. of Paris	2001/08/13
Neutrino Oscillations at Accelerators	Francois Vannucci	Dept. of Physics, Univ. of Paris	2001/08/15
氮碳硼三元系統之超硬特性研究	翁明壽	東華大學材料所	2001/09/07
Viral Host Interaction	阮麗蓉	國家衛生研究院	2001/09/10
The Investigation of the nucleon spin-from quarks to gluons	Naoaki Horikawa	Nagoya University, Japan	2001/09/11
Dark Matter Detection	Sung-kee Kim	Dept. of Physics, Seoul National University	2001/09/12
天氣預報與氣象資料之應用	林民生	中央氣象局應用氣象組	2001/09/19
Review of the 27th International Cosmic Ray Conference	黃明輝	中央研究院物理所	2001/09/21
Recent result in neutrino physics	Henry Wong	中央研究院物理所	2001/09/21
Measurement of Sin2φ at Belle	Paoti Chang	國立台灣大學	2001/09/21
Non-equilibrium tools for Quark-Gluon Plasma	余海禮	中央研究院物理所	2001/10/05
Neutrino masses and oscillation in the MSSM without R parity.	Sin Kyu Kang	KIAS/KEK	2001/10/19

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Berry Phase, Anomalous hall Effect, and Orbital Magnetism in Strongly Correlated Electronic Systems	Nagaosa	Applied Physics, University of Tokyo	2001/10/26
Atrial Fibrillation 醫學觀點	陳高揚	桃園醫院	2001/10/27
Ventricular response to atrial fibrillation: random or deterministic	楊智傑	國立陽明大學醫學系	2001/10/27
Stochastic resonance in dynamical systems	蕭又新	國立東華大學	2001/10/27
Nonlinear transformations of time series	何淮中	中研院統計科學研究所	2001/10/27
Elastically driven Linker Aggregation between Two Semiflexible Polymer	黃俊燕	中央大學物理系	2001/10/29
燃燒過程實驗研究	俞剛	中國科學院力學研所	2001/10/31
Application of Fluorescence and Micromanipulation Microscopy in Biophysics	董成淵	台灣大學物理系	2001/11/01
Holographic Cosmic Quintessence on Dilatonic Braue World	林豐利	淡江大學物理系	2001/11/09
Phase Behavior of Bolck Copolymer System	黃慶怡	台灣科技大學	2001/11/12
Reconstructing Quantum Geometrodyuamics from Gauge Theory	許祖斌	成功大學	2001/11/16
Single Molecular Measurement of DNA During Collapsing Transition	M. Sano	日本東京大學物理系	2001/11/19
RNA and Single-Stranded DNA Folding	歐陽鍾燦	中國科學院物理研究所	2001/11/20
Carbou Nanotubes Synthesis, Some of Their Physical and Chemical Properties	Leszek Stobinski	中央研究院物理所 大同工學院	2001/11/22

演　講　題　目	演講者姓名	所　屬　機　構	日　期
The High Energy Physics Program at the HERA ep Collider : Present and Future	Stathes Paganis	Columbia University	2001/11/23
矽奈米元件電物理特性及量測	黃恆盛	台北科技大學機電整合所	2001/11/28
Summary of RHIC runs at the First Year	章文箴	中央研究院物理所	2001/11/30
Dark Matter in the Universe	Keith Olive	University of Minnesota	2001/12/05
Mobility of 2D Electron Gas oner Liquid Helium	A. Zhukov	中央研究院物理所	2001/12/05
Theoretical Study on Mechanical and Electrical Properties of Single Wall Caarbon Nanotubes	歐陽鍾燦	中國科學院物理研究所	2001/12/10
Leptogenesis with Majorana Neutrinos	E. A. Paschos	University of Dortmund	2001/12/10
Thermodynamics and Conserved Quantities for Spatially Bounded Spacetime Regions	Roh-Suan Tung	California Institute for Physics and Astrophsics	2001/12/14
Synchronization and Weak Signal Processing in Neuronal System.(Ⅰ)(Ⅱ)	Wei Wang	南京大學物理系	2001/12/17
Small X Physics and Joint Resummation	李湘楠	中央研究院物理所	2001/12/21
Exact Derivation of QNL σ-Modal from QHA	張爲民	成功大學物理系	2001/12/28

Visiting Scholars

中央研究院物理所九十年度訪問學人表

(2001 年 1 月-2001 年 12 月)

訪問學人	所屬機構	訪問期間
李匡邦	美國麻州大學	2000.12.26-2001.01.29
V. B. Priezzhev	Lab. of Theoretical Phys. Joint Inst. for Nuclear Research Dubna	2001.01.01-2001.02.28
何孟書	中華大學	2001.01.01-2001.12.31
Harry L. Swinney	美國德州大學	2001.01.03-2001.01.12
張樹霖	北京大學物理系	2001.02.01-2001.03.31
Iijima	日本 Meijo 大學	2001.02.09
胡比樂	馬里蘭大學	2001.02.11-2001.02.13
Sin Kyu Kong	韓國 Advanced Study	2001.02.12-2001.02.19
胡崗	北京師範大學	2001.02.17-2001.03.17
邱進發	中國科學高能物理研究所	2001.03.01-2001.05.02
李匡邦	美國麻州大學	2001.03.15-2001.03.25
孫成軍	新加坡大學材料研究所	2001.03.17-2001.03.29
Alfred Stephens	印度 Tata Institute	2001.03.26-2001.05.25
Hector de Vega	法國巴黎大學	2001.03.26-2001.03.30
Stephan Narison	法國 Montepellier 大學	2001.03.29-2001.04.04
陳曉新	加拿大 Toronto 大學	2001.04.01-2001.04.07
Katsuaki Kasahara	Shibaura Institute of Technology	2001.04.01-2001.04.07
張桂林	中國科學院上海原子核研究所	2001.04.20-2001.04.29
Koriun Oganesian	Yerevan Physics Institute	2001.04.26-2001.06.27
Sergei A. Nikitov	俄國科學院	2001.04.30-2001.05.08
Zhyrair Gevorgian	Yerevan Physics Institute, Yerevan, Armenia	2001.05.01-2001.10.31
Albert H. Walenta	德國 Siegen 大學	2001.05.06-2001.05.13
劉思煌	美國 University of Nebraska	2001.05.18-2001.06.12

訪問學人	所屬機構	訪問期間
何建民	Wichita State University	2001.05.20-2001.06.12
梁宗嶽	University of Delaware	2001.06.01-2001.06.30
Ulrich H. E. Hansmann	Michigan Tech. Univ.	2001.06.03-2001.06.23
陳萬春	中國科學院	2001.06.04-2001.08.03
Estate Pia	KEK Tsukuba Japan	2001.06.11-2001.06.14
Prashant Manohar Gade		2001.07.01-2001.07.31
陳明志	台灣科技大學	2001.07.01-2001.09.30
何建民	Wichita 州立大學	2001.07.01-2002.01.31
彭仲康	哈佛大學	2001.07.05-2001.08.04
梁培德	波特蘭大學	2001.07.16-2001.08.31
楊弘敦	中山大學	2001.08.01-2002.07.31
Francois Vannucci	法國巴黎大學	2001.08.05-2001.08.18
Po-Zen Wong	麻州大學	2001.08.06-2001.08.10
岳騫	中國科學院	2001.08.13-2001.12.12
張元勛	中國科學院上海原子核研究所	2001.09.01-2001.10.31
唐澤眉	中國科學力學研究院	2001.09.01-2001.11.30
閔方本	中國科學院	2001.09.01-2001.09.30
程建平	北京清華大學	2001.09.01-2001.09.15
Prashant Manohar Gade		2001.09.17-2001.11.20
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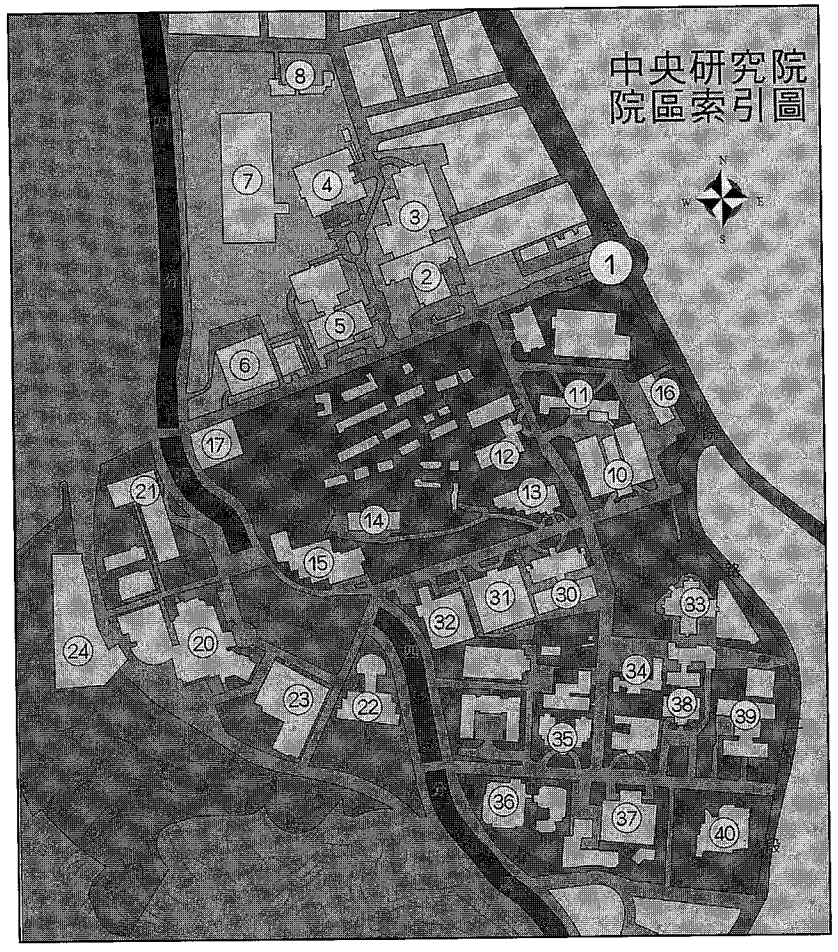

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