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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. In this study 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. (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) Numerical simulations of surface wave propagation over a submerged obstacle

This study is to propose a numerical model simulating free surface flows. It will be used to investigate the interaction of travelling waves with a submerged obstacle, especially the vortex generation in the vicinity of the obstacle. The finite analytical method is the main numerical scheme employed. Ursell number and Keulegan-Carpenter (KC) number are two parameters of the free surface flows. Their effects will be explored in the study. (Robert R. Hwang, Ming-Jyh Chern)

(3) Direct Numerical Simulation study from laminar to chaotic flows

Following the rapid development of the chaos theory and computational methods, it is the best time to investigate phenomena of fluid dynamical system from transition to chaos in terms of direct numerical simulation. Transition processes in benchmark flow fields will be explored in terms of various Reynolds numbers. Cavity flows are currently being studied and some results are obtained. Channel flows and flow past a obstacle such as a square or cylindrical cylinder will be considered. (Robert R. Hwang, Yin-Ferng Peng, You-Shien Shiau)

(4) Two-dimensional soap film tunnel

A soap film tunnel is planed to establish for observation of two-dimensional turbulent flows. The soap film is extremely thin (about 1 μm). The drag reduction theory is planed to be investigated in the soap film tunnel. The main work of the study includes the measurement of the thickness of the soap film, flow visualization, the measurement of velocity field. (Robert R. Hwang, Ming-Jyh Chern)

(5) 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)

(6) 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)

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. (Pei-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)

NUCLEAR PHYSICS AND ACCELERATOR-BASED PHYSICS

1. Experimental Nuclear Physics and Accelerator-Based Physics

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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 2 GeV/c pion and kaon.

The first physical runs of the experiment were performed during the period of May to June, 2000. In the physical 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 a 33 mm C 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. Preliminary analysis of the collected data reveals clear phi-meson signal. However, the number of events is not enough to draw any physical conclusion. A software package for reconstruction of the trajectories of the detected particles is developing.

Next physical runs are prepared to collect data to improve statistical fluctuations. In addition, the collaboration group is intensively investigating the details of next stage experiment such as increasing gamma ray energy, using polarized targets, improving detecting system····. We decided to get more involve in developing a time-projection counter (TPC). The related works are under way.

(2) (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.

(3) 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 $\Delta J^\pi\neq0^+$ 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.

(4) The nuclear microprobe facility at IPAS

A new scanning nuclear microprobe is being designed and installed at the IPAS 3 MV tandem accelerator. It is projected to focus light ions of typically 3 MeV to a beam spot size of 2 um. That will result in new opportunities in material analysis and modification. The high energy nuclear microprobe can not only perform Particle Induced X-ray Emission (PIXE) and Rutherford Backscattering Spectrometry (RBS), but also other ion beam analysis techniques such as Elastic Recoil Detection Analysis (ERDA) and Ion Beam Induced Charge (IBIC).The (alpha ,alpha) scattering cross section for 3.045 MeV alphas is enhanced by a factor of 25 over the Rutherford cross section. This resonance can be used to measured oxygen in conjunction with PIXE determination of heavier elements in a single measurement.

Becoming more popular is the used of the combination of PIXE and RBS, where RBS is used for the matrix determination and depth profiling and PIXE is used simultaneously for the minor - and trace - element analysis. In this work, we will prepare some electronic material samples under different operational conditions. Then, we will use the nuclear microprobe along with PIXE and RBS analysis techniques to trace elements and their corresponding spatial profiles in the samples. In addition, ion beam analysis results will showed the importance of a microstructure studies in material science. Furthermore, a conclusion of the best operational condition for the electronic material processing will be drawn from it.

(5) Charge state dependence of the L-shell x-ray energy shifts and fluorescence yields in heavy ion-atom collisions

L-shell x-ray from ionization by energetic oxygen ions have been measured with a Si(Li) x-ray detector. The purpose of this study was to investigate the charge state dependence of x-ray energy shifts that are indicators of multiple ionization. In this work, L-shell x-ray energy shifts in collisions of $^{16}O^{q}$ ions (q=3+, 4+, 5+, 6+, 7+ and 8+) impinging on $_{29}Cu$ target have been studied at 12 MeV. The data obtained are for vanishingly thin (less than 0.6 ug/cm^2) solid targets which approximate single collision conditions. The characteristic target L-shell x-ray lines were shifted to higher energies and broadened as compared to the energies and peak shapes obtained by proton bombardment. This energy shift becomes dramatic for singly and fully-stripped oxygen ions because of electron capture from the target M-shell to the projectile K-shell. From the measured energy shifts, the average number of 3d vacancies is determined using the non-relativistic Hartree-Fock model for atomic energy levels of Froese Fischer's program [Comput. Phys. Commun., 43, 355 (1987)] and, in turn, the enhancement of fluorescence yields due to multiple ionization is calculated according to Fortner et al. [J. Phys. B5, L73 (1972)].

(6) PIXE analysis of ancient Chinese Changsha porcelain

In this work, proton induced X-ray emission (PIXE) method was applied for the analysis of ancient Chinese Changsha porcelain produced in the Tang dynasty (AD 618~907). A collection of glazed potsherds was obtained in the complex of the famous kiln site at Tongguan, Changsha city, Hunan province. Studies of elemental composition were carried out on ten selected Changsha potsherds. Minor and trace elements such as Ti, Mn, Fe, Co, Cu, Rb, Sr, and Zr in the material of the porcelain glaze were determined. Variation of these elements from sample to sample was investigated. Details of results are presented and discussed.

(7) PIXE analysis of Chinese chicken-blood stone

This paper reports the chemical compositions of chicken-blood stone measured by Proton Induced X-ray Emission (PIXE). The experimental results show that for the red portion of chicken-blood stone, the concentration of Hg is as high as 20 wt%, and the concentration of S can be above 10 wt%. For the non-red portion the main chemical compositions are Al_2O_3 and SiO_2. The obtained chemical compositions are close to those of kaolinite for Balin chicken-blood stone, and of pyrophyllite for Changhua chicken-blood stone, respectively. So far many Changhua chicken-blood stones and Balin chicken-blood stones were found in China, the PIXE method can be used to

explore the provenance of available chicken-blood stones.

(8) Investigation of the mechanism for Ti/Al ohmic contact on etched n-GaN surfaces

In this study, the mechanism for ohmic contact of Ti/Al bilayer formation on as-grown, etched and postetch annealed GaN surfaces were investigated. A nonalloyed Ti/Al ohmic contact to etched GaN surface, with postetch annealing prior to metal deposition, was obtained. The specific contact resistance of $2.3 10^{-4} \Omega\ c\ m^2$ was obtained. The nonalloyed ohmic contact may be attributed to the postetch annealing which generates nitrogen vacancies that result in a heavily *n*-type surface thereby forming a tunneling junction. On the other hand, the nonalloyed Ti/Al contact on as-grown and as-etched GaN surfaces exhibits non-ohmic behavior. After alloying at 500℃ for 5 min, Ti/Al contacts on as-grown, as-etched and postetched annealing GaN surfaces have specific contact resistances around $9.81 0^{-5}$, $11 0^{-4}$, and $7.2 10^{-5} \Omega\ c\ m^2$, respectively. Nonalloyed Ti/Al ohmic contacts would be especially useful for fabricating high breakdown, recessed-gate field effect transistors on GaN since the moderate postannealing condition converts only the near surface layer to heavily *n* type.

(9) Effect of H_2 addition on SiCN film growth in an electron cyclotron resonance plasma chemical vapor deposition reactor

The effect of H_2 addition on SiCN film growth was studied in an electron cyclotron resonance plasma chemical vapor deposition reactor. No carbon incorporation was observed in the film by feeding $CH_4/SiH_4/N_2$ even at CH_4:SiH_4 ratios as high as 150:1. With H_2 addition and at a CH_4:SiH_4 ratio of 100:1 and above, the carbon contents within the films increased significantly. Possible explanations for this behavior involve gas phase and surface reactions of hydrogen including formation of active carbon species in the gas phase by hydrogen abstraction reactions and preferential etching of surface-bonded carbons.

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 $Q(\rho)$ 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 $Q(\rho)$ can be used to save tremendous computing time.

(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 ${}^{16}_{\Lambda}O$.

(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.

(4) Quantum Bit Commitment

Bit commitment is an important cryptographic protocol which involves a sender and

a receiver. The sender has a bit (b=0 or 1)in mind,which he wants to disclose to the receiver at a later time. The protocol is secure if (1) the sender cannot change his mind without being discovered, and (2) the receiver has no way of obtaining any information about the commitment before the sender disclose it. In this work, we propose a new quantum bit commitment scheme which is unconditionally secure. The key observation we make is that, by random permutation of particles, two appropriately prepared quantum mixtures with distinguishable density matrices can be rendered indistinguishable to another observer. Consequently, in our new scheme, the sender can encode the committed bit in a quantum mixture with commitment dependent density matrix (so that the sender cannot cheat), and randomizes the order of the particles to conceal the information from the receiver. Our result shows that quantum bit commitment can be unconditionally secure.

(5) Hadron gas model in heavy ion collisions

The experimental data taken at NBL AGS, CERN SPS and future RHIC will provide the opportunity to explore the physics of hadron to quark gluon plasma phase transition. A thermodynamically consistent volume excluded hadron gas model is used, as the first step in this study on heavy-ion collisions, in an attempt to understand the particle number ratios in all reactions performed at AGS and SPS. As a result, the freeze-out temperature, baryonic chemical potential, baryon number density, meson number density, etc. can be estimated. One can then determine whether the systems at freeze-out reach thermodynamical and/or chemical equilibrium. Afterwards, the gas of bag model approach shall be attempted in the study of hadron to quark gluon plasma phase transition.

For equal values of the hadron hard-core parameters the excluded volume model gives essentially the ideal gas predictions for the particle number ratios. However, a systematic excess of experimental pion abundances compared to the ideal gas results have been observed. This effect can be explained in our model by a smaller pion hard-core volume compared to those of other hadrons. Recent analysis of BNL AGS and CERN SPS data with a thermodynamically consistent hadron gas model with repulsive hard-core volume corrections (VDWHG) has produced very interesting results. We studied the possible effects of pion enhancement due to different hard-core repulsion for pions from other hadrons and strangeness suppression because of incomplete chemical equilibrium in the hadron gas. Each of these two modifications improve the results. The combined effect of these two mechanisms leads to and extremely good agreement with data. An interpretation of the obtained results in terms of the possible quark-gluon plasma formation at the early stage of the Pb+Pb collisions at SPS energies is

proposed.

In our future study, we shall take one step forward to investigate the hadron gas to quark-gluon plasma (HG-QGP) phase transition. The QGP phase is described by the perturbative QCD with nonperturbative bag-pressure effects. On the other hand, the HG phase is described by the above mentioned realistic van der Waals hadron gas model. We expect to map out the phase transition region on the T-μ_B plane, and to further estimate the energy density and baryonic number density discontinuities, viz. to calculate the size and location of the mixed phase on ε-n_B plane. We believe this study is of crucial importance in searching for the phase transition signatures in experimental observables of A+A collisions. We are also hopeful that these signatures might eventually lead to new interesting physical phenomena.

PARTICLE PHYSICS

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1. Experimental High Energy Physics

(1) Joining the ATLAS Experiment

The "Large Hadron Collider" (LHC) is now under construction at CERN and is scheduled to start operating in July 2005. By that time, it will be the world's largest hadron collider while the CDF experiment, which we are participating now, is expected to end.

An LHC committee was set up by the National Science Council to explore the best way for Taiwan to join the LHC experiments in late 1998. Acting upon recommendation of the committee, we submitted an expression of interest to join the ATLAS experiment in June, 1999 and was approved as a member of the collaboration in September, 1999. A proposal was submitted to the National Science Council and a major review was conducted in November, 1999 with favorable conclusions. The main content of the proposal is included below where pictures and tables are suppressed.

A. Motivation and background information

The High Energy Physics Group of Academia Sinica has joined the CDF experiment at Femilab since February of 1993 which resulted in Taiwan being one of the five countries finding the evidence of the top quark in the Spring of 1994. We helped in the installation of SVX', improved the simulation program of SVX' and participated in developing a new b-tagging algorithm which played a major role in the discovery of the top quark at CDF.

Our major hardware responsibility in CDF, however, is to design and construct the Dense Optical Interface Module (DOIM) used in parallel optical readout of SVXII, the new double sided silicon vertex detector to be used in RunII. The 700 pairs of DOIM needed will be delivered by the end of this year. This will be the first time parallel optical link is used in high energy experiments. As we expected, optical link is now the main stream of readout techniques and will be employed by both ATLAS and CMS, the two major all purpose experiments at LHC.

In the DOIM project, we collaborated with the Telecommunication Laboratory of the Chung Hwa Telecommunication Company (TL) and the Radiantech Inc. to develop the packaging and quality control procedures, including all the test equipments and fixtures needed, suitable for mass production. For components which are not commercially available such as the laser and photo-diode arrays, the driver and receiver chips, we produced ourselves. This makes us a unique team in the high energy physics community having extensive experiences in optical link

design, production and most importantly, in quality control.

CDF RunII will start in 2000 and will last until 2005 when ATLAS and CMS are expected to take data. Evidences accumulated in the analysis of RunI data hint on a high probability of discovering new physics in RunII. The Academia Sinica team is responsible for data production, employing parallel processing by a PC-farm, for RunII. We are interested in developing simulation and b-tagging algorithm for SVXII to search for new physics and to study various interesting phenomena in b-baryons.

Since CDF experiment will terminate in 2005, it is natural for our team to continue search or study interesting new physics phenomena in an LHC experiment. Moreover, it is also natural for us to continue to collaborate with the industry and the industrial research institutes in Taiwan to develop high speed optical link and Linux-based PC-farm parallel processing technologies to be used in LHC experiments. Both of these technologies possess high potentials in the opto-electronics and information industries under development in Taiwan.

We chose to join ATLAS after many contacts with both CMS and ATLAS collaborations, consultation with prominent high energy physicists such as Professor S.C.C.Ting, and most importantly, after consultation with our collaborators in the industry, President Robert Ching of Radiantech Inc. and Professor K.F. Huang of National Chiao Tung University and chief technical consultant of True Light Inc., both of whom participated in an optical link workshop of LHC held recently at Oxford, England and visited CERN afterwards. The general consensus is that the ATLAS optical link project, which employs 850nm VCSEL based digital link technology uniformly over all subdetectors, is more in line with possible future application and with the interests of our industry. CMS will use analog optical readout for inner detectors and is more advanced in their development works so that less role may be played by the Academia Sinica team. However, with the National Central University (NCU) team joining CMS, our industry may still provide VCSEL's and PIN's and work on packaging and quality assurance for the CMS optical links through the NCU team. Both our industrial partners Radiantech and True Light strongly favor the current recommendation of the LHC planning committee of NSC to support AS to join ATLAS and NCU to join CMS.

Besides CDF, some of our group members are participating in the "Alpha Magnetic Spectrometer" (AMS) experiment to search for antimatter and dark matter in Space. The first version of the detector, AMS-01, was flown by shuttle Discovery (STS-91) from June 2 to June 12, 1998. The trigger, data acquisition, silicon tracker front end readout, and the monitor and control electronics systems were designed and

built at the Chung-Shan Institute of Science and Technology (CSIST), the military research institute of Taiwan, under close collaborations among AS, NCU and CSIST teams. The Taiwan team also collaborated with the MIT team in developing the trigger and data acquisition softwares for the systems. We are actively involved in the data analysis for the first flight.

Through the AMS project, we learned how to build space electronics where long term reliability and single event errors are major concerns. Interestingly, these are also two of the major concerns of the electronics systems to be built for the LHC experiments.

The Alpha Magnetic Spectrometer is having a major upgrade to version 2 (AMS-02).

Taiwan will build the upgraded electronics systems and will play a major role in developing the softwares again.

B. ATLAS detector and optical links

ATLAS, like CMS, is a general purpose detector to search for new physics in the high energy and high luminosity collisions of protons at LHC. The inner detector consists of three subdetectors:

a. Pixel Detector: closest to the beam pipe with two dimensional readout totaling 140 million readout channels.

Academia Sinica team proposed to take the responsibility of design and construction of the optical readout links for the Pixel Detector.

b. Silicon Central Tracker (SCT): single-sided silicon microstrip detectors with 6 million readout channels.

Pixel and SCT are the key detectors for precision vertex finding. Radiation hardness of detectors, electronics and all material used are required.

c. Transition Radiation Tracker (TRT): straw tube tracker embedded in polyethylene radiators for both tracking and particle identification. 0.42 million readout channels. Need 270K digital links. Copper links were chosen because optical links are not affordable.

The inner detectors of the ATLAS are enclosed in superconducting magnet which provide a 2T axial field. Outside detectors are liquid argon calorimeter for both electromagnetic and hadronic calorimetry, a tile calorimeter for hadronic calorimetry and a stand-alone precision muon counter with a toroidal magnetic field.

Except the transition radiation tracker, all subdetectors will use optical links to readout the front-end signals and send in the control signals. The front-end signals are sent to the readout driver (ROD) using optical links running at 40 MHz (system

clock rate). Data from ROD, which is underground, are sent to the readout buffer (ROB) on the surface by high speed optical links for level 2 trigger and further processing.

The total number of optical links needed for outer detectors and inner detectors is about 20 to 30 times the number of links we are producing for CDF.

C. Proposal for Academia Sinica to join ATLAS

We propose to join the ATLAS experiment now. Our main hardware responsibilities will be the following.

a. Optical links:

(i) Design and develop packaging and quality assurance procedures for the optical links of the inner detectors, in particular, the pixel detector. The Oxford team in SCT had contracted with GEC-Marconi to develop a packaging solution for the frontend optical links. Before one evaluates the prototypes which are still not available, it is not clear to us if that will be a viable solution suitable for mass production. We shall develop an alternative solution based on our experience in DOIM. The frontend links will run at 40 MHz which is relatively low speed in the standard of optical transmission. The driver and receiver chips that we designed for DOIM can be used but need to have a rad-hard version. Since Oxford, Siegen and Ohio State University teams had invested in R&D for the rad-hard drivers and receivers, we shall adopt their chips if they can be used with VCSEL and PIN provided by True Light Inc. This will allow us to focus our efforts in developing chips for gigabit transceivers which will be used in readout links of the ATLAS detectors and possess commercial industrial applications.

(ii) Design and develop parallel links for the outer detectors. The links should transmit the frontend signals (32bit @ 40 MHz) to the readout buffer. The current solution was suggested by the Stockholm team which use Glink chip by HP to transmit data at 16bit @ 80 MHz. This solution requires a rad-hard multiplexer to multiplex 32bit data into 16bit and also requires rad-hard gigabit transceivers which are not available. The most serious problem, however, is the single event errors (SEE, flip of a bit or sending a transistor into a large current state due to radiation). Once an error happens, it takes milli-seconds to re-establish the synchronization and a lot of data will be lost. This serious problem can be resolved by using parallel transmission. We can use two 9-channel VCSEL DOIM to transmit data at 16bit @ 80 MHz (sending data at both the rising and falling edge of a clock cycle to achieve 80 MHz transmission on 40 MHz clock rate so that no multiplexer is needed).

(iii) Design and develop high speed links for connecting the readout drivers and

the readout buffers (the readout links). This matches perfectly with the interest of Taiwan industry such as the Radiantech Inc. Driving VCSEL's above gigabits is not a trivial task and is an area of intense global competitions for viable commercial solutions. We shall develop chips with multiplexer (demultiplexer) and communication control built in.

b. Computing: we shall participate in the development of PC-farm based on-line and off-line computing. Computing is an area which is less developed in ATLAS. As a result, we have more opportunities but less can be specified at this moment. Our experience in Linux based PC-farm off-line computing at CDF should allow us to make significant contribution in ATLAS computing. In this case, our industrial partner is the Soliton Technologies Co. Ltd. who is interested in developing real time Linux-based software and hardware systems for commercial applications.

According to ATLAS rules, 44 percent of hardware contribution has to be in the "Common Projects", such as superconducting magnets and cryogenics. It is possible that PC's related to computing will be listed among the "Common Projects". In that case, we may contribute PC's made in Taiwan as part of the 44 per cent required.

c. Electronics: We can collaborate in electronics modules and chips design and produce them in Taiwan for ATLAS. Since Taiwan is one of the manufacturing centers in the world for electronics modules and chips, it is quite possible that both ATLAS and CMS may want to exploit our capabilities in this area.

Through the CDF and the AMS projects, we have established closed working relation with many electronics companies and with all the major industrial research institutes in Taiwan such as the Industrial Technology Research Institute (ITRI), the Chip Implementation Center (CIC) and the CSIST.

d. Physics and Simulations: during the construction phase of ATLAS, our physicists will mainly concentrate on data taking and searching for new physics at CDF and AMS. Physics analysis at CDF will provide leads to what to look for at ATLAS.

The hadronic environment at ATLAS, however, will be different from that at CDF. While for each beam crossing at the Tevatron, an average of 1.6 events are produced at CDF detector, for each beam crossing at the LHC, an average of some 20 events will be produced at ATLAS detector. Moreover, while we are familiar with silicon microstrip vertex detector, the pixel detector will be new to us. In this respect, it is good for us to be in the pixel detector group and we shall participate in developing the simulation program for the inner detectors, particularly the pixel detector, as early as we can.

D. Schedule

The ATLAS detector is now under construction. "Module zero", the final full size prototype module, of the liquid argon calorimeter as well as, the precision muon chamber had been finished and had gone through extensive beam test. The construction of other detector systems are also progressing on schedule. The construction phase is expected to end in 2005. The construction of the optical links should start in 2000 and finish in 2003 followed by installation. It is clear that the funding for hardware construction should concentrate in a period of four to five years (2000~2004).

From 2005 on , we shall enter the physics phase. The detector is expected to run for 10 years before major upgrades. During this phase, we should be responsible for operation and maintenance of the optical links. With 15~20% of spares built in the construction phase, the maintenance cost is expected to be low and will be covered under the operation costs.

E. Manpower and Task Sharing

a. Overview

The Academia Sinica (AS) group in CDF consists of two faculties (Dr. P.K. Teng and Dr. M. J. Wang), five to seven postdoctors and one to three research assistants. Besides CDF, we also participate in the "Alpha Magnetic Spectrometer" (AMS) experiment to search for antimatter in space. The AMS group consists of two faculties (Dr. S. C. Lee and Dr. P. Yeh), two to three postdoctors and two to three research assistants. The Alpha Magnetic Spectrometer is scheduled to be placed on the International Space Station Alpha in May, 2003 and will take data for three years. Physicists in the CDF and the AMS group of AS are expected to join ATLAS. The time they spend on ATLAS related works will gradually increase as we approach and enter the physics phase.

During the construction phase, our main focus will be on the design and construction of the optical links. Since the DOIM project for CDF is in its final production phase and the production is expected to finish before end of the year (1999), the AS optical link group together with the Telecom. Lab., the Radiantech and the True Light teams are starting to work on the optical link project for ATLAS and will be able to work full time on the project as soon as our proposal is approved by the ATLAS collaboration and by the National Science Council.

b. Optical Links

(i) AS will be responsible for overall coordination of the project. A steering committee chaired by S.-C. Lee and consisting of P. K. Teng and M. L. Chu from AS,

Dr. T. C. Shih, leader of the Opto-electronics Division of the Application Research Lab. of TL, Dr. Robert Chiang, President of Radiantech, and Professor K. F. Huang, pioneer of the VCSEL technology and chief consultant of True Light, had been formed with weekly meetings for the CDF DOIM and the ATLAS optical link projects.

Dr. M. L. Chu, who designed the bipolar driver and receiver chips for DOIM, will be responsible for chip design, evaluation, production and procurement for our ATLAS optical link project. Both Radiantech and True Light are interested in IC related R&D.

Dr, M. L. Chu, Dr. P. K. Teng from AS and Dr. C. Y. Wang, Dr. H. L. Chang from TL together with engineers and technicians from the Opto-electronics Lab. of the Radiantech will be responsible for design and development of the packaging procedures.

Besides S.-C. Lee, P. K. Teng and M. L. Chu, AS will have one postdoctor and one to three full time assistants to work on the project.

(ii) Opto-electronics Division of the Applied Research Lab. of Telecommunication Lab. will be responsible for quality assurance of the components and the modules. This includes the specification of various test protocols and procedures. Dr. C. Y. Wang and Dr. H. L. Chang were the key persons for quality assurance in the DOIM project. TL is experienced and well-equipped for this kind of job.

(iii) Opto-electronics Lab. of the Radiantech will be the place where packaging is done. They will be responsible for carrying out the integration, tests and quality control.

By working closely with the AS and TL teams, Radiantech has built up experience and expertise in optical links through the DOIM project. They have the resources needed to construct production lines for the quantities of optical links that the ATLAS detector will need.

(iv) True Light Inc. will be our source of VCSELs and PINs. They will collaborate closely with us to provide VCSEL and PIN arrays that we need and help to integrate with the driver and receiver chips that we will use. True Light had provided samples of VCSEL arrays for IBM and they are a provider of VCSEL for gigabit transceivers. They have the capacity of producing all the VCSELs and PINs and the arrays for use in the optical links of the ATLAS detector.

c. Computing

Dr. Ping Yeh was responsible for data production for RunI of CDF. Together with Dr. Yen Chu Chen and Dr. Antonio Wong Chan, they are now responsible for

design and developing software for data production of RunII using Linux-based PC-farm parallel processing.

Besides data production, Dr. Ping Yeh plays a major role in design and implementation of the on-line DAQ software for AMS while Dr. Yen Chu Chen was the key person in developing DAQ software for the Fermilab fixed target experiment HyperCP.

During the construction phase, all our physicists at CDF and AMS will concentrate on data analysis since both experiments possess great dicovery potentials. As a result, we need to hire one new postdoctor and one to two full time assistants to work on ATLAS computing project with the guidance from experienced physicists mentioned above. Moreover, we will collaborate closely with the Soliton Technologies Co. who had worked with us in developing DAQ systems for HyperCP and Neutrino projects, set up the PC-farm that our group is using and is also responsible for the maintenance of the computer system of our group.

d. Physics and Simulation

Dr. M. J. Wang, who improved the simulation program for SVX' and participated in developing a new b-tagging algorithm leading to the discovery of top quark at CDF, Dr. Paul Chang and Dr. Ping Yeh are all experienced in simulation for silicon vertex detectors. As before, during the construction phase of ATLAS, physicists will concentrate on searching for new physics at CDF and AMS. We will hire one postdoctor and one or more assistants to work on physics and detector simulation for ATLAS.

Our experience with physics analysis at CDF will help us to continue searching for or studying new physics phenomena at ATLAS. The physicists in the AS team will consist of 4 faculties, five to seven postdoctors and a few research assistants to analyse data during the physics phase of the ATLAS experiment.

F. Budget

a. Request Funding

We request a support of US$2M for hardware and an annual operation budget averaging US$300K from National Science Council for ATLAS project which will last 15 years or more from now on.

Of the $2M, 0.5M will be used for design and development of the packaging procedures suitable for mass production of the optical links for both the inner and outer detectors of ATLAS experiment. The other 1.5M will allow us to produce 2500 links + 500 spares for the Pixel Detector and a portion of the parallel optical links for the outer detectors. We shall negotiate with ATLAS for special

arrangements so that some of the optical links that we produced for the outer detectors or for SCT will be counted as a contribution to the "Common Projects".

As for the operation cost, our experience with CDF indicates that at least $160K per year is needed for travel for a team of 10 faculties and postdoctors and $80K is needed for sharing the experimental cost and for day-to-day onsite operation. The remaining $60K is needed for hiring research assistants, both full time and part time, and for day-to-day operation in Taiwan.

For DOIMs which we are producing for CDF, the laser diode and PIN arrays were provided by TL at their own cost. TL also absorbed a large part of the cost in developing the packaging and quality assurance procedures and in carrying out the quality assurance processes for the DOIMs. Hence it is not possible to estimate the production cost of each pair of DOIM. We did purchase samples made by Hitachi in the early stages of the development of DOIM for a discount price of $6000 a pair. Hitachi no longer produces DOIMs.

For ATLAS, we are aiming at producing optical links at a cost of $100~200 per link not including the cost of fibers, fiber cables and connectors. To achieve this goal, a lot of development efforts as well as managing skills during the production stage are needed.

b. Funding profile

Although the ATLAS project will last for 15 years or more, the funding for hardware as requested has to be distributed in the first five years, from 2000 to 2004, and peaking around 2001~2002. It is particularly important for the National Science Council to address the issue of funding profile facing major international collaboration projects.

G. Conclusion: what could be achieved?

For the coming twenty years, LHC no doubt will be the most powerful machine for mankind to explore phenomena happening at 1 TeV energy scale, an order of magnitude improvement, in terms of linear scale, over what we can achieve at the Fermilab Tevatron. Evidences are mounting by analyzing RunI data at CDF that new discoveries are around the corner. Careful analysis of the b-tagged events at CDF showed inconsistencies with the Standard Model predictions. Analyses of the excess of W + 1jet and W + 2jets events by Dr. M.J. Wang and many others in the Collaboration exhibit anomalies beyond our current understanding. *Joining ATLAS will provide our physicists with a great opportunity to continue participating in the frontier researches of the high energy physics.* If new physics are found at RunII of CDF in the next few years, joining ATLAS will allow us to study these phenomena in

detail which may lead to further important discoveries. If new physics were not found at CDF due to limited available energy or statistics, our team will be in a great position to make discoveries at ALTAS based on our experiences and leads from data analysis at CDF.

It is well recognized that opto-electronics and information industries will play an important role in shaping the world in the 21th century. These industries are still at their infancy in Taiwan and deserve strong support from the government. One of the best way to do that is to support companies like Radiantech, True Light and Soliton Technologies to get involved in an international collaboration project like ATLAS and to collaborate with major research institutes such as Academia Sinica, Telecommunication Laboratory etc. to design and develop a *product* leading to its application in the ATLAS experiment at first and commercially in the end. *Through such a project, they will collaborate with leading research laboratories in Europe, in US and in Japan, and will compete directly with companies possessing leading technologies in the opto-electronics and information industries around the world.* Indeed, even before we join ATLAS, samples of VCSEL from True Light provided through the AS team were tested by optical link groups at CERN and compared favorably with samples from Honeywell.

Close collaboration between AS and the industrial companies in Taiwan is the key to the manpower problem for the ATLAS project in the construction phase. There is no possibility, not to mention cost effectiveness, for AS to keep a team of high quality engineers needed to accomplish what we want to contribute for ATLAS. *By involving technicians and engineers from the collaborating companies, AS gets the things done and the companies get the experience, technology transfer, credibility and international exposure.* This collaboration also opens a channel for our physics students, postdoctors and research assistants to work in potentially important industries.

According to our discussion with Peter Jenni, the Spokesperson of ATLAS, for a team of 10~15 people from non-member states of CERN like Taiwan, a hardware contribution of $2~3M is reasonable and acceptable to CERN when there are two teams from Taiwan joining ATLAS and CMS with similar contributions.

We believe this is the right time for Taiwan to join LHC projects. It will be increasingly difficult to find suitable projects where our team, together with our industries, can make significant contributions as the construction phase progresses. In view of the physics potential for our physicists and the development potential for our opto-electronics and information industries, the requested funding for hardware of $2M over the course of 15 years of the project is a worthy investment for the National

Science Council.

(2) Review of IPAS/CDF Project (by the Academia Sinica IPAS/CDF group)

A. Introduction

The CDF Collaboration at FNAL has been upgrading its detectors, data acquisition systems, and computing facilities in order to cope with the Tevatron RunII running goals with a peak instantaneous luminosity of 2 x 10^{32} $cm^{-2}s^{-1}$, the bunch spacing reduced from 396 to 132 ns, an integrated luminosity of $2fb^{-1}$ on tapes, and $\sqrt{s} = 2.0$ TeV.

The overall CDF strategy to reach its various physics goals is to have excellent tracking, vertex detection, a calorimeter with good energy resolution, muon detection and a flexible multi-level trigger system. The scope of this upgrade project includes detector hardwares, data links, data acquisition systems, triggering systems, production farms, physics analysis computing facilities and associated software projects.

The current schedule is to roll in the CDF detector in the first two weeks of August 2000 and to have the commissioning run between Aug-15-00 and Oct-31-00. The physics data run will start on Mar-01-01 with both CDF and D0 detectors.

B. IPAS/CDF hardware and software projects

The IPAS/CDF group have been making contribution to this CDF upgrade project in both the optical data link for the silicon detector (SVXII and ISL) readout system and the production farm which consists of hundreds of PC's for the first pass to filter raw data.

a. DOIM project

We are responsible for the optical readout system for the silicon detector. A total of 700 pairs of Dense Optical Interface Module (DOIM) is needed. From 1998 to 1999, the DOIM project for the SVXII readout system has come to its production stage.

The final version of bipolar driver and receiver chips designed by Ming-Lee Chu was submitted to AMS through CMP in France for fabrication in the end of 1997. The 0.8/μm BiCMOS DPDM technology was used.

While we were waiting for the IC's, we vigorously searched for an industrial partner for DOIM production. Radiantech Inc., a high-tech company in the Hsin-Chu Science based Industrial Park, specialized in fiber optics test and measurement equipment, expressed great interest in this project and agreed to collaborate with us.

In March 17-21, 1998, SVXII project manager, Prof. Paul Shepard and Dr. Jeff Spalding, and Dr. Slawomir M Tkaczyk visited Taiwan. A pre-prodcution review was

held at Radiantech to examine the SIP, SOP, as well as the assembly line and the test station. It was suggested that a small quantity of DOIM TX and RX modules should be made first and subjected to the environmental test to ensure the packaging processes. It was also suggested that all components should be ready by mid-June, 1998.

The placement of IC on the ceramic substrate and the attachment of the substrate to the carrier board was done by Tong-Hsin Electronic Industries Ltd. The IC sub-assembly was completed and delivered to Radiantech for packaging in late July, 1998. However, later it was found that it is hard to detach the substrate from the carrier board for the TX module due to a serious mistake made in IC sub-assembly. As a result, a new bach of substrate (with gold bonding pad) and carrier board had to be made.

The project was further slow down due to the low yield rate of Laser Diode Array (LDA) produced by the Chung Hua Telecommunication Laboratory. On the other hand, the Photo Diode Array (PDA) production was going smoothly and on schedule.

After the visit of Vince Pavlicek and Slawomir Tkaczyk from Fermilab in Dec. 7-11, 1998, the collaboration gave a green light for the RX module production. It was also requested that all the module to be sealed in a low humidity (<10% RH) chamber flashed with nitrogen gas.

Intensive study of TX module assembly procedures using the new substrate had been done in March and April, 1999. The UV glue was replaced with one which has higher glassy temperature to assure the alignment of V-groove stays the same during the rework.

Paul Shepard and Slawomir Tkaczyk visited us again in May 17-20, 1999. The TX production processes were reviewed and well accepted. An immediate goal and long term schedule was set.

Currently the DOIM production is going smoothly. We expect to finish the packaging of the 700 pairs of DOIM's and deliver to Fermilab at the end of the year for system integration.

b. PC farm project

The production farm is the first path of data analysis. In the production farm, events are reconstructed and split into a few tens of physics data streams based on the trigger type. The major request to this production farm is that it must be able to handle data at a maximum throughput of 20 MB/s. To reach this goal, it is estimated that two hundred dual Pentium II 500 MHz computers are needed. This farm should also be reliable, efficient and expandable.

The IPAS/CDF group members joined the production farm project in August of

1998. That included A. W. Chan, P. Chang, P. Yeh and Y.C. Chen. Y.C. Chen takes charge the overall management of this project as a co-leader with S. Wolbers of the Fermilab computing division. P. Yeh, Y.C. Chen, and P. Chang worked on the conceptual design of this system. A.W. Chan installed and debugged the CDF RUN II software environment on a PC farm with 18 nodes and later compiled, linked, and ran the production code successfully. He also did the stress test of the prototype farms and carried out a Root I/O performance study with the help from P.S. Chang.

For the PC farm control package, P. Yeh finished a module called Coordinator, Y.C. Chen finished a module called Bookkeeper, A.W. Chan finished modules called Dispatcher, Reconstructor and Collector. A.W. Chan integrated all these modules together. This package is currently running on the prototype farm. It will be used in the first Mock Data Challenge of the CDF experiment of this coming November.

C. IPAS/CDF analysis projects

Since CDF has demonstrated the ability to carry out various b physics measurements by taking both the advantages of the unique aspect of a large hadron production cross section and the data recorded from successful secondary vertex detector (SVX). Many of the CDF results are very competitive with measurements of LEP or CLEO. B hadron lifetime measurement is one of the areas in which CDF detector could produce either competitive or best results. On the other hand, the properties of Λ_b baryon were not understood well. It is a good analysis topic to measure the lifetime with CDF data.

After the top discovery, one started to search for either new physics beyond SM or information on Planck-scale physics, motivated by its large mass of 175 GeV. Not only these theoretical interests motivated us to study the top samples in more details but also the present top samples themselves show some signs of deviations from SM.

a. Λ_b life time measurement

The preliminary result of Λ_b lifetime from the decay channel $\Lambda_b \to \Lambda_c^+ e^+ \nu_e$, $\Lambda_c \to \Lambda\pi^+\pi^+\pi^-$ was obtained. P.S. Chang observed 57± 12 signal events from the inclusive electron data collected at CDF RunI. The corresponding integrated luminosity is about 110 pb^{-1}. With the help from P. Chang on the Maximum Likelihood fitter, The fitting result obtained by P.S. Chang after the side band subtraction is c-tau $=1.36^{+0.39}_{-0.51}$ (stat.) $^{+0.19}_{-0.20}$ (syst.). This result is limited by the statistics of signal event.

P.S. Chang had attempted to search for the signals from the decay channel $\Lambda_c \to pK_s$ and also to look for more events from the inclusive muon sample. M.J. Wang also developed a Maximum Likelihood Ratio(MLR) method to reduce the faked proton in the A sample and expect to reduce the combinatory backgrounds.

b. Search for new phenomena in top samples

M.J. Wang have been working on the search of new physics in top samples. Based purely on observations of the present top samples of 110pb^{-1} without any prior assumption, he found some statistically unlikely deviations in top counting experiment, cross section, and mass results. It provided us some valuable clues in searching for new physics. Moreover, some anomalous events were revealed in the tagged W+2,3 jet samples. It is important to explore this possibility for new physics with the RunII data which will be at least 20 times more than that of RunI

(3) Neutrino and Astroparticle Physics Group

Group Members at the Academic Sinica (1999-2000)

Chen Chin-ping (陳晉平), Chen Ya-Ping (陳雅萍), Hsu Hui-Chin (許惠琴), Hou Long (侯龍)[1], Jon Guo-Ching (仲國慶),Kiang Ge-Cheng (江紀成), Lai Wen-Ping (賴文彬),Lee Shih-Chang (李世昌),Li Hau-Bin (李浩斌), Li Jin (李金)[2], Lin Shin-Ted (林興德), Liu Yan (劉延)[2], Liu Zheng-Shan (劉正山)[3], Luo hing-Shan (羅青山), Qiu Jin-Fa (邱進發)[2], Sheng Hua-Yi (盛華義)[2], Teng Ping-Kun (鄧炳坤), Wang Chang-Wan (王建萬), Wang Sun-Chong (王孫崇), Wong Tsz-king (王子敬)[4], Zhou Zhu-ying (周祖英)[1], Zhuang Bao-An (莊保安)[2]

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[3]Visitor from Institute of Radiation Protection, Taiyuan
[4]Principal Investigator

The principal focus of the TEXONO (**T**aiwan **EX**periment **O**n **N**eutrin**O**) Collaboration in 1999-2000 is the construction and commissioning of the "pilot" experiment [2,4,8]. The experiment will be based on a 500-kg CsI(Tl) crystal scintillator detector to be placed at 30 m from a reactor core at the Nuclear Power Plant II (NP2) at the northern coast. The scientific motivations are the studies of neutrino interactions at low energy, including neutrino-electron scattering, neutrino-nucleus neutral current excitation, 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. Proceeding in parallel with this flagship experiment are the various R&D efforts on the prospects of using scintillation crystal detectors in low-energy low-background experiments for neutrino and astro-particle physics [7].

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), Mainland

China (Institute of High Energy Physics, China Institute of Atomic Energy, Institute of Radiation Protection, Nanjing University, Shandong University) and the United States (University of Maryland), with the AS group playing the leading role. The expertise as well as the research program of the Collaboration are extending.

By Fall 2000, the preparation of the reactor pilot experiment is mostly completed. The 50-ton shielding structure has successfully been constructed on site inside the reactor building. Commissioning of the veto system made of plastic scintillators as well as the first background studies with germanium detectors are underway. The construction and tests of the electronics and data acquisition systems for at least 200 readout channels has completed. A total of 200 kg of CsI(Tl) crystals have been grown, and 120 low-background photo-multiplier tubes have been manufactured. A full 14-channel system has been running at the ASIoP laboratory robustly for months. The system will be moved to the NP2 experimental site when the site preparation will be ready, expected to be by November 2000. Physics data taking will start. It will start as a 50-channel readout to be upgraded to a 200-channel readout by Spring 2001.

The notable innovations of the experimental hardware include : development in the growth of long CsI(Tl) crystals to length of 40 cm, the longest record for this crystal; custom-designed photo-multiplier tubes; design and production of the 20-40 MHz FADC system and the associated electronics. It should be emphasized that the Collaboration is responsible for the coordination of the hardware construction and the subsequent operation. Much technical experience and expertise have developed, as are close connections with the industrial partners as well as various research institutes in Taiwan and Mainland China.

The pilot experiment, besides having its independent scientific motivations, provides a framework to build up the Collaboration and a "launch-pad" for more ambitious project beyond. Starting from 1998, the Collaboration has been exploring various future possibilities [3]. Workshops on the detection of Dark Matter and Low-Energy Solar Neutrinos were organized. Several R&D projects are initiated, including: (a) development of GSO crystals for solar neutrinos and electro-magnetic calorimeters, where a paper was submitted in 2000 [10], (b) feasibility studies of using CsI(Tl) for Dark Matter searches, a direction which became an approved project within the CosPa scheme with National Taiwan University, (c) use of the Accelerator Mass Spectroscopy (AMS) technique for measuring radioactive impurities of samples, (d) exploration of other physics directions, notably the effects of matter on neutrinos. (e) extensions of the scintillating crystal technique. Program (b) and (c) involves test beam measurements at the Tandem accelerator at the China Institute of Atomic Energy during October-December, 2000.

Our efforts has been presented in numerous international meetings, and are in general well-received. Several articles have been published in SCI-Journals including both the pilot experiment, expt and crystal scintillator approach [7] as well as the R&D efforts in 1997 on boron-loaded liquid scintillator [1,5,6]. A Technical Design Report [2] and an article on our directions [3] give detailed discussions for our present and future activities.

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.

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/EXONO/index.html/

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(4) IPAS/AMS group

The Alpha Magnetic Spectrometer (AMS) group consists of the following members: Shih-Chang Lee, Ping-Kun Teng, Ping Yeh (faculties), Ming-Huey Alfred Huang, Zhongliang Ren (postdoctors), Yao-Li Chuang, Bowen Ke, Fang-Chang Kang, and Pei-Jieh Hong (assistants).

In the year 1999, the data taken during shuttle flight STS-91 occured during 2 June 1998 to 12 June 1998 were extensively analyzed. Our group made the following progress within the AMS collaboration.

A. The acceptance of the AMS detector

The AMS detector is a large spectrometer immersed in a magnetic field produced by a large-bore permanent magnet made of alloys of Nd-Fe-B. The acceptance is a crucial factor for the success of the experiment. The larger the acceptance, the larger the event sample in a given time period. Getting a large event sample is essential for anti-matter search.

The acceptance is also a factor in measuring particle flux, which can be calculated as

$$F = \frac{N}{At_{eff}}$$

where F is the flux in units of $m^{-2}\cdot sr^{-1}\cdot sec^{-1}$, N is the number of measured events (in a bin of energy or solid angle or other variables), A is the acceptance in units of $m^2\cdot sr$, t_{eff} is the effective data taking time, which is the exposure time of the detector subtracted by the dead time of the detector and read-out system.

The active area of the detector as a function of momenta and direction of incoming particles were estimated by firing particles uniformly distributed in position and direction in the AMS detector simulation program, and calculate the ratio of particles that triggers the detector. As expected, the acceptance increases with particle momentum in the low-momenta region as lower momenta particles are bent more by the magnet and can not penetrate the apparatus. Soon the acceptance reaches a plateau of about 0.17 m^2 sr.

The detailed study can be found in an internal report written by Zhongliang, Ping and Alfred.

B. Particle classification

Charged particles moving in the earth's geomagnetic field are bent by the field. When viewed from a point far away from earth, the geomagnetic field works like a barrier such that charged particles with low rigidity R can not penetrate deep into the field. Here the rigidity is defined as

$$R \equiv \frac{momentum}{charge} \quad \frac{p}{q}$$

The geometric properties of the trajectory of a charged particle can be uniquely determined by its rigidity vector $\vec{R} = \vec{p}/q$ and its initial position $\vec{r}$ with respect to the earth center, independent of the particle mass.

For a particle to penetrate into a lower earth orbit like the shuttle orbit, it must have a rigidity higher than a threshold value R_c, hereby called *it rigidity cutoff*. The value of R_c varies with the arrival position and arrival direction. For a given detection position and a restricted field of view of the detector, the traditional wisdom is that one expects to see two types of particles:

- $R > R_c$: primary cosmic rays,
- $R < R_c$: trapped particles.

The trapped particles are particles that are ``trapped" within the vicinity of the earth because they don't have enough rigidity to escape the geomagnetic field and fly to infinity. The only viable source of the trapped particles is the product of the collision of primary cosmic rays with the atmosphere. However, since the discovery of the trapped particles in the late 1950s, the exact mechanism of the propagation of trapped particles from atmosphere to the altitude that they populate is still unknown. There have been many proposed mechanisms to explain it. But there is still a lack of evidence to quantitatively support any of these mechanisms over the other.

The above categorization is a simple-minded one with only the particle-field interaction put into the picture. In reality, there is atmosphere and a solid earth beneath the geomagnetic field. Some thought-to-be-trapped particles may not live for long after they are produced in the atmosphere: they leave atmosphere, fly for a short time, and fly back to atmosphere and disappear into the air due to collision. They can't really be called trapped radiation.

In order to determine if an under-cutoff particle is trapped, tracing out its trajectory is necessary before more sophisticated classification criteria are discovered. Our group decided to pursue this direction in September 1998 after a brief analysis of the AMS data that shows both above-cutoff and below-cutoff particles are present.

a. Geomagnetic Field Model

To study the trajectories of particles, a computer model of the geomagnetic field is

a key ingredient. We have studied a few models available on the market. Alfred and Yao-Li made a subroutine interface to the International Geomagnetic Reference Field (IGRF) model and U.S. Department of Defense (DoD) model. The IGRF model is used as the official model of the AMS collaboration. An internal report on the geomagnetic field model is written by Alfred.

b. Tracing Algorithm

We have developed a C language program to perform tracing of particles in the geomagnetic fields with the earth surface modelled as a ellipsoid. We have gone through an extensive testing procedure to validate the program. An internal report written by Yao-Li Chuang, Ping Yeh and Ming-Huey Huang on this topic has more details.

The numerical error caused by the tracing algorithm is studied with a sample of proton events below 3 GeV/c collected by the AMS detector, and was found to follow the form

$$\lambda(t) = 0.050t^2$$

With this formula in hand, we know the applicability of the tracing program in determining particle types.

c. Particle Category

There are three categories of particles: cosmic, trapped, and secondary. With forward tracing in addition to backward tracing, the fate of the particle can be known and the lifetime of the secondary particles can be determined. We found two populations of secondary particles with distinct lifetimes: *it short-lived* and *it long-lived* particles. The short-lived particles can only travel at most ≈ 200ms before they hit atmosphere. The long-lived ones can often stay in space for seconds. The following observations are made:

•For particles with very low rigidity, their motion can be approximated by a gyration around a gyration center moving along the surface with constant L value --- the L-shell. For this type of particles to fly through a detector at shuttle altitude, we found that it has to be produced near the South Atlantic Anomaly (SAA) where the L-shell goes down to atmosphere altitude. Our results show that such particles can drift around the earth before hitting the atmosphere near the other side of SAA. These are the long-lived particles. There is no correlation between the detection site of such particles and their production site.

•For particles with higher rigidity, but still lower than the cutoff, their large gyration radius make it easier to fly to shuttle altitude to be detected, so the detection site and production site are not too far from each other. However, these particles hit atmosphere in less than 200ms ---the short-lived particles.

•For particles with rigidity significantly above cut-off, they fly to outer space with rather simple trajectories.

•For particles with intermediate rigidities, they exhibit complex and sometimes chaotic trajectories. All candidates of trapped particles, i.e., particles that fly for a long time without hitting the atmosphere, belong to this category.

C. Measurement of the e^+/e^- ratio

Our collaborator, Prof. Yuan-Hann Chang of National Central University, was responsible for the measurement of the e^+/e^- ratio in the AMS collaboration. He found the ratio is around 1:1 in high latitude sample, consistent with the results from high latitude balloon experiments. But the same measurement with data sample taken near magnetic equator shows a totally unexpected ratio of about 3:1 or more.

Since most e^+ and e^- are secondary, Zhongliang classified them according to lifetime and found that the ratio is around 3.7 for long-lived particles and 1.7 for short-lived ones.

Alfred proposed a simple yet somewhat quantitative explanation:

•Assume that the positrons and electrons near the equator are entirely secondary particles produced by the air showers resulted from the collision of primary protons with the atmosphere molecules.

•The number of electrons and positrons produced in an air shower is proportional to the energy of the primary proton. This is an established result from observations of ultra-high cosmic rays.

•Put in the well-known east-west effect of rigidity cutoff into account. For the 0th order, assume that all positrons are produced by protons coming from the west (with lower cutoff) and all electrons are produced by protons coming from the east (with much higher cutoff).

•Integrating over the spectra of primary proton *($dN/dE \propto E^{-2.7}$)* to find out the e^+/e^- ratio.

With this simplified calculation, one can arrive at a e^+/e^- ratio around 3:1 to 4:1.

Our group is studying the air shower simulation and transportation of particles from atmosphere to shuttle altitude to make the above picture convincing.

D. Data acquisition with PowerPC and real-time Linux

The AMS detector is being upgraded for the next shuttle flight scheduled in May 2003. The upgraded detector will have about 3 times more channels and post a challenge to the data acquisition (DAQ) and trigger system. A powerful level-3 trigger and DAQ electronics is called for. Two options are being considered at this

moment: an Analog Device Digial Signal Processor ADSP-21020 based circuit board, and an IBM PowerPC 750 based one. There is a radiation-tolerant version of ADSP-21020, but it is much slower than PowerPC 750. The electronics team in CERN is evaluating ADSP-21020 and our group is responsible for evaluating PowerPC 750.

When the system gets more complex, a robust and modest sized operating system can make the system easier to develop and maintain. Our group is pursuing using real-time Linux (rtLinux) on the PowerPC chip. So far we have installed Intel Pentium flavor of rtLinux, and we'll get our hands on PowerPC once we gained enough experience with rtLinux.

2. Particle Phenomenology

(1) Charmless Hadronic Two-body Decays of *B* Mesons

Two-body charmless nonleptonic decays of B mesons are studied within the framework of generalized factorization in which the effective Wilson coefficients c_i^{eff} are renormalization-scale and -scheme independent while factorization is applied to the tree-level hadronic matrix elements. Contrary to previous studies, our c_i^{eff} do not suffer from gauge and infrared problems. Nonfactorizable effects are parametrized in terms of $N_c^{eff}(LL)$ and $N_c^{eff}(LR)$, the effective numbers of colors arising from *(V-A)(V-A)* and *(V-A)(V+A)* four-quark operators, respectively. Tree and penguin transitions are classified into six different classes. The data of $B^-\to\rho^0\pi^-$ and $B^-\to\phi K^-$ clearly indicate that $N_c^{eff}(LR)\neq N_c^{eff}(LL)$: The first measurement of the $b\to u$ mode $B^-\to\rho^0\pi^-$ and the experimental information on the tree-dominated mode $B^-\to\omega\pi^-$ all imply that $N_c^{eff}(LL)$ is less than 3, whereas the CLEO measurement of $B^-\to\phi K$ shows $N_c^{eff}(LR)>3$. For given input parameters, the prediction of $B(B\to\eta'K)$ is largely improved by setting $N_c^{eff}(LL)\sim 2$ and $N_c^{eff}(LR)>N_c^{eff}(LL)$; in particular, the charm content of the η' contributes in the right direction. The decay rate of $B\to\phi K^*$ is very sensitive to the form-factor ratio A_2/A_1; the absence of $B\to\phi K$ events does not necessarily invalidate the factorization approach. If the branching ratio of $B^-\to\omega K^-$ is experimentally found to be significantly larger than that of $B^-\to\rho^0K^-$, we argue that inelastic final-state rescattering may account for the disparity between ωK^- and ρ^0K^-. By contrast, if $B(B^-\to\rho^0K^-)\sim B(B^-\to\omega K^-)$ is observed, then W-annihilation and/or spacelike penguins could play a prominent role. The decay modes $\bar{B}_d^0\to\phi\pi^0,\phi\eta,\phi\eta',\phi\rho^0,\phi\omega$, $B^-\to\phi\pi^-,\phi\rho^-$ involving a vector meson ϕ are dominated by electroweak penguins. We show that a unitarity angle γ larger than 90° is helpful for explaining the $\pi^+\pi^-$, πK and $\eta'K$ data. The relative magnitudes of tree, QCD penguin and electroweak penguin amplitudes are tabulated for all charmless $B\to PP,VP,VV$ decays. Our favored predictions for branching ratios are those for $N_c^{eff}(LL)\approx 2$ and $N_c^{eff}(LR)\sim 5$. (Y.H. Chen, H.Y. Cheng, B. Tseng, K.C. Yang)

(2) Phenomenological Analysis of *D* Meson Lifetimes

The QCD-based operator-product-expansion technique is systematically applied to the study of charmed meson lifetimes. We stress that it is crucial to take into account the momentum of the spectator light quark of charmed mesons, otherwise the destructive Pauli-interference effect in D^+ decays will lead to a negative decay width for the D^+. We have applied the QCD sum rule approach to estimate the hadronic matrix elements of color-singlet and color-octet 4-quark operators relevant to nonleptonic inclusive D decays. The lifetime of D_s^+ is found to be longer than that of D^0 because the latter receives a constructive W-exchange contribution, whereas the hadronic annihilation and leptonic contributions to the former are compensated by the Pauli interference. We obtain the lifetime ratio $\tau(D_s^+)\,\tau(D^0)\approx 1.08\pm0.04$, which is larger than some earlier theoretical estimates, but still smaller than the recent measurements by CLEO and E791. (H.Y. Cheng, K.C. Yang)

(3) The ΔI=1/2 Rule and CP Violation in Kaon Decays

The ΔI=1/2 rule and direct CP violation ε'/ε in kaon decays are studied within the framework of the effective Hamiltonian approach in conjunction with generalized factorization for hadronic matrix elements. We identify two principal sources responsible for the enhancement of ReA_0/ReA_2: the vertex-type as well as penguin-type corrections to the matrix elements of four-quark operators, which render the physical amplitude renormalization-scale and -scheme independent, and the nonfactorized effect due to soft-gluon exchange, which is needed to suppress the ΔI=3/2 K→ππ amplitude. Contrary to the chiral approach which is limited to light meson decays and fails to reproduce the A_2 amplitude, the aforementioned approach for dealing with scheme and scale issues is applicable to heavy meson decays. We obtain ReA_0/ReA_2=13-15 if $m_s(\mu=1\text{GeV})$ lies in the range (125-175)MeV. The bag parameters B_i, which are often employed to parametrize the scale and scheme dependence of hadronic matrix elements, are calculated in two different renormalization scehemes. It is found that $B_8^{(2)}\sim B_6^{(0)}$, which are of order 1.5 at μ=1GeV, are nearly scheme independent, whereas $B_{3,5,7}^{(0)}$ as well as $B_7^{(2)}$ show a sizable γ_5-scheme dependence. Moreover, only $B_{1,3,4}^{(0)}$ exhibit a significant m_s dependence, while the other B-parameters are nearly m_s independent. For direct CP violation, we obtain $\varepsilon'/\varepsilon=(0.7\text{-}1.1)\times10^{-3}$ if $m_s(1\text{GeV})=150$MeV and $\varepsilon'/\varepsilon=(1.0\text{-}1.6)\times10^{-3}$

if m_s is as small as indicated by some recent lattice calculations. (H.Y. Cheng)

(4) Nonspectator Effects and *B* Meson Lifetimes from a Field-theoretic Calculation

The *B* meson lifetime ratios are calculated to the order of $1/m_b^3$ in the heavy quark expansion. The predictions of those ratios are dependent on four unknown hadronic parameters B_1, B_2, ε_1 and ε_2, where B_1 and B_2 parametrize the matrix elements of color singlet-singlet four-quark operators and ε_1 and ε_2 the matrix elements of color octet-octet operators. We derive the renormalization-group improved QCD sum rules for these parameters within the framework of heavy quark effective theory. The results are $B_1(m_b)=0.96\pm0.04$, $B_2(m_b)=0.95\pm0.02$, $\varepsilon_1(m_b)=-0.14\pm0.01$, and $\varepsilon_2(m_b)=-0.08\pm0.01$ to zeroth order in $1/m_b$. The resultant *B* meson lifetime ratios are $\tau(B^-)/\tau(B_d)=1.11\pm0.02$ and $\tau(B_s)/\tau(B_d)\approx1$ in SU(3) symmetry limit. (H.Y. Cheng, K.C. Yang)

(5) Higher Twist Effect in Transversely polarized DIS

Recently, results in the deep inelastic scattering transversely polarized structure function were reported and have shown a non-negligible contribution. The transversely polarized structure function contains a chiral even part which measures the quark transverse spin asymmetry and a chiral odd part which is described by the quark transversity distribution in nucleon. Quak transverse spin is fameous for its conceptual difficulties and confusions in the literature. To measure the quark transverse spin in deep inelastic scattering requires the inclusion of quark masses and hence is of high twist in nature. We have clarified the quark mass effect in parton model approach to the transversely polarized nucleon structure function. We develop the massive special propagator technique to obtain manifestly gauge invariant results. Our result offers natural scheme to extract the buried short-distance contribution inside the soft part after momentum factorization in the collinear expansion approach. We have also been able to identify the corresponding matrix elements of the transversely polarized structure function in deep inelastic scatterings by using the massive propagator technique.(Hoi-Lai Yu, Kwei-Chou Yang)

(6) PQCD study of Inclusive B decays

Conventionally, the inclusive B meson decays are described by a systematic HQEFT based Euclidean space operator expansion(OPE) of relevant hadronic matrix elements in the inverse power of b-quark mass. Instead, we develop perturbative QCD factorization theorems to analyze inclusive B meson decays. We then apply perturbative QCD factorization theorems to inclusive heavy hadron decays, and

obtain simultaneously a low semileptonic branching ratio $B(B\to X\lambda\bar{\nu})=3D10.16$, the average charm yield $\langle n_c\rangle=3D1.17$ per *B* decay, a small lifetime ratio $\tau(\Lambda_b)/\tau(B_d)=3D0.78$, and the correct absolute decay widths of the *B* meson and of the Λ_b baryon.(Hoi-Lai Yu, We-Fu Chang and Hsiang-nan Li)

3. Gravitation and Cosmology

(1) The SPOrt project: cosmological and astrophysical goals

We present the cosmological and astrophysical objectives of the SPOrt mission, which is scheduled for flying on the International Space Station (ISS) in the year 2002 with the purpose of measuring the diffuse sky polarized radiation in the microwave region. We discuss the problem of disentangling the cosmic background polarized signal from the Galactic foregrounds. (R. Fabbri, S. Cortiglioni, S. Cecchini, M. Orsini, E. Carretti, G. Boella, G. Sironi, J. Monari, A. Orfei, R. Tascone, U. Pisani, K.-W. Ng, L. Nicastro, L. Popa, I. A. Strukov, and M.V. Sazhin)

(2) Cosmic microwave background temperature-polarization correlation

We give a full analysis of the auto- and cross-correlations between the Stokes parameters of the cosmic microwave background. In particular, we derive the windowing function for an antenna with Gaussian response in polarization experiment, and construct correlation function estimators corrected for instrumental noise. They are applied to calculate the signal to noise ratios for future anisotropy and polarization measurements. While the small-angular-scale anisotropy-polarization correlation would be likely detected by the MAP satellite, the detection of electric and magnetic polarization would require higher experimental sensitivity. For large-angular-scale measurements such as the being planned SPOrt/ISS, the expected signal to noise ratio for polarization is greater than one only for reionized models with high reionization redshifts, and the ratio is less for anisotropy-polarization correlation. Correlation and covariance matrices for likelihood analyses of ground-based and satellite data are also given. We reexamine the temperature-polarization correlation function of the cosmic microwave background induced by tensor mode with a scale-invariant spectrum in reionized standard cold dark matter models. It is found that the sign of the correlation function is positive on all angular scales even in a model with substantial reionization.(K.-W. Ng and G.-C. Liu)

(3) Photon production of axionic cold dark matter

Using the non-equilibrium quantum field theory, photon production from the

coherently oscillating axion field in a flat Robertson-Walker cosmology is re-examined. First neglecting the Debye screening of the baryon plasma to photons, we find that the axions will dissipate into photons via spinodal instability in addition to parametric resonance. As a result of the pseudo-scalar nature of the axion-photon coupling, we observe a circular polarization asymmetry in the produced photons. However, these effects are suppressed to an insignificant level in the expanding universe. We then briefly discuss a systematic way of including the plasma effect which can further suppress the photon production. We note that the formalism of the problem can be applied to any pseudo-scalar field coupled to photon in a thermal background in a general curved spacetime. (D.-S. Lee and K.-W. Ng)

(4) Neutrino-photon scattering and its crossed processes in a 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. (T.-K. Chyi, C.-W. Hwang, W. F. Kao, G.-L. Lin, K.-W. Ng, and J.-J. Tseng)

(5) Nonequilibrium photons as a signature of quark-hadron phase transition

We study the nonequilibrium photon production in the quark-hadron phase transition, using the Friedberg-Lee type solitons as a working model for quark-hadron physics. We propose that to search for nonequilibrium photons in the direct photon measurements of heavy-ion collisions may be a characteristic test of the transition from the quark-gluon to hadronic phases. (D.-S. Lee and K.-W. Ng)

SOLID STATE PHYSICS AND BIOPHYSICS

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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).

(1) 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).

(2) 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)

(3) Geometrical dependence of conductance quantization in metal point contacts

A scanning tunneling microscope with low-frequency modulation in the Z piezo is used to study conductance quantization of Au points contacts at ambient pressure and room temperature. Conductance up to 40 multiples of $2e^2/h$ can be repeatedly generated by pressing and pulling a Au tip against a Au sample with a sinusoidal distance modulation. By applying a symmetric double-cone model, only one parameter, the cone angle, is needed to describe the overall geometry of the contact. A conductance histogram in the low-conductance range is then tabulated as a function of the cone angle. The value of the conductance is found to decrease from the idealized value, nG_0, by an amount which increases with the angle of the cone. The distribution of the first conductance peak is analyzed to study the effect of the modulation speed. The peak width broadens as the speed is increased from 400 Å/s to 1000 Å/s. (W. B. Jian, C. S. Chang, W. Y. Li and Tien T. Tsong).

(4) Large Fermi density waves on the reconstructed Pt(100) surface

Several long-range superstructures have been observed with the scanning tunneling microscopy on the reconstructed Pt(100) surface at room temperature. They are present in strained domains and involve both the Fermi electrons and the concomitant lattice distortions. A first-principles calculation shows that the top layer expanded ~ 18% on average and the Fermi surface for a single hexagon layer displays some nesting portions, which can be related to the wavevectors of the observed superstructures. Thus, these superstructures existing in the local domains of the reconstructed surface have the likely origin of incipient charge density waves. (C.S. Chang, W.B. Su, C.M. Wei and T.T. Tsong).

(5) Direct observation of reaction-limited aggregation on semiconductor surfaces

We report a discovery that the nucleation and growth of two-dimensional (2D) Ge islands at a Pb layer covered Si(111) surface are reaction limited. Using scanning tunneling microscopy, a compact-to-fractal island shape transition is observed as the

deposition flux is lowered, the temperature is raised, or at a low Ge coverage. This behavior is completely opposite to what was predicted from those theories based on diffusion-limited aggregation and previous experimental observations. Energy barriers are found to exist for the nucleation and growth of Ge islands, indicating that their growth behavior is exchange-reaction rate limited. (T. -C. Chang, Ing-Shouh Hwang, and Tien T. Tsong)

(6) Low temperature growth of 2D Pb islands on Si(111)7x7 surfaces

Lead (Pb) is known to grow on Si(111) with the Stranski-Krastanov (SK) mode at room temperature. With the variable temperature scanning tunneling microscopy, we study the low temperature growth of Pb films on the Si(111)-7x7 surface from T ~40 K to 200 K. The islands are formed after the completion of the wetting layer and display peculiar properties that cannot be categorized into any of the conventional growth modes. Their tops are all very flat and even more surprisingly, they prefer to grow into some discrete thicknesses corresponding to 4, 7 and 9 atomic layers. Among them, that equivalent to seven atomic layers is especially dominant. While the stress in heteroepitaxy may be the only dominant factor for a thick film and hence causes the film to form into 3D islands, for a thin film some other effects may be in play to counterbalance the stress. One of such effects is the "quantum size confinement", which could reduce the system energy due to quantization of the confined electrons in the film. Preliminary ab initio calculations seem to support this theory. (S. H. Chang, W. B. Su, C. S. Chang, C. M. Wei, L. J. Chen, and T. T. Tsong).

(7) Patterson inversion of CTDS patterns

By collaborating with Dr. T. Abukawa and Prof. S. Kono at the Tohoku University, Sendai, Japan, a new structural tool based on Patterson inversion of correlated thermal diffuse scattering (CTDS) in low to medium energy electron diffraction is developed. Using the Si(100)-(2x1) surfaces as an example, we obtained high quality three-dimensional images, with a resolution better than 0.5 **Å**, of both surface dimer atoms and bulk atoms from Patterson inversion of CTDS patterns, and thus proved that it is a new surface structural tool.(Ching-Ming Wei)

(9) Patterson inversion of low energy electron diffraction curves

By collaborating with Dr. C. Y. Chang and Prof. Y. C. Chou, we proposed a Patterson-like scheme for direct inversion of low energy electron diffraction **I(E)** (i.e., LEED-IV) curves, which is in contrast with the previously suggested holographic

scheme. Using the Si(111)-(7x7) and Si(113)-(3x2) surfaces as examples, we obtained high quality three-dimensional images, with a resolution better than 0.5 Å, of both surface atoms and bulk atoms from direct Patterson inversion of LEED-I(E) curves with IEPSM, and thus proved that it is a new surface structural tool.(Ching-Ming Wei)

(10) Self-Diffusions of Small Clusters on fcc metal (111) surfaces

By collaborating with Dr. C. M. Chang and S. P. Chen, *ab-initio* density-functional theory and embedded-atom method are used to study the self-diffusion of small clusters on (111) surface of fcc metals. A zigzag motion is found to be important in the dimer and tetramer diffusions. Dimer diffuses by a zigzag and concerted motion. Trimer diffuses by a concerted three-atom motion. Tetramer diffuses through a zigzag motion where only two atoms move simultaneously in each step. Thus, the energy barrier for tetramer diffusion is lower than that for trimer diffusion, in agreement with FIM of Ir_n/Ir(111), and is predicted to be a general phenomenon. (Ching-Ming Wei)

(11) 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. Develop opticsless approach to apply phase contrast enhancement based on the collimated synchrotron radiation. Such approach allows direct observation of small biological specimen with high lateral resolution, high contrast and time resolution. The micrograph in fig 1, the skin of a leaf which is peeled off and imaged with X-ray, is one of the examples demonstrating the power of our approach. Note, although only one or few layer of cells consist of the skin, the contrast is high enough for the direct observation due to the apparent enhancement in the boundaries or the cell.

Real time applications to the biological specimen, including small insects and animals has been tested in Taiwan and Korea synchrotron facility. Large scale collaborative team has been formed to propose a multimillion US dollar medical beamlines for the application of this technique we developed to the medical diagnosis and therapy. (Yeukuang Hwu)

(12) 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 is the only

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. (Yeukuang Hwu)

(13) 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 nanastructured materials.

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

(14) 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)

(15) 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) Magnetostriction of Co-rich Co-Fe-Ni alloys:

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 are to be published in J. Magn. Magn. Mater. (S. U. Jen)

(2) Angular dispersion of easy axis as determined by XY-vector VSM:

The XY-vector VSM has been used to measure the hard-axis M_X and M_Y hysteresis loops. The angular dependence of the M_Y hysteresis loop contains more information than that of the conventional M_X loop. There are two different types of behavior for the M_Y hysteresis in two different zones, e.g. the in-center ($\varphi < \varphi_C$) and the off-center zones ($\varphi > \varphi_C$). We have shown that via the vectorial VSM measurements it is possible (a) to determine the direction of the average easy axis (EA) accurately (i.e. within the resolution of 0.5°, and (b) to study the angular disperaion of EA in most of the magnetic films. More discussion has been published in J. Appl. Phys. 87, 8640(2000). (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 , roughly 20% reflectivity differences between the amorphous and crystalline states are required for recording purpose. Various phase change materials will be febricated, and their physical properties will be investigated under this research topic. (Y. D. Yao)

(5) Tunneling Magnetoresistance

Two magnetic materials separated by a thin insulating layer can form a magnetic tunnel junction. Although this phenomenon was first reported over twenty years ago, it is difficult to make good quality insulating layer on ferromagnetic materials. We try different materials and different deposition procedures, including deposit insulting layer from sputtering a target directly, sputter thin metal layer then oxidize it, etc. We now have a good recipe to make reproducible junctions and are studying the details of oxidizing process. (Y. D. Yao, Y. Liou, and S. F. Lee)

(6) Surface Magneto-Optical Kerr Effect

A surface magneto-optical Kerr effect system has been 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 magnetic 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 film 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 years, a great deal of efforts has been made on the understanding of the physical phenomena in various magnetic fluids. Magnetic field induced optical 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 trilayers

Electric and magnetic properties of trilayers and multilayers of superconducting Nb, NbTi and ferromagnetic Co are studied in details. The variation of superconducting transition temperature Tc and magnetic hysteresis loop around Tc are measured systematically. Determination of superconducting coherence length and magnetic penetration depth of Co into Nb and NbTi are performed. More studies on different materials will reveal the effect of spin-orbit coupling and exchange field on proximity effect. (Y. D. Yao, Y. Liou, and S. F. Lee)

(10) Calorimetric Evaluation of Magnetic Ordering and Spin Reorientation in Er_3Ge_4

Calorimetric measurements have been made on orthorhombic Er_3Ge_4 having two crystallographically distinct Er sites. The temperature dependence of specific heat shows a peak near 7 K, confirming the antiferromagnetic ordering of both Er sublattices as suggested by neutron diffraction. A spin reorientation in one of the Er sublattices of the highly canted magnetic structure prevails as a second peak in specific heat around 3.5 K. Both magnetic transitions exhibit no thermal hysteresis. By further taking into account the relatively small contributions from lattice and crystal field effect, as well as 3Rln2 for the ordering of all Er^{3+} with a ground state doublet, entropy analysis results in a 30 J/mol energy associated with the spin reorientation process Phys Rev B, 61, 58 (Y. Y. Chen, Y.D. Yao, J.C. Ho etc.).

(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, ~90 K, 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,Al)-based compounds, $CeAl_2$, 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, an increased coefficient γ of the linear term in specific heat indicates a large enhancement of the Kondo behavior. In 80Å-CeAl2, 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-Dependent Kondo and RKKY Interactions

we are studing the quantum size effect on the Kondo behavior and RKKY interaction. In the past two years we have studied the quantum size effects in some heavy fermion compounds, such as $CeAl_2$, Ce_3Al, and Ce_3Al_{11} with particle size around 100 Å. We have discovered the size induced transition from magnetic ordering to Kondo behavior in these compounds. For example the linear coefficient γ of 80 Å - $CeAl_2$ is about sixty times larger than that of bulk $CeAl_2$.

The report of this observation did attract interests of scientist, but the problem raised by the report, such as the relation among magnetic order (T_N or T_C), Kondo temperature (T_K), and the size of sample (d) have to be clarified. In order to solve the problem, we need to make a series of different size samples. By virtues of their change in surface/volume ratio, we may distinguish the individual influence on T_N (or T_C) and T_K by quantum size effect and surface effect respectively. In the project we plan to prepare a series of samples with particle size for 10000 Å、5000 Å、1000 Å、500 Å、100 Å. We believe through this completed study we can solve the above problems.

(3) Single electronics

Taking advantage of the modern electron beam lithography technology, we have fabricated various nanometer-scaled structures with the line width as small as 30 nm. Our aim is to study electronic transport properties of the fabricated mesoscopic objects; they are composed of superconductors, ferromagnets, or semiconductors. Because the relevant energy scales of the interested physics are quite small, characterization of these small structures usually requires a low temperature and electrically quiet environment. To this end, we have built an ultra-low temperature measurement system, including a dilution refrigerator, with the base temperature as low as 40 mK, and a home made low-noise current-voltage amplifier. The following are some results from two of our on-going projects:

1. Ferromagnet-Superconductor-Ferromagnet Single Electron Transistors

Transport measurements on ferromagnet(Ni or Co)-superconductor(Al) Single Electron Transistors (FM-S-FM SETs) were conducted at mK temperatures and the results were compared with these of normal metal–superconductor–normal metal (N-S-N) SETs. The latter displayed a 2*e*-periodic gate-voltage modulation of the Andreev current with peaks appearing at odd-*N* states, *N* being the number of excess electrons in the island. Upon warming, a crossover from 2*e*-periodic to 1*e*-periodic oscillations was observed when the free energy difference between even-*N* and odd-*N* states vanished.

2*e*-periodic oscillations of FM-S-FM SETs showed, by contrast, a clear shift of the current peak positions in respect to the quasiparticle 1*e*-periodic oscillations. We argue that in the even-*N* states all conduction electrons are paired with equal numbers of spin-up and spin-down electrons, whereas in the odd-*N* states unbalanced net spin (due to the polarized source electrode) leads to a shift in ground state energy, giving rise to the observed shift in current peak positions. The crossover temperature did not differ from that of theirs N-S-N counterparts, presumably due to incomplete polarization of the Ni and Co-electrodes.

2. Superconductor-Insulator transition in 1D array 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. The zero bias resistance was found to display a drastic change upon application of a small magnetic field; this result was analyzed in context of the classical 2D *XY* model associated with the Kosterlitz-Thouless-Berezinskii(KTB) transition. A scaling analysis suggests a power law dependence of the correlation length instead of an exponential one. The dynamical exponent *z* was determined to be 0.27, suggesting that the insulating ground state is a Mott insulator with a Coulomb gap. (cond-mat/0007355) (ChiiDong 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 manufaturing 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:$BeAl_2O_3$ 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 properies 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 deffraction and other optical measurments 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. 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 Electronic Systems

(1) d-wave pairing correlation in the *t-J* type models

There are two papers, one published in Phys. Rev. Lett. 81, p1294 (1998); and the second one is in Chinese Journal of Physics 38, 300-305 (2000).

In the PRL paper we studied the pair-pair correlation function of the two-dimensional *t-J* model by using a particular numerical method, the power-Lanczos method, under the assumption of monotonic behavior. The power-Lanczos method was invented by us. In comparison with the results of the ideal Fermi gas, we conclude that the 2D *t-J* model does not have long range d-wave superconducting correlation in the

interesting parameter range of $J/t \leq 0.5$ which is the range believed to be relevant for high temperature superconductors. This is the first calculation done on large enough lattices to examine the pairing correlation. It is also the first reliable calculation to challenge the common belief that the mechanism of high temperature superconductivity is already contained in the two-dimensional *t-J* model.

In the second paper the assumption used in the first paper is further tested. Results calculated for the one-dimensional model and the two-leg ladder are compared with the exact solutions and results obtained by the density matrix renormalization group method. Very good agreement has been obtained. It reconfirms the reliability of our conclusion that in pure two dimensions, the pairing correlation is very weak in the *t-J* model.

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

This paper is published in Phys. Rev. B62, 1 (2000). In this study the spectra observed in angle-resolved-photoemission spectroscopy (ARPES) measurements are examined together with the resonance peak observed in neutron scattering, based on the t-t'-J model. We show that the peak/dip/hump features in 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. (J. X. Li, C. Y. Mou and T. K. Lee)

(3) Stripe stability in the extended *t-J* model on planes and four-leg ladders

This paper is published in Phys. Rev. B Rapid Comm. 59, R11649 (1999). We are in collaboration with a number of US and Japan Physicists. Recently we have begun to look at the stripe phase. We show that the stripe tendencies are considerably weaken when we include the next nearest hopping term in the *t-J* model. (T.K. Lee).

(4) A single unitary impurity in a d-wave superconductor

In this paper, Phys. Rev. B61, 8667-8670 (2000) we study the quasiparticle resonant states around a single nonmagnetic impurity with unitary scattering in a d-wave superconductor by solving the Bogoliubov-de Gennes equations based on a *t-J* model. We find that a particle-hole symmetric system has a single symmetric zero energy peak in the local density of states regardless of the size of the superconducting coherence length. For the particle-hole asymmetric case, an asymmetric splitting of the zero-energy peak is intrinsic to a system with a small value of $k_F\xi_0$, in qualitative

agreement with experiments. (T.K. Lee)

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) Cluster Analysis of the Ising Model and Universal Finite-Size Scaling.

(2) Randomness-induced evolution of first-order to second-order phase transition in the three-state Potts antiferromagnetic model on a triangular lattice.

(3) Polydispersity Effect and Universality of Finite-size Scaling Function in Continuum Percolation.

(4) Finite-size corrections for the number of clusters in the critical Potts model.

(5) Exact phase diagram for hydrogen-bonded crystals with bond defects.

(6) Partition function zeros of the Q-state Potts model for non-integer Q.

(7) Exact universal amplitude ratios for the planar Ising model and a quantum spin chain.

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

(9) Universal amplitude ratios in the Ising model on the Bethe lattice.

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

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

(12) Anomalous finite-size effect induced by boundary condition

(13) On the critical behaviors of hierarchically decorated lattices

2. Nonequilibrium Statistical Physics

(1) Crack paths and patterns in slow fracture.

(2) Derivation of continuum dynamics from microscopics.

3. Chaos and Nonlinear Dynamics

(1) The diffusion behavior of a simple map with periodic quenched disorder.

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

(3) Pattern Competition in Photorefractive Semiconductors.

(4) Inversion symmetry and exact critical exponents of dissipative waves in the Sandpile Model.

(5) Renormalization Group Study of Abelian Sandpile Model on the Planar Lattices.

(6) Synchronous Chaos in Coupled Map Lattices with small-world Interactions.

(7) Multifractal charaterization of stochastic resonance.

(8) Bifurcation, scaling and universality in a bouncing ball system.

4. Random Medium and Complex Fluid

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

(2) Crossover phenomena in a two-dimensional phase-separating binary fluid containing surfactants.

(3) Correlation function of random heteropolymer solutions.

5. Theoretical Biological Physics

(1) Carrying capacity and demographic stochasticity: Scaling behavior of the stochastic logistic model.

(2) Pathogen-driven outbreaks in forest defoliators revisited: Building models from experimental data.

(3) Parallel calculation of protein energy in a pentium cluster.

(4) [SMMP] A Package for the Molecular Mechanics and Monte Carlo Simulation of Proteins.

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

(6) Synchronous Chaos in Coupled Map Lattices with small-world Interactions.

(7) The helix-Coil transition in circular DNA

(8) Do Proteins Sit between a Ferromagnet and a Spin Glass ?

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, J. Dussoff (left in August 2000), P. M. Gade (left in January 2000), S. Hayryan, Chai-Yu Lin, N. Sh. Izmailian, A. Silchenko, Y.-H. Shiau (left in Dec. 2000), and Z. E. Usatenko. The gaduate student is C.-S. Yang. During January-December 2000, we have published one conference proceedings and 14 papers in SCI journals, including two papers in *Physical Review Letters* and two papers in *Physical Review E*. We have submitted 20 manuscripts to SCI journals, one of them has been accepted by *Nature,* three of them have been accepted by *Physical Review E,* and one of them has been accepted by *Comp. Phys. Commu.*. The main research results are listed below.

1. Equilibrium Phase Transitions

(1) Cluster Analysis of the Ising Model and Universal Finite-Size Scaling.

The recent progress in the study of finite-size scaling (FSS) properties of the Ising model is briefly reviewed. We calculate the universal FSS functions for the Binder parameter g and the magnetization distribution function $p(m)$ for the Ising model on L_1x L_2 two-dimensional lattices with tilted boundary conditions. We show that the FSS functions are universal for fixed sets of the aspect ratio L_1x L_2 and the tilt parameter. We also study the percolating properties of the Ising model, giving attention to the effects of the aspect ratio of finite systems. We elucidate the origin of the complex structure of $p(m)$ for the system with large aspect ratio by the multiple-percolating-cluster argument (Y. Okabe, K. Kaneda, Y. Tomita, C.-K. Hu).

(2) Randomness-induced evolution of first-order to second-order phase transition in the three-state Potts antiferromagnetic model on a triangular lattice.

The three-state Potts antiferromagnetic model on the two-dimensional triangular lattice has a weak first-order transition in the pure case. Our Monte Carlo simulation displays a transition temperature at $T = 0.628$, which is consistent with previous studies. The nature of phase transition due to the randomness of quenched bonds is considered in this study, The energy histogram arn shows a single Gaussian peak due to randomness of the bond, while the first-order phase transition displays distinct double peaks due to the coexistence of two states. The histogram analysis ascertains the significance of order variation from the first-order to the second-order phase transition in this system (C. S. Yang and I. M. Jiang).

(3) 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).

(4) Finite-size corrections for the number of clusters in the critical Potts model.

Using a Monte Carlo method, Hu and Lin found that bond and site percolation models on planar lattices have universal finite-size scaling functions for the probability *Wm* for the appearance of *m* percolating clusters, which implies that the average number of percolating clusters, *C*, is a universal quantity. Hu and Lin found that *C* increases linearly with the aspect ratio, R, of the lattice for large *R*, i.e. in this case $C = aR$ with a constant a. Hu and Lin also found that *a* is apparently independent of the boundary conditions. For the periodic boundary conditions in both horizontal and vertical directions, Ziff et al. found that the number of clusters per lattice site, *n*, for percolation on planar lattices of linear dimensions *L* can be written as $n = n(c) + b/N$, where *n(c)* is *n* in the limit $L\to\infty$, *b* is a constant, and *N* is the number of lattice sites. Ziff et al. found that *b* is universal and argued that *b* is the number of percolating clusters so that its universality may be related to the universality of *C*. Hu found that for large *R*, $b = b(c)R$, but *b(c)* not equal *a*. In this paper, we use a cluster Monte Carlo simulation method to calculate the number of clusters per site, *n*, of a q-state bond-correlated percolation model (QBCPM) which is equivalent to the *q-state* Potts on *L x L* square lattices. We find that for *q* greater than or equal to the slopes of *n* as a function of $1/L^2$ are negative. For $q = 2$, i.e. the Ising model, we find that our data can be well represented by $n = n(c) - c/L + b/L^2 + \ldots$, where *b* can be calculated exactly from conformal field theory, $c > 0$ and can be calculated exactly from the critical internal energy of the Ising model (C.-K. Hu, J.-A. Chen, N. Sh. Izmailian, and P. Kleban).

(5) Exact phase diagram for hydrogen-bonded crystals with bond defects.

It is shown that the percolation model of hydrogen-bonded crystals, which is a 6-vertex model with bond defects, is completely equivalent with an 8-vertex model in an external electric field. Using this equivalence we solve exactly a particular 6-vertex model with bond defects. The general solution for the Bethe-like lattice is also analyzed

(N. Sh. Izmailian, C.-K. Hu, and F. Y. Wu).

(6) Partition function zeros of the *Q*-state Potts model for non-integer *Q*.

The distribution of the Fisher zeros of the *Q*-state Potts model in the complex temperature plane is studied for non-integer *Q*. As *Q* approaches unity we find the zeros rapidly converge to the ferromagnetic self-dual unit circle in the complex *p* plane where $p=(e^{\beta J}-1)/\sqrt{Q}$ and we verify the Den Nijs formula for the thermal critical exponent y_t of the Potts ferromagnet. The critical point and the thermal exponent of the Potts antiferromagnet are discussed using the same distribution of the Fisher zeros (S.-Y. Kim, R. J. Creswick, C.-N. Chen, and C.-K. Hu).

(7) Exact universal amplitude ratios for the planar Ising model and a quantum spin chain.

Let fN 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: $N(f_N \to f_\infty) = \sum_{k=1}^{\infty} a_k / N^{2K-1}$ and $\xi_N^{-1} = \sum_{k-1}^{\infty} b_k / N^{2k-1}$ for square, honeycomb, and plane-triangular lattices, and find that $b_k / a_k = (2^{2k}-1)/(2^{2k-1}-1)$ 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).

(8) Exact amplitude ratio and finite-size corrections for the *M x 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 x 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: $N(f - f_\infty) = \sum_{i=1i}^{\infty} f_{2i-1} / N^{2i-1}, U = -\sqrt{2} + \sum_{i-1}^{\infty} u_{2i-1} / N^{2i-1}$, and $C = 81nN/\pi + \sum_{i=0}^{\infty} c_i / N^i$, i.e. *Nf* and *U* are odd function of N^{-1}. We also find that $u_{2i-1} / c_{2i-1} = 1/\sqrt{2}$ and $u_{2i-1} / c_{2i-1} = 0$ for $1\le i<\infty$ and 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).

(9) Universal amplitude ratios in the Ising model on the Bethe lattice.

For the Ising systems in the same universality class, it is believed that the ratio of the high- and low-temperature amplitudes for the correlation length and for

susceptibility are universal quantities. Using recently developed methods we have calculated exactly the correlation length amplitude ratios for Ising model on the Bethe lattice and found that this ratio is independent of the coordination number of the lattice (N. Sh. Izmailian and C.-K. Hu).

(10) 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 ε expansion. (Z.E.Usatenko, M. A. Shpot and C.-K. Hu).

(11) 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, Wn, the percolating probabilities, P, the average fraction of lattice bonds (sites) in the percolating clusters, $< c^b >_n$ ($< c^s >_n$, 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 Wn, P, $< c^b >_n$ ($< c^s >_n$, 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).

(12) Anomalous finite-size effect induced by boundary condition

Basic analysis on the analytic solutions of infinitely long Ising cylinder reveals that there can be anomalous finite-size effect observed in both the internal energy and the specific heat. The effect is specifically induced by the antiperiodic boundary condition and characterized by the finite jump locating exactly at the critical temperature of the system. We prove this result explicitly for the triangular and hexagonal lattices with ferromagnetic couplin. (Ming-Chang Huang, Simon C. Lin, Tsong-Ming Liaw).

(13) On the critical behaviors of hierarchically decorated lattices

We provide an analytical study for the critical behaviors of Ising model embellished with hierarchical decorations, called n-lattice, of fundamental types. The lattices possesses manifest translational invariance only above certain scale defined as primary cell, while in the limit of infinite level of decoration, scale symmetry can be recovered below the scale of primary cell. Via formulation similar to renormalization for the inner scale, we prove that there are no ferromagnetic phase transition for the n-lattice as n approaches infinity. Some significant measurements for the system are also included (Tsong-Ming Liaw, Ming-Chang Huang, Simon C. Lin).

2. Nonequilibrium Statistical Physics

(1) Crack paths and patterns in slow fracture.

Slow crack propagation gives rise to intriguing patterns that encompass wide range of scales from microns to kms. What is the underlying mechanism for the diversity of scale and similarity of morphology? Does fracture happen catastrophically, like a first order phase transition, or gradually like a continuous one? We attempt to answer such questions by carrying out analytic and extensive numerical studies of simplified models using concepts and methods of statistical physics, along with simple experiments.

Under uniform stresses, competition between stick-slip action and cracking leads to a cellular, hierarchical pattern of cracks. We derive the growth of correlation in the stress field and show that it selects the final fragment size. We characterize the crack patterns by progressive damages exhibited by the history of broken bonds and energy release. Consistent with experiments, fragment size depends linearly on sample thickness. A novel scaling involving friction and thickness is derived and confirmed, thus providing a quantitative explanation for the ubiquity of similar patterns over wide range of scales in nature (K.-t. Leung and Z. Neda).

Under non-uniform stresses, instead of generating a network the crack propagates

preferentially in order to maximize stress relief. This often leads to fascinating crack paths. Using thin layer of fine precipitate, we obtain novel spiral cracks inside desiccated fragments. We propose that a converging stress front induced by detachment from the substrate is the driving force behind this formation. Computer simulation incorporating this mechanism successfully reproduces the observed spirals (K.-t. Leung, L. Jozsa, M. Ravasz and Z. Neda).

(2) Derivation of continuum dynamics from microscopics.

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).

3. Chaos and Nonlinear Dynamics

(1) The diffusion behavior of a simple map with periodic quenched disorder.

To explore the effect of quenched disorder on chaotic diffusion, we investigate the diffusion properties of a simple map with periodic quenched disorder. As the period T approaches infinity, the map will exhibit sublinear diffusion behavior, the same as that revealed by Radons [Phys. Rev. Lett, 77 (1996) 4748], such that the corresponding diffusion coefficient D vanishes. For $T = 140$, we find, the system varies with the configuration of disorder to exhibit a great diversity of diffusion behavior, including normal diffusion with diminished D (about less than two or three orders of magnitude), the crossover from large D diffusion to very small D diffusion, and the crossover from normal diffusion to completely suppressed diffusion. Based on the decomposition formalism [H.C. Tseng. H.J. Chen, Int, J. Mod. Phys. 13 (1999) 83], we find that the correlation behavior of the sequences of +1 or -1, which are determined by the kinds of disorder (represented by +1 or -1) visited by the trajectories of the may, is responsible

for the different diffusion processes. We also show that the connection between the diffusion behavior and the disorder configuration is dominated by the variance and the power spectrum of the associated potential (Tseng HC, Huang PR, Chen HJ, Hu CK).

(2) 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, {\em 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).

(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_0m, is small, the system has a periodic domain train (PDT), consistent with the results of linear stability analysis. When I_0m 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).

(4) Inversion symmetry and exact critical exponents of dissipative waves in the Sandpile Model.

By an inversion symmetry, we show that in the Abelian sandpile model the probability distribution of dissipating waves of topplings that touch the boundary of the system shows a power-law relationship with critical exponent 5/8 and the probability distribution of those dissipating waves that are also last in an avalanche has an exponent of 1. Our extensive numerical simulations not only support these predictions, but also show that inversion symmetry is useful for the analysis of the two-wave probability distributions (C.-K. Hu. E.V. Ivashkevich, C.Y. Lin, and V.B. Priezzhev).

(5) Renormalization Group Study of Abelian Sandpile Model on the Planar Lattices.

The renormalization group approach to a sandpile model on the square, triangle and honeycomb lattices is investigated. Here we develop a systematic method to exactly count all possible toppling processes of sandpile dynamics inside a cell. This method is easy to apply to different kinds of lattices. For each lattice, the only attractive fixed point is found. The obtained height probabilities and critical exponents of avalanche size distribution at fixed point are consistent with numerical simulations and exact or proposed results. We also compare the branching probabilities of the spanning trees and the fixed point of sandpile dynamics (C.-Y. Lin and C.-K. Hu).

(6) Synchronous Chaos in Coupled Map Lattices with small-world Interactions.

In certain physical situations, extensive interactions arise naturally in systems. We consider one such situation, namely, small-world couplings. We show that, for a fixed fraction of nonlocal couplings, synchronous chaos is always a stable attractor in the thermodynamic limit. We point out that randomness helps synchronization. We also show that there is a size dependent bifurcation in the collective behavior in such systems. (P. M. Gade and C.-K. Hu).

(7) Multifractal charaterization of stochastic resonance.

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).

(8) Bifurcation, scaling and universality in a bouncing ball system.

The period-doubling bifurcation of bouncing ball system is investigated numerically. We found that the numerical values of the scaling factors δ and α which characterize the scaling structure of the period-doubling bifurcation agree with the Feigenbaum constants. This implies that the bouncing ball system, on certain parameter ranges, can be effectively reduced to one-dimensional unimodal map $\chi_{n+1} = 1 - ax_n^2$ x and they belong to the same universality class (J.-A. Chen 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.

We have considered X-ray radiation of a relativistic charged particle moving in a system consisting of microspheres distributed randomly in a dielectric material. A new mechanism based on the diffusional scattering of pseudophotons is suggested. The result leads to a stronger dependence of radiation intensity on the particle energy, $\gamma = E/mc^2$, than that predicted by the traditional transition radiation theory, and explains a recent experiment on such a system of randomly distributed superconducting granules (Zh. S. Gevorkian, C. P. Chen, and C.-K. Hu).

(2) Crossover phenomena in a two-dimensional phase-separating binary fluid containing surfactants.

Extensive simulations were carried out to investigate the crossover between the hydrodynamic regime at intermediate stage and the thermal fluctuation regime at late stage in a phase-separating binary fluid/surfactant system in two dimensions. The existence of the crossover and its dependence on the surfactant concentration were analyzed using Kawasaki and Ohta's interface kinetic equation [Physica A 118, 175 (1983)]. The analysis showed that there should exist a critical surfactant concentration, above which thermal fluctuations dominate hase separation at all times. Simulations suggested that the crossover exists and the hydrodynamic regime shrinks when surfactant concentration increases. Simulations also demonstrated that the trapped surfactants seen in a previous study [Phys. Rev. E 59, 2109 (1999)] can remain trapped for a time much longer than the time needed to form well segregated domains, in spite of the presence of significant thermal fluctuations (J.-R. Roan and C.-K. Hu).

(3) Correlation function of random heteropolymer solutions.

We consider density-density correlation function of random heteropolymer solutions in two dimensions. It is shown that a phase transition is possible on heterogeneity parameter. Corresponding phase diagram is presented. Critical behavior of the system is described by *O(N)* non-linear σ-model at $N=0$ (Zh.S. Gevorkian and C.-K. Hu).

5. Theoretical Biological Physics

(1) Carrying capacity and demographic stochasticity: Scaling behavior of the stochastic logistic model.

The stochastic logistic model is the simplest model that combines individual-level demography with density dependence. It explicitly or implicitly underlies many models of biodiversity of competing species, as well as non-spatial or metapopulation models of

persistence of individual species. The model has also been used to study persistence in simple disease models. The stochastic logistic model has direct relevance for questions of limiting similarity in ecological systems. This paper uses a biased random walk heuristic to derive a scaling relationship for the persistence of a population under this model, and discusses its implications for models of biodiversity and persistence. Time to extinction of a species under the stochastic logistic model is approximated by the exponential of the scaling quantity $U=(R-1)(2)\ N/R(R+1)$, where N is the habitat size and R is the basic reproductive number (J. Dushoff).

(2) Pathogen-driven outbreaks in forest defoliators revisited: Building models from experimental data.

Models of outbreaks in forest-defoliating insects are typically built from a priori considerations and tested only with long time series of abundances. We instead present a model built from experimental data on the gypsy moth and its nuclear polyhedrosis virus, which has been extensively tested with epidemic data. These data have identified key details of the gypsy moth-virus interaction that are missing from earlier models, including seasonality in host reproduction, delays between host infection and death, and heterogeneity among hosts in their susceptibility to the virus. Allowing for these details produces models in which annual epidemics are followed by bouts of reproduction among surviving hosts and leads to quite different conclusions than earlier models. First, these models suggest that pathogen-driven outbreaks in forest defoliators occur partly because newly hatched insect larvae have higher average susceptibility than do older larvae. Second, the models show that a combination of seasonality and delays between infection and death can lead to unstable cycles in the absence of a stabilizing mechanism; these cycles, however, are stabilized by the levels of heterogeneity in susceptibility that we have observed in our experimental data. Moreover, our experimental estimates of virus transmission rates and levels of heterogeneity in susceptibility in gypsy moth populations give model dynamics that closely approximate the dynamics of real gypsy moth populations. Although we built our models from data for gypsy moth, our models are, nevertheless, quite general. Our conclusions are therefore likely to be true, not just for other defoliator-pathogen interactions, but for many host-pathogen interactions in which seasonality plays an important role. Our models thus give qualitative insight into the dynamics of host-pathogen interactions, while providing a quantitative interpretation of our gypsy moth-virus data (J. Dushoff).

(3) Parallel calculation of protein energy in a pentium cluster.

It is well known that the potential energy function of protein molecule has very

complicated landscape with multiple minima and maxima. Computer simulations of such systems encounter certain problems and the search for more sophisticated algorithms and simulation techniques has been extensively done. Multicanonical ensemble method is one of the most successful steps in this direction. Parallel computation technique is also widely exploited and has lead to many important results. In this paper we combine both multicanonical and parallel computation techniques within a unique approach to Monte Carlo simulations of protein molecules. We report on the simple strategy of parallel calculation of the protein energy function. Two small peptides are used for the testing of the algorithm for one of which the known data are reproduced accurately (S. Hayrian, C.-K. Hu, S.-Y. Hu, and R.-J. Shang).

(4) [SMMP] A Package for the Molecular Mechanics and Monte Carlo Simulation of Proteins.

This paper presents a Fortran package providing useful routines for molecular simulation of proteins within the standard geometry model. Highly efficient algorithms are implemented for the calculation of energy and its derivatives. A set of energy minimization and modern Monte-Carlo algorithms are added. The calculation of energy and its derivatives can be parallelized easily. Two different parameter sets can be used to calculate internal energy: ECEPP/3 potential and FLEX potential (Frank Eisenmenger, U. H. E. Hansmann, Shura Hayryan, C.-K. Hu).

(5) 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).

(6) The helix-coil transition in DNA.

A model Hamiltonian for double-strand polynucleotides is suggested to describe the phenomenon of helix-coil transition. The Hamiltonian is constructed using solely the microscopical, pure physical quantities, characterizing the molecular chain, namely the energy of hydrogen-bond formation and the number of conformations of repeated unit. Realistic constraints are imposed on the conformations of chain in the case of loop formation. The advantage of the suggested approach is that the parameters of the model

can be obtained from independent calculations or experiments. It is shown that with the approximation of neglecting the effect of large loops, the model of DNA is reduced to the generalized microscopical model of polypeptide chain (V. F.Morozov, E.SH. Mamasakhlisov, Shura Hayrian, C.-K. Hu).

(7) The helix-Coil transition in circular DNA

A simplified model for the closed circular DNA (ccDNA) is proposed to describe some specific features of the helix-coil transition in this molecules. The Hamiltonian of the model is evaluated from the one introduced earlier for the linear DNA. The basic assumption is that the reduced energy of the hydrogen bond effectively depends on the fraction of already broken bonds. A transformation formula is obtained which relates the transition temperature of ccDNA to the temperature of the linear molecule for given degree of helicity. A simple method is suggested for obtaining the denaturation curves for the ccDNA from the melting curves of the linear DNA. (V. F.Morozov, E.SH. Mamasakhlisov, A.V.Grigoryan, Shura Hayrian, C.-K. Hu).

(8) Do Proteins Sit between a Ferromagnet and a Spin Glass ?

We study a simple spin system 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. Our results point out some guiding principles in protein evolution (C.-Y. Lin, C.-K. Hu, and Ulrich H.E. Hansmann).

III

List of Ongoing Research Projects

List of Ongoing Research Projects

中研院物理所八十九年度計畫清單一覽表

(1999 年 8 月～2001 年 7 月)

主持人	計畫名稱	執行期間	計畫編號
王子敬	台灣核電廠微中子導航實驗(Ⅱ)	88.08.01-89.07.31	NSC89-2112-M-001-028
王子敬	低能區微中子物理及探測器之研究	89.08.01-90.07.31	NSC89-2112-M-001-056
王明哲	重夸克及強作用物理之實驗探討(Ⅱ)(子計畫四):-CDF 實驗之電腦模擬與數據分析	88.08.01-89.10.31	NSC89-2112-M-001-025
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	89.08.01-90.07.31	NSC89-2112-M-001-072
王建萬	在 SPRING-8 研究光致向量介子產生(Ⅱ)	88.08.01-89.10.31	NSC89-2112-M-001-052
王建萬	在 Spring-8 研究光致向量介子產生(Ⅲ)	89.08.01-90.07.31	NSC89-2112-M-001-057
王唯工	體外聲波對主動脈血壓波形之影響(1/3)	88.08.01-89.07.31	NSC89-2213-M-001-019
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(1/3)	88.08.01-89.07.31	NSC89-2320-B-001-035-M08
王唯工	穴診儀之動物實驗	88.08.01-89.12.31	NRICM-89103
王唯工	體外聲波對主動脈血壓波形之影響(2/3)	89.08.01-90.07.31	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)	89.08.01-90.07.31	NSC89-2314-B-022-M08
任盛源	鐵鈷鎳合金膜材之磁伸縮與磁阻研究	88.08.01-89.07.31	NSC89-2112-M-001-041
任盛源	磁膜內應力及對磁性之影響	89.08.01-90.07.31	NSC89-2112-M-001-085
何侗民	矽與鍺中新雜質中心之形成及其特性之研究(1/3)	88.08.01-89.10.31	NSC89-2112-M-001-034
何侗民	矽與鍺中新雜質中心之形成及其特性之研究(2/3)	89.08.01-90.07.31	NSC89-2112-M-001-099
余岳仲	發展核微探針設備	88.08.01-89.10.31	NSC89-2112-M-001-022
余岳仲	核微探針於電子材料之離子束分析研究	89.08.01-90.07.31	NSC89-2112-M-001-076
余海禮	微擾 QCD 與小 X 物理(Ⅲ)	88.08.01-89.10.31	NSC89-2112-M-001-019
余海禮	微擾 QCD 與非平衡系統(1/3)	89.08.01-90.07.31	NSC89-2112-M-001-055
吳建宏	有限溫度規範場論之行爲及其宇宙學之應用-(子計畫三):-宇宙早期相變的非平衡動力學(3/3)	88.08.01-89.10.31	NSC89-2112-M-001-001
吳建宏	宇宙微波背景之圓偏極性	89.08.01-90.07.31	NSC89-2112-M-001-060

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(Ⅱ)(總計畫)及(子計畫一):-頂夸克搜尋及強作用之非微擾現象及其相關物理之研究	88.08.01-89.10.31	NSC89-2112-M-001-027
李世昌	以精密質譜儀探測宇宙中之反物質及暗物質(Ⅱ)(總計畫)-以精密質譜儀探測宇宙中之反物質及暗物質(Ⅱ)	88.08.01-89.10.31	NSC89-2112-M-001-042
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)	89.08.01-90.07.31	NSC89-2112-M-001-070
李世昌	參與 ATLAS 實驗搜尋新物理現象	89.08.01-90.07.31	NSC89-2112-M-001-075
李定國	t-J 模型與高溫超導體研究(3/3)	88.08.01-89.07.31	NSC89-2112-M-001-050
李定國	高溫超導的機制(1/3)	89.08.01-90.07.31	NSC89-2112-M-001-103
李尚凡	鈮/鈷薄膜的磁性與超導性質研究	88.08.01-89.10.31	NSC89-2112-M-001-036
李尚凡	鈮/鈷和鈮鈦/鈷系統中超導性質二維至三維的轉變	89.08.01-90.07.31	NSC89-2112-M-001-087
杜其永	電流變液體之動力行爲	88.08.01-89.10.31	NSC89-2112-M-001-017
杜其永	顆粒流堵塞之實驗研究	89.08.01-90.07.31	NSC89-2112-M-001-054
姚永德	超薄磁性金屬膜之物理性質研究	88.08.01-89.11.30	NSC89-2112-M-001-037
姚永德	編碼用磁性感測元件之研發設計之研究	88.08.01-89.12.31	89S15-J3
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)	89.08.01-90.07.31	NSC89-2112-M-001-088
胡宇光	EXAFS 能譜顯微術之發展與應用	88.08.01-89.07.31	NSC89-2112-M-001-044
胡宇光	超高解析度光電子能譜顯微術	89.08.01-90.07.31	NSC89-2112-M-001-089
胡進錕	展透與相變研究(2/3)	88.08.01-89.10.31	NSC89-2112-M-001-005
胡進錕	展透與相變研究(3/3)	89.08.01-90.07.31	NSC89-2112-M-001-084
張志義	強子結構與非微擾量子色動力學(1/3)	88.08.01-89.07.31	NSC89-2112-M-001-010
張志義	強子結構與非微擾量子色動力學(2/3)	89.08.01-90.07.31	NSC89-2112-M-001-079
梁鈞泰	斷裂現象之圖型形成(2/2)	89.08.01-89.07.31	NSC89-2112-M-001-078
梁鈞泰	斷裂現象之圖型形成(1/2)	88.08.01-89.10.31	NSC89-2112-M-001-015
陳志強	局部反饋下可激發介質圖形產生之研究	88.08.01-89.11.30	NSC89-2112-M-001-018
陳志強	可激發媒體在噪音影響下圖形產生之研究	89.08.01-90.07.31	NSC89-2112-M-001-058
陳洋元	量子點量子線中 3 維與 2 維之量子尺寸效應研究	88.08.01-89.10.31	NSC89-2112-M-001-031

主持人	計畫名稱	執行期間	計畫編號
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	89.08.01-90.07.31	NSC89-2112-M-001-096
陳啓東	高動作溫度的單電子電晶體的製作與評估	88.07.01-89.12.31	NDL-89-C-002
陳啓東	單電子電晶體的量子效應研究(2/3)	89.08.01-90.07.31	NSC89-2112-M-001-101
陳啓東	單電子電晶體的量子效應研究(1/3)	88.08.01-90.07.31	NSC89-2112-M-001-033
章文箴	2-4GEV/C 能量區域之光致向量介子產生及反應機制探討	88.10.01-89.07.31	NSC89-2112-M-001-053
章文箴	在 Spring-8 研究光致向量介子產生中之核物質效應	89.08.01-90.07.31	NSC89-2112-M-001-059
曾忠一	半拉格朗日法在雲模式上的應用(Ⅳ)	88.08.01-89.09.30	NSC89-2111-M-001-001
曾忠一	半拉格朗日法在雲模式上的應用(五):地形效應	89.08.01-90.07.31	NSC89-2111-M-001-003
曾詣涵	奇異數 1 或 2 之超核系統(1/3)	88.08.01-89.10.31	NSC89-2112-M-001-011
曾詣涵	奇異數 1 或 2 之超核系統(2/3)	89.08.01-90.07.31	NSC89-2112-M-001-080
黃榮鑑	含自由液面、流過障礙物複雜紊流場之數值研究	88.08.01-89.07.31	NSC89-2611-E-001-001
黃榮鑑	以直接數值模擬方柱體之渦漩逸出流場	88.08.01-89.07.31	NSC89-2611-E-001-002
黃榮鑑	結合拉格蘭奇方法之波浪淺化效應之數值研究	89.08.01-90.07.31	NSC89-2611-E-001-003
黃榮鑑	二維方柱體渦漩逸出流場之研究(1/3)	89.08.01-90.07.31	NSC89-2611-E-001-004
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	89.08.01-90.07.31	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	89.08.01-90.07.31	NSC89-2112-M-001-074
葉平	以精密質譜儀探測宇宙中反物質及暗物質(Ⅱ)(子計畫一)-探測反物質及暗物質	88.08.01-89.10.31	NSC89-2112-M-001-043
葉崇傑	介觀超導與原子陷阱中之超流體(1/3)	89.10.01-90.07.31	NSC89-2112-M-001-105
劉　鏞	氧化物多層膜的磁性交互耦合,自旋極化穿隧與臨近效應	89.08.01-90.07.31	NSC89-2112-M-001-090
劉鏞	金屬氧化物多層膜(鐵磁層/非鐵磁層)結構的磁性交互耦合作用	88.08.01-89.07.31	NSC89-2112-M-001-035
鄭天佐	奈米及低維結構之物理性質、製作與應用(2/3)	88.08.01-89.07.31	NSC89-2112-M-001-049

主持人	計畫名稱	執行期間	計畫編號
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(1/3)	89.08.01-90.07.31	NSC89-2119-M-001-010
鄭海揚	B 物理與 CP 破壞(1/3)	88.08.01-89.09.30	NSC89-2112-M-001-016
鄭海揚	B 物理與 CP 破壞(2/3)	89.08.01-90.07.31	NSC89-2112-M-001-082
鄧炳坤	重夸克及強作用物理之實驗探討(Ⅱ)(子計畫二): CDF 及相關實驗粒子偵測器研製及(子計畫四):-奇異重子衰變中 CP 不守恒現象之探討	88.08.01-89.10.31	NSC89-2112-M-001-024
鄧炳坤	重夸克及強作用物理之實驗探討(Ⅲ)(子計畫二):CDF 及相關實驗粒子偵測器研製	89.08.01-90.07.31	NSC89-2112-M-001-071
謝雲生	可調諧雷射晶體之生長與研究(3/3)	88.08.01-89.07.31	NSC89-2112-M-001-047
謝雲生	壓電晶體 $La_3Ta_{0.5}Ga_{5.5}O_{14}$ 之單晶生長與表面聲波及碳奈米結構物理化學性質研究(1/2)	89.08.01-90.07.31	NSC89-2112-M-001-104
顏迪佑	重離子碰撞中強子物質至括子膠子電漿之相變(1/2)	88.08.01-89.07.31	NSC89-2112-M-001-012
顏迪佑	重離子碰撞中強子物質至括子膠子電漿之相變(2/2)	89.08.01-90.07.31	NSC89-2112-M-001-081
魏金明	單原子在面心立方晶體(100)表面的擴散機制(1/3)	88.08.01-89.12.31	NSC89-2112-M-001-038
魏金明	單原子在面心立方晶體(100)表面的擴張機制(2/3)	89.08.01-90.07.31	NSC89-2112-M-001-100

IV

Publication List of 2000

Chan, Chi-Keung（陳志強）

1. L. C. Jia, P. Y. Lai and C. K. Chan, Scaling Properties of Avalanches from a Collpasing Sandpile, Physica A 281, 404 (2000).
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V

Supporting Facilities

Computing Facilities

The past two years has been a very exciting period for the development of the computing facilities in the Institute of Physics. With the completion of the network in the New Physics Annex and the new PC Farm clusters, our institute is now enjoying the service of a well-equipped computer room and a supporting team of knowledgeable technical staffs; thanks to all the help from the members of the computing facilities committee.

The primary tasks of the computer room are three-fold: (i) to provide high-speed computing environment for research using numerical simulations and symbolic manipulations, (ii) to maintain a network connection inside the institute and to the internet and, (iii) to maintain automation in the administration office and library.

Over the past 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.
- 2 DEC Alpha workstations (one of them is a 4CPU, 275MHz workstation, the other is a 400MHz workstation).
- 3 Alpha clone workstations with 533MHz CPU's.
- Three 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.

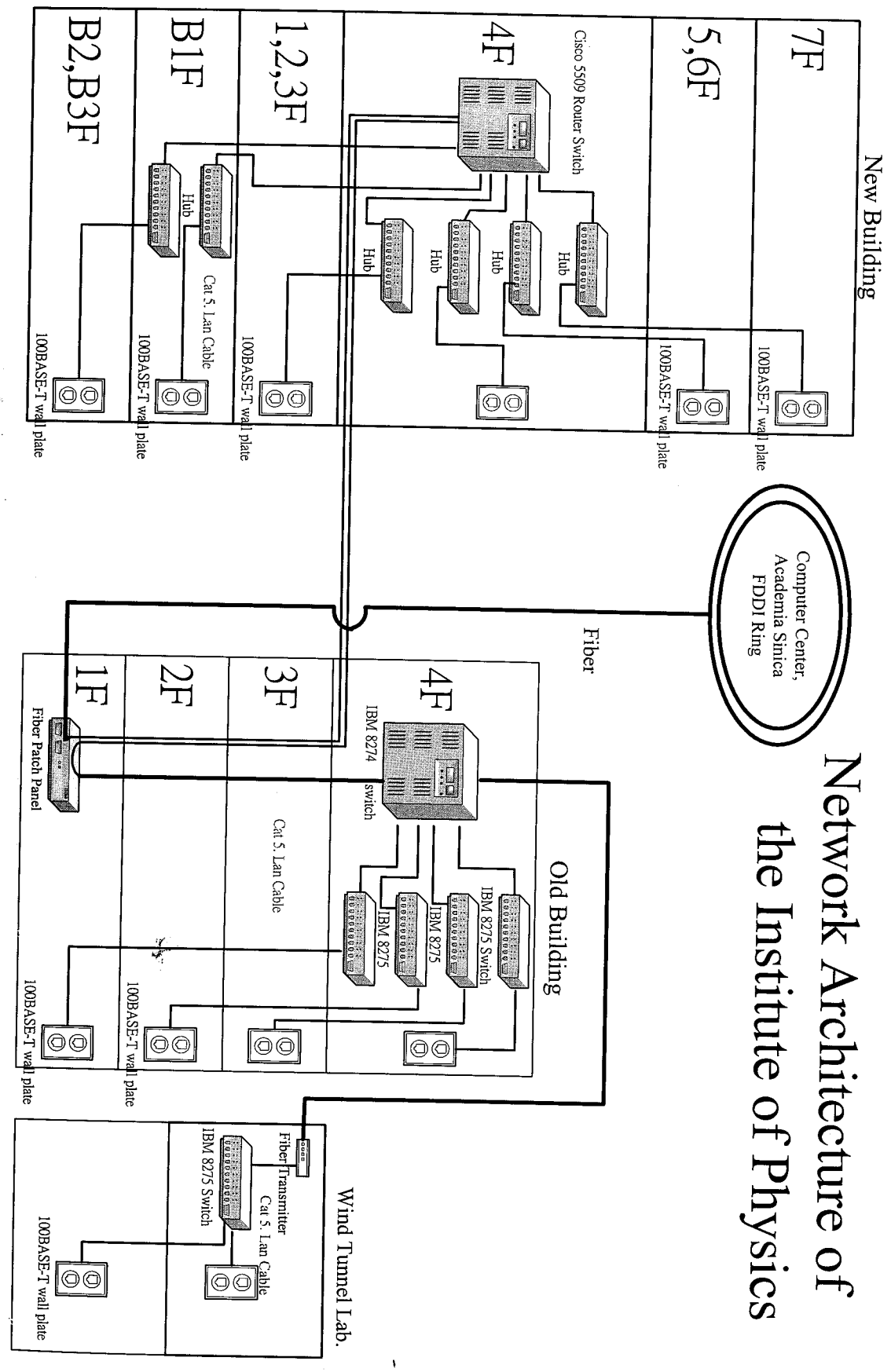
The network of the old building was also renovated, with help and guidance from network experts in the computing center. A similar network with star topology has replaced the old RG-58 cable in the old building. The sockets in each building are connected to the IBM 8275 switches purchased by the computing 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.

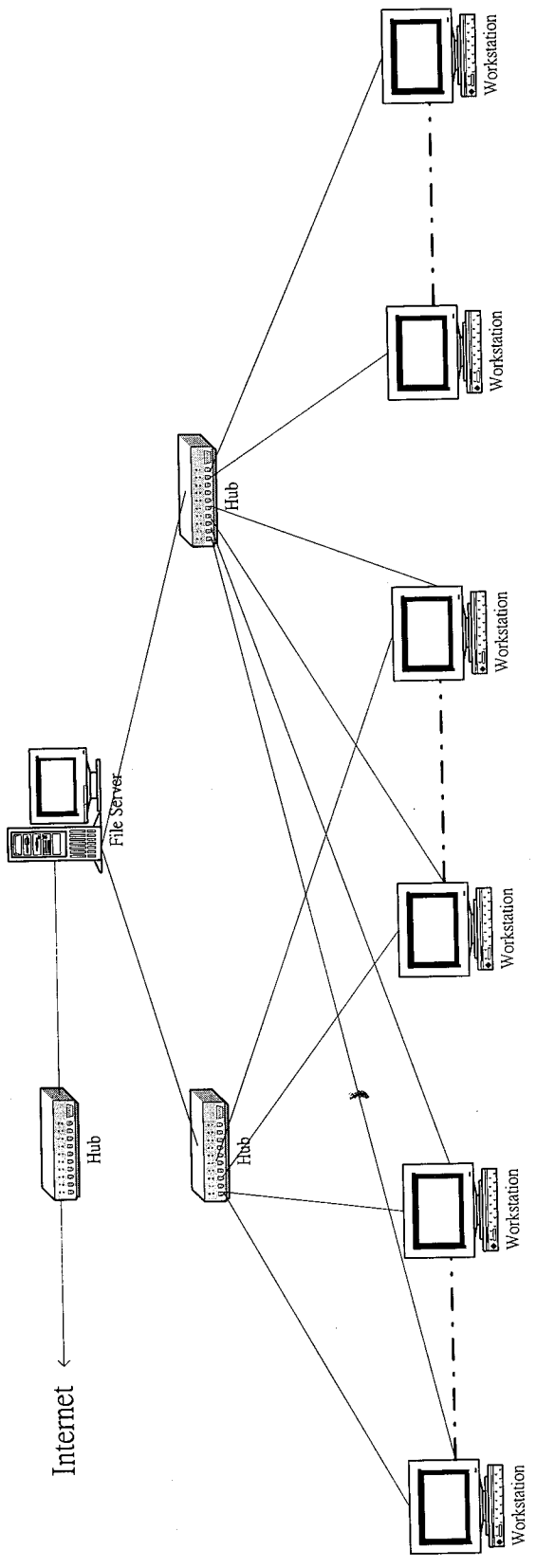
The computer room staffs have installed three PC Farm clusters in the past two

years. The first, which consists of 10 dual-Pentium 500MHz CPU's, began its service in August 1999. The second cluster was built in August 2000 with a total of 18 K7-700MHz PC's. The third cluster consists of 17 K7-700MHz PC's and is mainly for people to run parallel computing jobs. This third cluster is owned by one of the research members of the institute, Dr. Wei, Ching-Ming who has decided to share this cluster with any research workers in the institute who need to run parallel computing jobs. These three PC Farm clusters are connected to the same network together with the 3 Alpha clone workstations. The inter-connection between the three PC Farm clusters is depicted in Figure 2.

Figure 1

Network Architecture of the Institute of Physics





Parallel Processing
(Owned by Dr. Wei Ching-Ming)

lixk701~lixk718

lixp301~lixp310

Figure 2

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: fabrication and assembly of mechanical parts; making sample cells and testing tools; support of vacuum facilities; management and supplies of gases and liquids; operation and maintenance of complex and specialized research facilities; and management and handling of radioactive materials. It has been seven years since the machine shop was established. At this moment we have two technicians and one assistant in the workshop. 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. This year 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). In this year, we have designed and made numerous parts that worth more than two million dollars. In addition we also helped our research faculties to solve their problems in various laboratories of our institute. We 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.

To summarize, the work in the machine shop has been heavy and high-tech related. We are still evolving towards maturity and the main hurdle is lack of manpower. However, under the present regulations, it is rather difficult to recruit the right technical personnel. We are glad that 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 3MeV 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
中研院物理所八十九年度出席國際會議表
（2000 年 1 月～2000 年 12 月）

會議名稱	會議期間	舉辦地點	出席人員	經費來源
第卅八屆美國航太年會	89.01.10-89.01.13	美國 Reno	簡來成	自理
國際環境模式及模擬會議	89.01.23-89.01.27	美國聖地牙哥	黃榮鑑	本所+自理
KSRS-2000 同步輻射研討會	89.03.08-89.03.12	俄國莫斯科	胡宇光	本所+自理
美國物理學會三月會議	89.03.20-89.03.24	美國明尼亞波里斯	何侗民	自理
2000 年 IEEE 國際磁學會議	89.04.09-89.04.13	加拿大多倫多	何家驊	本院
宇宙結構的雛形	89.05.15-89.05.18	美國波士頓	吳建宏	國科會
第二屆海峽兩岸生物學啓發的理論問題研討會	89.05.15-89.05.19	北京	鄒忠毅	本院
第二屆海峽兩岸生物學啓發的理論問題研討會	89.05.15-89.05.19	北京	李定國	本院
第十二屆中國晶體生長會議暨第八屆中國晶體缺陷會議	89.05.15-89.05.20	上海	謝雲生	本院
第十二屆中國晶體生長會議暨第八屆中國晶體缺陷會議	89.05.15-89.05.20	上海	胡明理	自理
第十屆國際海洋工程會議	89.05.28-89.06.02	美國西雅圖	黃榮鑑	國科會
薄膜材料製程特性與分析暑期學校	89.06.12-89.06.16	山東瀋陽	劉鏞	本所
微中子 2000	89.06.16-89.06.21	加拿大 Sudbury	王子敬	本所
微中子 2000	89.06.16-89.06.21	加拿大 Sudbury	吳建宏	國科會
第廿屆國際表面物理研討會	89.06.16-89.06.25	波蘭庫多瓦	鄭天佐	國科會
NSC-NRC 尖端材料研討會	89.06.24-89.06.30	加拿大渥太華	陳啓東	國科會
第七屆國際複合材料年會	89.07.02-89.07.08	美國丹佛	任盛源	國科會
第十屆固態薄膜及表面國際會議	89.07.09-89.07.13	美國普林斯敦	黃英碩	本所
2000 年原子力顯微術及掃描探針顯微術國際會議	89.07.16-89.07.22	德國漢堡	黃英碩	本所
2000 年數學物理國際會議	89.07.17-89.07.22	英國倫敦	伍沙田可	自理
第五屆奇性國際研討會	89.07.20-89.07.25	美國加州	顏迪佑	本所
現代凝態物理趨勢	89.07.21-89.07.30	中國北京	李定國	國科會

會議名稱	會議期間	舉辦地點	出席人員	經費來源
第六屆亞洲國際會議	89.07.24-89.07.26	香港	黃英碩	本所
第六屆亞洲國際會議	89.07.24-89.07.26	香港	鄭天佐	本所
計算物理之新趨勢	89.07.24-89.07.29	俄國都伯那	陳晉平	本所
計算物理之新趨勢	89.07.24-89.07.29	俄國都伯那	林財鈺	本所
計算物理之新趨勢	89.07.24-89.07.29	俄國都伯那	海耳倫	本所
計算物理之新趨勢	89.07.24-89.07.29	俄國都伯那	胡進錕	國科會
計算物理之新趨勢	89.07.24-89.07.29	俄國都伯那	森摩南柯	本院
第八屆國際序率水力學研討會	89.07.25-89.07.28	中國北京	蕭葆羲	本所
第三十屆國際高能物理會議	89.07.27-89.08.02	日本大阪	章文箴	國科會
高能物理國際會議	89.07.27-89.08.02	日本大阪	江祖永	本所
第三十屆國際高能物理會議	89.07.27-89.08.02	日本大阪	鄭海揚	國科會
第廿三屆群論與物理國際會議	89.07.31-89.08.05	俄國都伯那	胡進錕	國科會
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	李定國	國科會
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	黃英碩	其它
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	謝雲生	自理
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	杜其永	本所+自理
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	王子敬	本所
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	陳志強	國科會
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	梁鈞泰	國科會
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	陳彥竹	本所
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	張志義	本所
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	陳啓東	本所
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	鄭天佐	本所
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	胡進錕	國科會
第三屆全球華人物理學大會	89.07.31-89.08.04	香港	李世昌	自理
2000 年國際磁性會議	89.08.06-89.08.11	巴西勒席非	楊謝樂	本所
第八屆國際電子光譜與結構會議	89.08.08-89.08.12	美國加州	陳洋元	國科會
美國物理學會粒子與場研討會	89.08.09-89.08.12	美國 Ohio	吳建宏	國科會
表面全像術與其他直接的方法	89.08.15-89.08.18	香港	魏金明	國科會
第十七屆國際拉曼光譜學大學	89.08.15-89.08.29	中國北京	謝雲生	自理

會議名稱	會議期間	舉辦地點	出席人員	經費來源
SRI2000	89.08.21-89.08.25	德國柏林	胡宇光	其它
近代軟凝體理論研討會	89.08.26-89.09.01	烏克蘭	伍沙田可	自理
第二十屆國際理論及應用力學會議	89.08.27-89.09.08	美國芝加哥	黃榮鑑	國科會
第十九屆歐洲表面科學研討會	89.09.05-89.09.08	西班牙馬德里	蔡志申	國科會
第七屆國際核微探針技術與應用會議	89.09.10-89.09.15	法國波爾多市	余岳仲	國科會
2000 年混沌與超級電腦國際會議	89.09.11-89.09.17	亞美尼亞 Yevevan	伊士麥林尼可	本所
經濟物理學高級研討班及金融複雜性國際學術交流會	89.09.21-89.09.27	安徽合肥	胡進錕	國科會
第九屆國際半導體內淺能階中心會議	89.09.24-89.09.27	日本 Hyogo	何侗民	國科會+本所
第五十一屆國際太空聯盟年會	89.09.28-89.10.06	巴西里約	簡來成	本所
美國真空學會第四十七屆國際學術會議	89.10.02-89.10.06	美國麻州	張嘉升	國科會
超對稱理論的三十年	89.10.13-89.10.27	美國	江祖永	本所
第三屆海峽兩岸中高能物理研討會	89.10.23-89.10.27	山東濟南	張志義	國科會
第三屆海峽兩岸中高能物理研討會	89.10.23-89.10.27	山東濟南	林爾康	國科會
第三屆海峽兩岸中高能物理研討會	89.10.23-89.10.27	山東濟南	曾詣涵	國科會
第三屆海峽兩岸中高能物理研討會	89.10.23-89.10.27	山東濟南	王建萬	本所
第三屆日本及韓國第一原則電子結構計算合作研討會	89.10.30-89.11.01	日本	魏金明	國科會
磁性材料之物理及磁性技術聯合國際研討會及延長會議	89.10.30-89.11.03	日本 Nagoya	姚永德	本所+國科會
第十六屆國際加速器在研究及工業應用會議	89.11.01-89.11.04	美國德州	余岳仲	本所
第五屆資訊儲存技術亞洲國際研討會	89.11.14-89.11.16	香港	姚永德	國科會
第三屆 RIRS-2000 研討會	89.11.18-89.11.19	韓國漢城	胡宇光	自理
表面科學及奈米結構國際研討會	89.11.22-89.11.24	新加坡	胡宇光	自理
表面科學及奈米結構國際研討會	89.11.22-89.11.24	新加坡	張嘉升	本院
表面科學及奈米結構國際研討會	89.11.22-89.11.24	新加坡	陳啓東	國科會
表面科學及奈米結構國際研討會	89.11.22-89.11.24	新加坡	黃英碩	其它
表面科學及奈米結構國際研討會	89.11.22-89.11.24	新加坡	鄭天佐	本院

會　　議　　名　　稱	會　議　期　間	舉　辦　地　點	出席人員	經費來源
材料學會 2000 年秋季年會	89.11.27-89.12.01	美國波士頓	黃英碩	國科會
第四屆蒙地卡羅與近似蒙地卡羅科學計算國際會議	89.11.27-89.12.01	香港	陳志強	國科會
第四屆蒙地卡羅與近似蒙地卡羅科學計算國際會議	89.11.27-89.12.01	香港	胡進錕	國科會
第八屆國際暨第三屆亞洲掃描探針式顯微術國際會議	89.12.07-89.12.09	日本 Atagawa	蘇維彬	本院
第八屆國際暨第三屆亞洲掃描探針式顯微術國際會議	89.12.07-89.12.09	日本 Atagawa	張嘉升	本院

Institute Sponsored Meetings

1. **Vector Meson Production Workshop(國際向量介子產生研討會)**
2. **第一屆海峽兩岸奈米材料與物理研討會**
3. **The 19th Academia Sinica Workshop on Statistical and Numerical Simulation :"Statistical Approach to Biological Problems"**
4. **LEPS Collaboration Meeting(在「Spring-8 研究光數向量介子產生」研究之國際合作會議)**
5. **The 8th Asia Pacific Physics Conference(第八屆亞太物理大會)**

Vector Meson Production Workshop

Plenary Session:

•03/03 AM09:30

Dr. Richard K. Seto (University of California, Riverside):

"Light Vector Mesons and the Search for Chiral Symmetry Restoration in Heavy Ion Collisions"

•03/03 AM11:00

Dr. Hiroshi Toki (RNCP, Osaka University):

"Quark Nuclear Physics with Photons"

•03/04 AM10:00

Dr. Mannque Rho (SACLAY):

"Vector-meson excitations in dense medium"

Parallel Session for Vector Meson Workshop:

Session chariman:Dr. Richard K. Seto

•03/03 PM 02:00

Dr. Naomi C. R. Makins (University of Illinois):

"Diffractive Vector Meson Production at HERMES"

•03/03 PM 02:30

Dr. Kazuo Tsushima(Adelaide University):

"J/Psi suppression"

•03/03 PM 03:00

Dr. T. S. Lee (ANL):

"Recent results on Photoproduction of Omega Sigma"

Coffee Break

Session chariman: Dr. T. S. Lee

•03/03 PM 04:00

Dr. Takashi Nakano (RCNP, Osaka University):

" Phase Measurement of ϕ Photoproduction Amplitude near Production Threshold"

•03/03 PM 04:30

Dr. HaJIME Shimizu (RCNP, Osaka University):

"Sigma photo-production through sigma-omega mixing in nuclei"

•03/03 PM 05:00

Dr. Bing Song Zou (Institute of High Energy Physics):

"Vector Meson production in -p+pbar collisions"

•03/03 PM 05:30

Dr. Yongseok Oh (Seoul National University):

"Anomalous f_1 exchange in vector meson photoprodcution"

•03/03 PM 06:00

Round Table Discussion

第一屆海峽兩岸奈米材料與物理研討會

六月十五日　　**地點: 中央研究院物理研究所**

			主持人	地點
08:30 - 08:4	報到			五樓會議室
08:45 - 09:00	開幕式		姚永德	五樓會議室
09:00 - 09:20	馮　端	磁性納米結構:概念與進展	邢定鈺	五樓會議室
09:20 - 09:40	林鴻明	奈米半導體金屬氧化物的氣體感測性質	姚永德	五樓會議室
09:40 - 10:00	邢定鈺	隧道磁電阻的理論模型	王廣厚	五樓會議室
10:00 - 10:20	鄭秀蘭	Nanoparticles Synthesis by Spray Pyrolysis	姚永德	五樓會議室
10:20 - 10:40	照　相　與　休　息			五樓會議室
10:40 - 11:00	熊詩杰	Cotunneling and Konde-type Transport of a Quantum Dot	邢定鈺	五樓會議室
11:00 - 11:20	傅昭明	High freguency impedance spectra in magnetic oxides	姚永德	五樓會議室
11:20 - 11:40	林中魁	奈米及非晶質材料之X光吸收光譜檢測分析	邢定鈺	五樓會議室
11:40 - 12:00	鹿　牧	自動記錄磁轉矩儀	姚永德	五樓會議室
12:00 - 12;20	李尚凡	Influence of Al Thin Boundary Layers on Fe/Si/Fe Multilayers	姚永德	五樓會議室
12:20 - 13:00	午　餐			五樓會議室

六月十九日　　**地點: 國立臺灣大學物理系**

			主持人	地點
08:45 - 09:00	學術交流會議開幕式		黃偉彥	物四教室
09:00 - 09:30	張世遠	Giant Magnetoresistance of the $La_{1-x}Ag_xMnO_3$	馮　端 黃暉理	物四教室
09:30 - 10:00	黃昭淵	Polycrystalline Inhomogeneous Granular System Study of a Novel Transition Radiation Detector	邢定鈺	物四教室
10:00 - 10:30	都有爲	Utilizing Superconducting Microspheres for 納米磁性材料進展	陳政維	物四教室
10:30 - 10:45	Coffee Break			物四教室
10:45 - 11:15	許仁華	Enhancement of Tunneling Magnetoresistance Through a Magnetic Barrier of Granular Fe-Pb-O	胡　安	物四教室

11:15 - 11:45	唐少龍	Pr-Tb-Fe-Co 納米晶材的巨磁致伸縮性質	莊東榮	物四教室
12:00 - 14:00	理學院院長午宴			餐廳
14:00 - 14:30	蔡定平	Near-Field Study of the super-Resolution Near-Field Structures (Super-RENS)	董錦明	物四教室
14:30 - 15:00	王廣厚	C.uster Assemblies and Nanostructures	胡崇德	物四教室
15:00 - 15:20	Coffee Break			物四教室
15:20 - 15:50	楊鴻昌	Physics and Applications of High Tc Josephson Junction and Superconducting Quantum	熊詩杰	物四教室
16:00 - 16:30	校長召見			校長室
16:30 - 17:00	參觀實驗室		石明蜂	物理系
17:00 -17:30	參觀實驗室		石明蜂	凝態中心
18:00 - 20:00	校長晚宴			

六月二十一日　　地點:國立中央大學

09:00 - 11:00 學術座談會

胡　安	磁性隧道結的研究
李文獻	Fabriaction, Characterization, and Applications of Metallic Ag Nanoparticles
董錦明	Universal Experession for Localization Length in Metallic Carbon Nanotubes
姚永德	奈米材料之物性研究

The 19th Academia Sinica Workshop on Statistical Physics and Numerical Simulation: "Statistical Approach to Biological Problems"

Date: 21-22th, February
Place: Meeting Room(7F), Institute of Physics, Academia Sinica.
Schedule:
2/21:

14:30-15:30 Prof. Zoltan Neda
(Department of Theoretical Physics, Univ. Babes-Bolyai, Romania)
"Self-Organization in the Concert Hall:Statistical Physics of the Rhythmic Applause."

15:30-15:50 Break

15:50-16:50 Dr. Jau-Ann Chen 陳昭安
(Insitute of Physics, Academia Sinica)
"Multicanonical Monte Carlo Method: An Introduction."

16:50-17:00 Break

17:00-18:00 Dr. Chi-Ning Chen 陳企寧
(Insitute of Physics, Academia Sinica)
"Monte Carlo Dynamics in Global Optimization."

18:15 Dinner

2/22

10:00-11:00 Prof. Shyue-Chu Ke 柯學初
(Dep. of Physics, National Dong-Hua Univ.)
"Quantum Mechanical Approach in ESEEM Spectra Simulation."

11:00-11:10 Break

11:10-12:10 Prof. Ulrich. H. E. Hansmann
(Dep. of Physics, Michigan Tech Univ.)
"Physics of Proteins: a) Methods and Algorithms."

12:10-14:00 Lunch Break

14:00-15:00 Prof. Ulrich. H. E. Hansmann
(Dep. of Physics, Michigan Tech Univ.)
"Physics of Proteins: b) Folding Mechanism and Structure Prediction."

15:00-15:20 Break

15:20-16:20 Dr. Shura Hayryan
(Insitute of Physics, Academia Sinica)
"Simulation of Small Peptides in Solvent with SMM Package."

16:20-16:30 Break

16:30-17:30 Prof. Chi-Ming Chen 陳啓明
(Dep. of Physics, National Taiwan Normal Univ.)
"Monte Carlo Simulation of Membrane Protein Folding."

LEPS Collaboration Meeting

Date: 03/02/2000, PM

Place: Conference Room, 5TH Floor, New Building, Institute of Physics, Academia Sinica

Time	Speaker	Topic
03:30-03:40	T. Iwata	Gas Cerenkov counter R & D
03:40-04:00	T. Hotta	Tagger and VTX counters
04:00-04:20	M. Sumihama	e+e- veto counter
04:20-04:40	T. Yorita	gamma detector construction
04:40-05:00	Z.-Y. Kim	Measurement of Electron Beam Transverse Polarization
05:00-05:20	T. Mibe	Study of Tagger resolution and efficiency
05:20-05:30	M. Yosoi	Drift chamber
05:30-05:50	J.-K. Ahn	Simulation and offline analysis programs
05:50-06:05	W. C. Chang	Proton Trigger on TOF
06:05-06:30	T. Nakano	Status and Plan
06:30-	Collaboration Dinner in the Activity Center	

The 8th Asia Pacific Physics Conference
August 7 - 10, 2000
Institute of Physics, Academia Sinica, Taipei

A
PLENARY
Chairman : Tien T. Tsong
Institute of Physics, Academia Sinica, Taiwan
Monday morning
9:40 a.m. *1F-A*

9:40

A 1 GaAs MOSFET-Material Physics and Devices
M. Hong, J. Kwo, A. R. Kortan, J. P. Mannaerts, Bell Laboratories, Lucent Technologies, Murray Hill, New Jersey, U.S.A.

10:20 Coffee Break

Chairman : Swee Ping Chia
INTI College Malaysia, Nilai, 71800 Negeri Sembilan, Malaysia

10:40

A 2 Direct Observation of Dynamics of Electrons and Atoms on Solid Surfaces
T. T. Tsong, Inst. of Phys., Academia Sinica, Taiwan

11:20

A 3 Implications of Results of Neutrino Mass Experiments
B. McKellar, Theoretical Phys., The Univ. of Melbourne, Parkville, Vic 3052, Australia

12:00 Lunch

12:40 Poster Session

BA
APPLIED PHYSICS
Chairman : Serge Lefrant
Laboratoire de Physique Cristalline, Institut des Materiaux Jean Rouxel BP 32229, 44322 Nantes cedex 03, France
Monday afternoon
1:30 p.m. *1F-A*

1:30

BA 1* Exciton Localization and the Stokes' Shift in Undoped InGaN/GaN Multiquantum Wells
Y. F. Chen, T. T. Lin, H. C. Yang, Dept. of Phys., National Taiwan Univ., Taipei, Taiwan

1:54

BA 2* The Doping Process of GaN Films
G. C. Chi, Optical Sci., National Central Univ., Chungli, Taiwan

2:18

BA 3 Photoluminescence of Si Doped GaN Grown by Electron Cyclotron Resonance Molecular Beam Epitaxy
Y. S. Choi[2], Y. J. Yoon[1], Y. H. Han[1], S. J. Yu[1], [1]Dept. of Electronics, Sunmoon Univ., 100 Kalsanri, Tangjeong, Asan, Choongnam 336-840 Korea, [2]Dept. of Phys., Kyonggi Univ., San 94-6, Yiuidong, Paldal, Suwon, Kyonggi 442-760 Korea

2:30

BA 4 Self-Organized Quantum Wires in $In_x Ga_{1-x}N$ Epitaxial Layers
Ruisheng Zheng, Tsunemasa Taguchi, Dept. of Electrical and Electronic Engineering, Faculty of Engineering, Yamaguchi Univ., Japan

2:42

BA 5 Piezoelectric-Field Modified 2D Carrier Diffusion Behavior in InGaN/GaN Quantum-Wells
C. K. Sun[1], Y. C. Hunag[1], J. C. Liang[1], A. Abare[2], S. P. Denbaars[2], [1]Graduate Inst. of Electro-Optical Engineering, National Taiwan Univ., Taipei 10617, Taiwan, [2]Material Dept., Univ. of California, Santa Barbara, CA 93106

2:54

BA 6 Bandstructure Parameter Studies of InGaN Crystal
J. Lin, K. W. Chang, Dept. of Phys., National Chung-hua Univ., Chung-hua City, 500, Taiwan

3:06

BA 7 Dimension Effect Simulation of InGaN Active Layer in GaN LED
J. Lin, I. J. Lai, Dept. of Physics, National Chung-hua Univ., Chung-hua City, 500, Taiwan

3:18

BA 8 Growth Mechanism of Atomic Layer Epitaxy of III-V Compounds
S. Hirose, Mechanical Engineering Lab., 1-2 Namiki, Tsukuba, Ibaraki 305-8564, Japan

3:30 Coffee Break

Chairman : Y. F. Chen
Dept. of Phys., National Taiwan Univ., Taipei, Taiwan

3:48

BA 9* Electron Transport in Silicon Nanodevices
Shunri Oda, Research Center for Quantum Effect Electronics, Tokyo Institute of Technology, O-okayama, Meguro-ku, Tokyo 152-8552, Japan

4:12

BA 10* Raman and SERS Investigation of Carbon Nanotubes
Serge Lefrant, Laboratoire de Physique Cristalline, Institut des Materiaux Jean Rouxel BP 32229, 44322 Nantes cedex 03, France

4:36

BA 11* New Cabon and Silicon Structures
Pham V. Huong, Phan H. Khoi, Unversity of Bordeaux 1, 351 Cours Liberation, 33405 Bordeaux-Talence, France

5:00

BA 12 Au/N-Si Schottky Diode with NO_x Incorporation
Le Thi Trong Tuyen[1], Dang Xuan Vinh[2], Nauyen Hong Quang[1], Dao Duc Khang[1], Naguyen xuan Nahia[1], Phan Hong Khoi[1], [1]Institute of Materials Sci., NCST, Vietnam, [2]Hue University

5:12

BA 13 Luminescence of Nanostructured Phosphors
Weiyi Jia, Dept. of Phys., Univ. of Puerto Rico, Mayaquez, PR 00681, U.S.A.

BB

ASTROPHYSICS AND COSMIC PHYSICS
Chairman : Chul H. Lee
Dept. of Phys., Hanyang Univ., Seoul, Korea
Monday afternoon *B2-D*
1:30 p.m.

1:30

BB 1* Testing Event Horizons with Violent Acceleration Using Intense Lasers
Pisin Chen, Stanford Linear Accelerator Center, U.S.A.

2:00

BB 2* Very High Energy Gamma Ray Astronomy
P. R. Vishwanath, Dept. of High Energy Phys., School of Natural Sci., India

2:30

BB 3 Ultra-High Energy Cosmic Neutrinos
Athar Husain, Dept. of Phys., Tokyo Metropolitan Univ., Minami-Osawa 1-1, Hachioji-Shi, Tokyo 192-0397, Japan

2:45

BB 4 Atmospheric Secondary Particles in Near Earth Space
M.H. A. Huang, Inst. of Phys., Academia Sinica, Taipei 11529, Taiwan

3:00

BB 5 Nucleation of Hydrogen Deficient Carbon Clusters in Circumstellar Envelopes of the Carbon Stars
O. Asvany[1], C. C. Chiong[1], Y. T. Lee[1], R. I. Kaiser[2], [1]Inst. of Atomic and Molecular Sciences, Academia Sinica, 1, Section 4, Roosevelt Rd., Taipei 106, Taiwan, [2]Dept. of Phys., National Taiwan Univ., 4, Roosevelt Rd., Taipei 106, Taiwan

3:15

BB 6 An Extraordinary Flare Detected on DF TAU
J. Z. Li, W. Ip, W. P. Chen, Inst. of Astronomy, National Central Univ., Taiwan

3:30 Coffee Break

Chairman : P. Chen
Stanford Linear Accelerator Center, U.S.A.

3:45

BB 7* Electric Charge on a Black Hole Surrounded by Force-Free Magnetosphere

Chul H. Lee, Hyun Kyu Lee, Dept. of Phys., Hanyang Univ., Seoul 133-791, Korea

4:15

BB 8 Scintillating Crystal Detector for Neutrino and Astro-Particle Physics Experiments
Wen-Ping Lai, Henry Tsz-king Wong, Inst. of Phys., Academia Sinica, Taiwan (on behalf of the TEXONO Collaboration)

BC

ATOMIC, MOLECULAR, OPTICAL PHYSICS, AND PLASMA PHYSICS
Chairman : K. N. Huang
IAMS, Academia Sinica, and Dept. of Phys., NTU, Taipei, Taiwan
Monday afternoon
1:30 p.m. *1F-D*

1:30

BC 1* Study on Femtosecond Laser-Plasma Interaction
J. Zhang, L.M. Chen, T. J. Liang, Y. T. Li, H. Teng, Z. L. Chen, L. Z. Zhao, Lab. of Optical Phys., Inst. of Phys., Chinese Academy of Sciences, Beijing 100080, China

1:54

BC 2* A Systematic Approach, Using Laser Diagnostics, for Understanding and Optimization of Plasma Formation and Maintenance
K. Muraoka[1], K. Uchino[1], M. Bowden[1], M. Maeda[2], [1]Interdisciplinary Graduate School of Engineering Sciences, Kyushu Univ., Kasuga Fukuoka 816-8560, Japan, [2]Graduate School of Information Science and Electrical Engineering, Kyushu Univ., Hakozaki Fukuoka 812-8581, Japan

2:18

BC 3 2-Dimensional Distribution of Charge Particles in a Neutral Loop Discharge Plasma
Y. Okraku-Yirenkyi[1], Y. M. Sung[1], M. Otsubo[1], C. Honda[1], K. Uchino[2], K. Muraoka[2], [1]Dept. of Electrical Engineering, Miyazaki Univ., Miyazaki, Japan, [2]Kyushu Univ., Fukuoka, Japan

2:30

BC 4 Present Status of Submillimeter Wave Gyrotrons (FU Series) Development as Versatile Radiation Sources
T. Idehara[1], S. Mitsudo[1], S. Sabchevski[1], M. Glyavin[1], Aripin[1], M. Ui[1], K. Matsuda[1], K. Kitai[1], I. Ogawa[2], [1]Research Center for Development of Far-Infrared Region, Fukui Univ., Fukui 910-8507, Japan, [2]Cryogenic Lab., Faculty of Engineering, Fukui Univ., Fukui 910-8507, Japan

2:42

BC 5 Preheat in D-D and D-T as Fusion Fuel in Inertial Confinement Fusion Plasma
N. P. Chapagain, Dept. of Phys., Patan Multiple Campus, Tribhuvan Univ., Patan Gate, Lalitpur, Nepal

2:54

BC 6 Effect of Cathode Electrode in Plasma Focus Discharges
M. Kashani[1], S. Yamad[1], A. Baba[1], T. Miyamoto[1], K. Sato[1], V. Vikhrev[2], [1]College of Science and Technology, Nihon Univ., Kanda-Surugadai, Chiyoda-ku, Tokyo, Japan, [2]Kurchatov Institute

3:06

C. N. Yang Outstanding Young Researcher Award

BC 7 Coherent Control of Semiconductor Phonon Oscillations
C. -K. Sun, J.-C. Liang, H.-L. Chen, Graduate Institute of Electro-Optical Engineering and Dept. of Electrical Engineering, National Taiwan Univ., Taipei 10617, Taiwan

3:18

BC 8 Excited States of O_2 Investigated by Measuring the Metastable O('D) Atom
J. B. Nee, P. C. Lee, Dept. of Phys. and Chemisty, National Central Univ., Chung-Li, Taiwan 320

3:30 Coffee Break

Chairman : J. Zhang
Lab. of Optical Phys., Inst. of Phys., Chinese Academy of Sciences, Beijing, China

3:48

BC 9* Novel Symbols for Angular-Momentum Couplings
K.N. Huang, IAMS, Academia Sinica, and Dept. of Phys, Taiwan Univ., Taipei, Taiwan

4:12

BC 10* Microscopic Visco-Elastic Response of Sheared Cold Coulomb Liquids
Lin I, Ying-Ju Lai, Wen-Tau Juan, Ming-Hua Chang, Dept. of Phys., National Central Univ., Chungli 32054, Taiwan

4:36

BC 11* New Suggested Experiments on Turbulence
Amador Muriel, Center for Fluid Dynamics, Univ., of the Philippines Los Banos, Philippine

5:00

BC 12 Velocity Profiles of the Poiseuille Flow in Laminar and Turbulent Regimes
Ludek Jirkovsky, Luis Bo-ot, National Institute of Phys., Univ. of the Philippines, Diliman, Quezon City, Philippines

5:12

BC 13 Microstructure and Raman Spectra of Tetravelent Metallo-Phthalocvanies
Vu Thi Bich[1,2], Le Quoc Minh[1], Do Xuan Thanh[1], Pham V. Huong[2], [1]Inst. of Materials Science, Vietnam NSCT, Duong Hoang Quoc Viet, Cau Giay, Ha Noi, Vietnam, [2]Laboratoire de Spectroscopic Moleculaire et Cristalline, Universite de Bordeaux, 33405 Bordeaux-Talence, France

5:24

BC 14 Spin-Orbit and Core-Shielding Effects on Double-Excitation Resonances of Zn
Lin-Ru Wang[1], Keh-Ning Huang[1,2], [1]Inst. of Atomic and Molecular Sciences, Academia Sinica, Taipei, Taiwan, [2]Dept. of Phys., National Taiwan Univ., Taipei 16, Taiwan

BE

CONDENSED MATTER PHYSICS

Chairman : K. Yagi
Dept. of Phys., Tokyo Inst. of Tech., Oh-okayama, Tokyo, Japan
Monday afternoon *B2-B*
1:30 p.m.

1:30

BE 1* Quantum Conductance of Gold Nanowire at Room Temperature
Kunio Takayanagi, Tokyo Inst. of Tech., 4259 Nagatuta, Midori-ku, Yokohama, 226-8502, Japan

1:54

BE 2* Optical Spectroscopy of Surface Nanostructures with Atomic Spatial Resolution
S. Ushioda, Y. Uehara, T. Tsuruoka, M. Iwami, Res. Inst. of Electrical Communication, Tohoku Univ. and CREST-JST, Sendai 980-8577, Japan

2:18

BE 3* The Structure of Cu(210) Clean Surface and Oxygen-Induced Reconstructions
Andrew T. S. Wee, Y. P. Guo, K. C. T. Tan, H. Q. Wang, C. H. A. Huan, Dept. of Phys., National Univ. of Singapore, Kent Ridge, Singapore 119260

2:42

BE 4* Intermolecular Interaction between the Adsorbed Molecules on Metal Surfaces
M. Kawai, RIKEN, Japan

3:06

BE 5 Large Fermi Density Waves on the Reconstructed Pt(100) Surfaces
C. S. Chang, W. B. Su, C. M. Wei, Tien T. Tsong, Inst. of Phys., Academia Sinica, Nankang, Taipei, Taiwan

3:18

BE 6 Molecular Manipulation by means of the SPM Tip, and Nano-technology
Yuan Ron Ma, Dept. of Phys., National Dong Hwa Univ., Haulien 974, Taiwan

3:30 Coffee Break

Chairman : M. Kawai
RIKEN, Japan

3:48

BE 7* New Methods for Nanoscale Structure Fabrication and Property Measurement
M. Aono, RIKEN, Japan

4:12

BE 8* Surface Electromigration on Si Surfaces
K. Yagi, M. Degawa, H. Minoda, Y. Tanishiro, Dept. of Phys., Tokyo Inst. of Tech., Oh-okayama, Tokyo, 152-8551, Japan

4:36

BE 9 Direct Observation of Si Magic Clusters on Silicon(111) Surfaces
Mon-Shu Ho, Ing-Shouh Hwang, Tien-Tzou Tsong, Inst. of Phys., Academia Sinica, Nankang, Taipei, 11529, Taiwan

4:48

BE 10 Electron Correlation Effects on Light Emission from Si(001) by Scanning Tunneling Microscopy
Mamoru Sakaue[1], Naoki Nishimura[1], Hiroshi Nakanishi[1], Hideaki Kasai[1], Ayao Okiji[2], [1]Dept. of Applied Phys., Osaka Univ., Suita, Osaka 565-0871, Japan, [2]Wakayama national Colleage of Tech., Nada, Gobo, Wakayama 644-0023, Japan

5:00

BE 11 The Growth of 2D Pb Islands on Si(111)7×7 Surfaces at Low Temperatures
W. B. Su, S. H. Chang, C. S. Chang, C. M. Wei, L. J. Chen, T. T. Tsong, Inst. of Phys., Academia Sinica, Nankang, Taipei, Taiwan, Dept. of Materials Sci., Engineering, National Tsing Hua Univ., Hsinchu, Taiwan

5:12

C. N. Yang Outstanding Young Researcher Award

BE 12 Observation of Single Oxygen Atom on Si(111)-7x7 Surface : Water Decomposition at High Temperatures
Rong-Li Ro, Ing-Shouh Hwang, and Tien-Tzou Tsong, Institute of Physics, Academia Sinica, Nankang, Taipei, 11529, Taiwan

BF

NUCLEAR PHYSICS

Chairman : Wen-Chen Chang
Inst. of Phys., Academia Sinica, Taipei 11529, Taiwan
Monday afternoon *1F-C*
1:30 p.m.

1:30

BF 1* Hadron Physics with Polarized Photons at Spring-8
T. Nakano, RCNP, Osaka Univ., 10-1 Mihogaoaka, Ibaraki, Osaka 567-0047, Japan

2:00

BF 2* Neutron Structure Studies with Polarized ^{3}He Targets
Haiyan Gao, Massachusetts Inst. of Tech., Cambridge, MA 02139, U.S.A.

2:30

BF 3 Determination of KNΛ and KNΣ Coupling Constants from $\gamma + p \rightarrow K^+ + \Lambda^0$ (Σ^0) near Threshold
Moon Taeg Jeong[1], Il-Tong Cheon[2], [1]Dept. of Phys., Dongshin Univ., Naju 520-714, Korea, [2]Dept. of Phys., Yonsei Univ., Seoul 120-749, Korea

2:45

BF 4 Production of Slow Particles in 84Kr with Emulsion Nuclei Collisions at 1A GeV
V. Singh, S. K. Tuli, Phys. Dept., Banaras Hindu Univ., Varanasi 221 005, India

3:00

BF 5* Nucleon Resonances in Electromagnetic Productions of Mesons
Tsung-Shung H. Lee, Phys. Division, Argonne National Lab., Argone, Illinois 60439, U.S.A.

3:30 Coffee Break

Chairman : Haiyan Gao
Massachusetts Inst. of Tech., Cambridge, U.S.A.

3:45

BF 6* Production of Quark-Gluon Plasma in Relativistic Heavy-Ion Collisions
Santosh Kumar Gupta, Nuclear Physics Division, BARC, India

4:15

BF 7* The Anomalour J/ψ Suppression in Pb-Pb Collisions and the Production of the Quark-Gluon Plasma
Cheuk-Yin Wong, Phys. Division, Oak Ridge National Lab., Oak Ridge, TN 37831 U.S.A.

4:45

BF 8 Strangeness Enhancement in Relativistic Heavy Ion Collisions
Wen-Chen Chang, Inst. of Phys., Academia Sinica, Taipei 11529, Taiwan

5:00

BF 9 Enhancing the Decay Rate of 16^+ Isomer State in ^{178}Hf
Hsiao-Hua Hsu[1],Gary D. Doolen[1], Joseph M. Mack[1], Willard L. Talbert[2], Guy T. Emery[3], [1]Los Alamos National Lab., Los Alamos, NM 87545 U.S.A., [2]Amparo Corp. P.O.Box 2687, Santa Fe, NM 87504 U.S.A., [3]Bowdoin College, Brunswick, ME 04011, U.S.A.

BG

PARTICLES AND FIELDS

Chairman : A. E. Chen
Phys. Dept., National Central Univ., Chung-li, Taiwan
Monday afternoon *1F-B*
1:30 p.m.

1:30

BG 1* A Solution to the Generation Puzzle from Yang-Mills Duality
H.M. Chan, Rutherford Appleton Lab., Chilton, Didcot, Oxon, OX 11 0QX, United Kingdom

2:00

BG 2* Production of Dissimilar Quark-Antiquark Pair from Electron-Positron Collision
Swee Ping Chia[1], W. L. Lim[2], [1]INTI College Malaysia, Nilai, 71800 Negeri Sembilan, Malaysia, [2]Tunku Abdul Rahman College, 50932 Kuala Lumpur, Malaysia

2:30

BG 3* One Point Function of Affine Toda Field Theory
Chaiho Rim, Dept. of Phys., Chonbuk National Univesity, Chonju, 561-756 Republic of Korea

3:00

BG 4* Complete Supersymmetric Quantum Mechanics of Monopoles in N=4 SYM Theory
Dongsu Bak, Phys. Dept., Univ. of Seoul, Korea

3:30 Coffee Break

Chairman : H. M. Chan
Rutherford Appleton Lab., Chilton, Didcot, Oxon,, United Kingdom

3:45

BG 5* Measurement of the Proton-Antiproton Pair Production from Two-Photon Collisons
A. E. Chen, C. H. Lin, Phys. Dept., National Central Univ., Chung-li, 320 Taiwan

4:15

BG 6 Symplectic Reduction of B-F-Nonlinear Sigma Model and 2+1 Dimensional WZW Model
Phillial Oh, Dept. of Phys., Sungkyunkwan Univ., Suwon 440-746, Korea

4:30

BG 7 Supersymmetry in Classical Mechanics
W. M. Suen[1,2], C. W. Wong[1], Kenneth Young[1], [1]Phys. Dept., The Chinese Univ. of Hong Kong, Shatin, NT, Hong Kong, China, [2]McDonnell Center for Space Sciences, Dept. of Phys., Washington Univ., St. Louis, MO 63130, U.S.A.

4:45

BG 8 Constraints on R Symmetry Breaking Parameters in Supersymmetric Theories
Darwin Chang[1], We-Fu Chang[1], Chung-Shian Chou[1], Wai-Yee Keung[2], [1]NCTS and Phys. Dept., National Tsing-Hua Univ., Hsinchu 30043, Taiwan, [2]Phys. Dept., Univ. of Illinois at Chicago, IL 60607-7059, U.S.A.

BH
INTERDISCIPLINARY PHYSICS: NONLINEAR DYNAMICS, BIOLOGICAL PHYSICS, QUANTUM ELECTRONICS
Chairman : T. Tsutsui
Dept. of Applied Sci. for Electronics and Materials, Kyushu Univ., and the Core-Research for Evolutional Science and Technology, Japan Science and Technology Corporation, Kasuga, Japan
Monday afternoon *B2-C*
1:30 p.m.

1:30

BH 1* Molecular Native Driving Force for Early Protein Folding
H. C. Lee[1], Z. H. Wang[2], [1]Dept. of Phys. and Dept. of Life Science, National Central Univ., [2]Computing Center, Academia Sinica, Taipei, Taiwan

2:00

BH 2* Bending and Base-Stacking Interactions in Double-Stranded DNA
Zhou Haijun[1], Zhang Yang[1], Ou-Yang Zhong-can[1,2], [1]Inst. of Theoretical Phys., Chinese Academy of Sci., Beijing, China, [2]Center of Advanced Study, Tsinghua Univ., Beijing, China

2:30

BH 3 Trace Element Measurement in Human Blood Using Neutron Activation Technique
M. Samareh Shahpasand, Physics Dept. Kerman Univ. Kerman-Iran

2:45

BH 4 Moliere Scattering Theory with Ionization
Takao Nakatsuka, Okayama Shoka Univ., Tsushima-Kyomachi, Okayama 700-8601, Japan

3:00

BH 5 Quasi-Two-Dimensional Photonic Band Structures in Colloidal Particle Layers
R. Shimada[1], Y. Komori[1], T. Koda[1], K. Ohtaka[2], [1]Dept. of Mathematical, Physical Sciences, Faculty of Science, Japan Women's Univ., Tokyo 112-8681, Japan, [2]Center of Frontier Sci., Chiba Univ., Chiba 263-8522, Japan

3:15

BH 6 Thermoreversible Gelation and Phase Separtation in Aqueous Methyl Cellulose Solutions
M. Takahashi, M. Shimazaki, Faculty of Science, Japan Women's Univ., Tokyo 112-8681, Japan

3:30 Coffee Break

Chairman : Z. C. Ou Yang
Inst. of Theoretical Phys., Chinese Academy of Sci., and Center of Advanced Study, Tsinghua Univ., Beijing, China
Chairman : H. C. Lee
Dept. of Phys. and Dept. of Life Science, National Central University

3:45

BH 7* Study on Quantum Efficiency in Organic Light-Emittering Devices
Tetsuo Tsutsui, Dept. of Appliec Sci. for Electronics and Materials, Graduate School of Engineering Sciences, Kyushu Univ., and the Core-Research for Evolutional Science and Technology, Japan Science and Technology Corporation, Kasuga, Fukuoka 816-8580, Japan

4:15

BH 8 Hypertron and Antihypertron
C. H. Chin and C. L. Chung, Center for Theoretical Sciences and Dept. of Electrophysics, National Chiao Tung Univ., Hsin Chu, Taiwan 300

4:30

BH 9 A Consideration of Utility Functions in Hogg-Huberman Model
Toshijiro Tanaka[1], Junko Shibata[1], Masayoshi Inoue[2], [1]Dept. Information Sci., Hiroshima Prefectural Univ., Shobara, Hiroshima 727-0023, Japan, [2]Dept. of Phys., Kagoshima Univ, Kagoshima 890-0084, Japan

4:45

BH 10 Optical Birefringence Imaging of Dentin and Enamel
Xiao-jun Wang, Dept. of Phys., Georgia Southern Univ., Statesboro, GA 30460, U.S.A.

C
Plenary
Chairman : Nguyen Ba An
Institute of Phys., Bo Ho, Hanoi, Vietnam
Tuesday morning *1F-A*
9:00 a.m.

9:00

C 1 Physical Properties of Ferroelectric Mixed Crystals
Sook II Kwun, Dept. of Phys., Seoul National Univ., Korea

9:40

C 2 The Zeno Effect and an Inter-layer Pairing Mechanism for High-Temperature Superconductivity in Layered Materials
N. Kumar, Raman Research Inst., Bangalore 560080, India

10:20 Coffee Break

Chairman : H. Minakata
Dept. of Phys., Tokyo Metropolitan Univ., Japan

10:40

C 3 Laser Fusion and it's Applications in Science and Industry
S. Nakai, Inst. of Laser Engineering and Faculty of Engineering, Osaka Univ., Yamada-ika2-6, Suita, Osaka 565-0871, Japan

11:20

C 4 New Algorithms and the Statistical Physics of Protein Folding
U.H.E. Hansmann, Dept. of Phys., Michigan Tech. Univ. Houghton, MI 49931-1295, USA

12:00 Lunch

12:40 Poster Session

DA
APPLIED PHYSICS
Chairman : H. Ohno
Lab. for Electronic Intelligent Systems, Research Institute of Electrical Communication, Tohoku Univ., Japan

1:30

DA 1* Single FIR-Photon Detection Using a Single-Electron Transistor
S. Komiyama[1], O. Astafiev[2], V. Antonov[2], T. Kutsuwa[1], [1]Dept. of Basic Sci., Univ. of Tokyo, Komaba 3-8-1, Meguro-ku, Tokyo, Japan, [2]Japan Sci. and Tech. Corportion(JST)

1:54

DA 2* Micro-Raman and Micro-Photolumin Escence Spectroscopies of H-terminated Nanocrystalline Silicon
Phan Hong Khoi, Le Thi Trong Tuyen, Institute of Materials Sci., NCST, Vietnam

2:18

DA 3* Peaks or Dips: Optical-Phonon Raman Spectra in Quantum Wells
Bang-Fen Zhu, Center for Advanced Study, Tsinghua Univ., Beijing 100084, China

2:42

DA 4 FTIR Analysis of Thermal-Annealed GaAs: As^+ at Different Dosages
Gong-Ru Lin, Chin-Chia Hsu, Institute of Electro-Optical Engineering, Tatung Univ., No. 40, Chung Shan North Rd., Sect. 3 Taipei 10451, Taiwan

2:54

DA 5 Experimental Evidence for the Aggregation of the Near IR Bands in BaFBr: Eu2+Single Crystals
T. Kurobori[1], M. Liu[1], H. Kido[1], Y. Hirose[1], E. Radzhabov[2], [1]Dept. of Material Sci. and Engineering, Kanazawa Univ., Kakuma, kanazawa 920-1192, Japan, [2]Inst. of Geochemistry, Academy of Sciences of Russia, Siberian Branch. Favorskii street la, P.O. Box 4019, 664033 Irkutsk, Russia

3:06

DA 6* Layer-by-Layer Oxidation of Silicon Surface by Molecular and Atomic Oxygen
Takeo Hattori[1], Kensuke Takahashi[1], Hiroshi Nohira[1], Tadahiro Ohmi[2], [1]Dept. of Electrical and Electronic Engineering, Musashi Inst. of Tech., 1-28-1 Tamazutsumi, Setagaya-ku, Tokyo 158-8557, Japan, [2]New Industry Creation Hatchery Center, Tohoku Univ., Aza-Aoba, Aramaki, Aoba-ku, Sendai 980-8579, Japan

3:30 Coffee Break

Chairman : B. F. Zhu
Center for Advanced Study, Tsinghua Univ., Beijing, China
Chairman : C. D. Chen
Institute of Physics, Academia Sinica, Taipei, Taiwan

3:48

DA 7* Ferromagnetic Heterostructures for Semiconductor Spintronics
Hideo Ohno, Lab. for Electronic Intelligent Systems, Research Institute of Electrical Communication, Tohoku Univ., Katahira 2-1-2, Aoba-ku, Sendai 980-8577, Japan

4:12

DA 8* Kondo Effect in Semiconductor Quantum Dots
M. Eto, Faculty of Science and Technology, Keio Univ., Yokohama 223-8522, Japan

4:36

DA 9* Spin Effects in Quantum Dot Structures
S. Tarucha, ERATO Mesoscopic Correlation Project, Dept. of Phys., Univ. of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

5:00

DA 10 Miniature Microwave Bandpass Filters Using Low-loss Superconductors
D. S. Hung, Inst. of Applied Sci. and Engineering Research, Academia Sinica, Nangkang, Taipei, Taiwan 11529

DC
ATOMIC, MOLECULAR, OPTICAL PHYSICS, AND PLASMA PHYSICS
Chairman : J. Wang
IAMS, Academia Sinica, Taiwan
Tuesday afternoon *1F-D*
1:30 p.m.

1:30

DC 1* Spatial Resolution in Photo-Limited Confocal Optical Microscopy

Giovanni Tapang, Caesar Saloma, National Institute of Phys., Univ. of the Philippines, Diliman, Quezon City 11-1 Philippines

1:54

DC 2* Near-Field Optical Properties of Ordered Polystyrene Fine Particle Layers as Photonic Crystals
Tadashi Itoh, Toru Fujimura, Dept. of Physical Science, Graduate School of Engineering Science, Osaka Univ., 1-3, Machikaneyama-cho, Toyonaka, Osaka 560-8531, Japan

2:18

DC 3* High Speed Light Modulation Using Complex Refractive Index Change of Electro-optic Polymers
T. Yatagai[1], K. Harada[1], K. Munakata[1], M. Itoh[1], S. Umegaki[2], [1]Inst. of Applied Phys. and Tsukuba Advanced Research Alliance, Univ. of Tsukuba, [2]Faculty of Science and Technology, Keio Univ.

2:42

DC 4 Self-Induced Suppression Effect in Nonlinear Optical Processes as a Consequence of Time-Reversal Symmetry
Hsiang-Shun Chou, Inst. of Optoelectronic Sciences, National Taiwan Ocean Univ, Keelung, Taiwan 202

2:54

DC 5 Silica Based Photonic Materials for Integrated Optics
Le Quoc Minh[1], Tran Kim Anh[1,2], Nguyen Thanh Huong[2], Pham Truong Giang[1], Nguyen Vu[1], Paul Benalloul[3], Carlos Barthou[3], Jean-Marc Frigerio[3], Laurence Darcel[3], [1]Institute for Materials Science, Hoang Quoc Viet Road, Hanoi, Vietnam, [2]International Training Institute for Materials Science(ITIMS), 1 Dai Co Viet Road, Hanoi, Vietnam, [3]Universite Piere et Marie Curie, Laboratorie D'Optique des Solides, UMR 7601, Tour 13, Polace Jussieu, F 75252 Paris Cedex 05, France

3:06

DC 6 Dynamics of Instantaneous Phase Shifted Two-Mode Two-Photon Process
M. M. Ashraf, A. Neeem, Process Technology Division, Dr. A. Q. Khan Research Laboratories, P.O. Box 502 Rawalpindi, Pakistan

3:18

DC 7 Quantization Axes in the Calculation of EIT Spectra
Y. W. Chen, I. A. Yu, Dept. of Phys., National Tsing Hua Univ., Hsinchu 300, Taiwan

3:30 Coffee Break

Chairman : Hsiang-Shun Chou
Inst. of Optoelectronic Sciences, National Taiwan Ocean Univ., Keelung, Taiwan

3:48

DC 8* All Electronic Phase-Retrieval Measurement of Femtosecond Optical Waveform
Jyhpyng Wang, IAMS, Academia Sinica, Taiwan

4:12

DC 9* Monochromatic Field Electron Emission from a Niobium Superconductor
C. Oshima, Dept. of Applied Phys., Waseda Univ., 3-4-1, Okubo, Shinjyuku-ku, Tokyo 169-8555, Japan, Kagami Memorial Lab. for Material Sci. and Technologies, Waseda Univ., 2-8-26, Nishiwaseda, Shinjyuku, Tokyo 169-0051, Japan

4:36

DC 10 Ultranarrow Dispersive Profiles Due of to Optical Pumping Effect
J. J. Su, I. A. Yu, Dept. of Phys., National Tsing Hua Univ., Hsinchu 300, Taiwan

4:48

DC 11 Bose-Einstein Condensate in Two-Dimensions for Negative Scattering Lenghth
Sang-Hoon Kim[1], Sung Dahm Oh[2], Wonho Jhe[3], [1]Division of Liberal Arts, Mokpo National Maritime Univ., Mokpo 530-729, Korea, [2]Dept. of Phys., Sookmyung Women's Univ, Seoul 140-742, Korea, [3]CNAT and Dept. of Phys., Seoul Nationala Univ., Seoul 151-742, Korea

5:00

DC 12 A Quasi-Optical System Converting a Gyrotron Output Radiation into a Gaussian Beam
I. Ogawa[1], K. Yamada[1], Y. Miyake[1], T. Idehara[2], S. Sabchevski[2], W. Kasparek[3], [1]Faculty of Engineering, Fukui Univ., Fukui 910-8507, Japan, [2]Research Center for Development of Far-Infrared Region, Fukui Univ., Fukui 910-8507, Japan, [3]Institut Fur Plasmaforschung, Universitat Stuttgart, Pfaffenwaldring 31, D-70569 Stuttgart, Germany

5:12

DC 13 Spectroscopic Study of MnF_2 Thin Film

Xiaojum Wang[1], S. H. Huang[2], D. L. Huber[3], W. M. Yen[2], [1]Dept. of Phys., Georgia Southern Univ., Statesboro, GA 30460, U.S.A., [2]Dept. of Phys. & Astronomy, Univ. of Southern, Athens, GA 30602, U.S.A., [3]Dept. of Phys., Univ. of Wisconsin, Madison, WI 63706, U.S.A.

DD

COMPUTATIONAL & STATISTICAL PHYSICS

Chairman : C. K. Hu

Inst. of Phys., Academia Sinica, Taipei, Taiwan

Tuesday afternoon *1F-C*

1:30 p.m.

1:30

DD 1* About the Asymptotic State of Thermal Turbulence
Masaki Sano, Department of Physics, Graduate School of Science, University of Tokyo, Japan

2:00

DD 2* Non-equilibrium Relaxation Study of the Phase Transition
Nobuyasu Ito, Dept. Applied Phys., School of Engineering , The Univ. of Tokyo, Japan

2:30

DD 3 Pattern Competition in the Photorefractive Semiconductors
You-Hsien Shiau, Chin-Kun Hu, Inst. of Phys., Academia Sinica, Taipei 11529, Taiwan

2:45

DD 4 Renormalization Group Study of Sandpile on the Honeycomb Lattice
Chai-Yu Lin, Chin-Kun Hu, Inst. of Phys., Academia Sinica, Taipei 11529, Taiwan

3:00

DD 5 Interfacial and Nanostructural Studies of Polymer Blends
Min Yue Lin, National Inst. of Standards and Technology, Gaithersburg, MD 20899 U.S.A., ExxonMobil Research and Engineering Company, Annandale, NJ 08801 U.S.A.

3:15

DD 6 Exact Finite-size Scaling Corrections in Two Dimensional Ising Model
N. Sh. Izmailian, Chin-Kun Hu, Inst. of Phys., Academia Sinica, Taipei 11529, Taiwan

3:30 Coffee Break

Chairman : N. Ito

Dept. Applied Phys., School of Engineering , The Univ. of Tokyo, Japan

3:45

DD 7* Syncronization in Coupled Map Lattices
Chin-Kun Hu, Inst. of Phys., Academia Sinica, Taipei 11529, Taiwan

4:15

DD 8 Multifractal Characterization of Stochastic Resonance
Alexander Silchenko[1,2], Chin-Kun Hu[1], [1]Inst. of Phys., Academia Sinica, Taipei 11529, Taiwan, [2]Dept. of Phys., Saratov State Univ., Saratov, Astrakhanskaya st. 83, 410026 Russia

4:30

DD 9 Forest Fire Models on the Small-world Lattice
Chi-Ning Chen, Inst. of Phys., Academia Sinica, Taipei 11529, Taiwan

4:45

DD 10 Tsallis Statistics for Cluster-Size Distributions in Percolation
H. Ohnishi, Makoto S. Watanabe, Faculty of Humanity and Environment, Hosei Univ., Fujimi, Chiyoda-ku, Tokyo 102-8160, Japan

5:00

DD 11* Local Properties of Multifraciontal Brownian Motion of Riemann-Liouville Type
S. C. Lim, Applied Physics Program Centre for Applied Physical Sciences, National Univ., of Malaysia, 43600 UKM Bangi, Selangor, Malaysia

5:30

DD 12* Simulations of Granular Materials with SOC-like Rules
C. K. Chan[1], L. C. Jia[2], Pik-Yin Lai[2], [1]Inst. of Phys., Academia Sinica, Taipei, Taiwan 11529, [2]Dept. of Phys. and Center for Complex Systems, National Central Univ., Chung-Li, Taiwan 320

DE1

CONDENSED MATTER PHYSICS

Chairman : N. T. Thang

Inst. of Phys., Bo Ho, Hanoi, Vietnam

Chairman : H. F. Cheng

Dept. of Phys., National Taiwan Normal University, Taipei, Taiwan

Tuesday afternoon *B2-B*

1:30 p.m.

1:30

DE1-1* Experimental Investigation of the Pairing Symmetry and Mechanism of High-Temperature Superconductivity
Nai-Chang Yeh, Dept. of Phys., California Inst. of Tech., Pasadena, CA 91125, U.S.A.

1:54

DE1-2* Unusual Magnetic Properties or Unconventional Superconductivity in $PrBa_2Cu_3O_7$?
H. C. Ku, Dept. of Phys., National Tsing Hua Univ., Hsinchu, Taiwan 300

2:18

DE1-3* Possibility of the Best Performance High-Tc Superconductor Baded on Cu-1234 System
Hideo Ihara, Electrotechnical Lab., 1-1-4 umezono, Tsukuba, Ibaraki 305-8568, Japan and CREST, JST

2:42

DE1-4* Superconductivity above 115K
Sung-Ik Lee, Phys. Dept., Pohang Univ. of Sci. and Tech., Pohang, Korea

3:06

DE1-5 YBCO and Bi Based Superconducting Thick Films Prepared by a Partial Melt Method
Duong Cong Hiep, Do Thi Sam, Le Van Hong, Inst. of Materials Sci., NCST of Vietnam

3:18

DE1-6 The Electric Basis of Ferroelectricity in $LiNbO_3$
Rebekah Min-Fang Hsu, Dept. of Applied Chemistry, Foo Yin Inst. of Tech., Ta-Liao, Kaohsiung County 831, Taiwan

3:30 Coffee Break

Chairman : S. I. Lee

Phys. Dept., Pohang Univ. of Sci. and Tech., Pohang, Korea

3:48

DE1-7* Low-Temperature Electron Dephasing Times in Disordered Metals
J. J. Lin, Inst. of Phys., National Chiao Tung Univ., Hsinchu 300, Taiwan

4:12

DE1-8* Models of Reentrant Charge Ordering in Manganites
Nguyen Toan Thang, Inst. of Phys., P.O. Box 429 Bo Ho, Hanoi 10000, Vietnam

4:36

DE1-9 Development of Microwave Dielectric Thin Films
H. F. Cheng[1], Y. C. Chen[1], Y. M. Tsau[1], I. N. Lin[2], [1]Dept. of Phys., National Taiwan Normal Univ., Taipei, Taiwan 117, [2]Materials Science Center, National Tsing-Hua Univ., Hsinchu Taiwan

4:48

DE1-10 Simultaneous Structural, Magnetic, and Electronic Transitions in $La_{0.7-x}Nd_xPb_{0.3}MnO_3$
H. Z. Chen[1], S. L. Young[2], J. B. Shi[3], Y. C. Chen[2], [1]Dept. of Electrical Engineering, Shu-The Junior College of Technology and Commerce, Taichung, Taiwan, [2]Inst. of Electrical Engineering, National Sun Yat-Sen Univ., Kaohsiung, Taiwan, [3]Dept. of Electronic Engineering, Feng Chia Univ., Taichung, Taiwan

5:00

DE1-11* Ce_2CuGe_6: A Possible Non-Magnetic Atom-Disorder Spin Glass
Cheng Tien, Dept. of Phys., National Cheng Kung Univ.

DE2

CONDENSED MATTER PHYSICS THEORY

Chairman : N. Kumar

Raman Research Inst., Bangalore, India

Tuesday afternoon *B2-C*

1:30 p.m.

1:30

DE2-1* Organic Ferromagnetism and Spin Density of a Quasi-1D Model
Kailun Yao, Dept. of Phys., Juazhong Univ. of Science and Technology, Wuhan, China

2:00

DE2-2* Applications of the Spin Theory as a Microscopic Mechanism of High Temperature Superconductivity

Danilo M. Yanga[1], Augusto A. Morales, Jr.[2], [1]National Inst. of Phys. College of Science, [2]Univ. of the Philippines, Diliman, Quezon City, Philippines

2:30

DE2-3* Effective Mass of the Vortex in Superfluids
V. Sayakanit, K. Tayanasanti, Forum for Theoretical Science, Dept. of Phys., Faculty of Sci., Chulalongkorn Univ., Bangkok, Thailand

3:00

DE2-4 High-Temperature Superconductivity and SU(4) Symmetry
Cheng-Li Wu, Dept. of Phys., Chung-Yuan Christian Univ., Chung-Li, Taiwan 320

3:15

DE2-5 Phase Transition between Ferroelectric and Antiferroelectric States and Two-Phase Nucleation in Perovskite Ferroelectrics
V. L. Sobolev[1], V. M. Ishchuk[2], [1]Minot State University, Minot, North Dakota, 58707, U.S.A., [2]Institute for Single Crystals of Acad. of Sci. of Ukraine, Kharkov 61001, Ukraine

3:30

DE2-6 The Exact AC Susceptibility of a Superpara-magnetic Particle
Ivo Klik, Inst. of Phys., Academia Sinica, Taipei, Taiwan

DG
PARTICLES AND FIELDS
Chairman : W. S. Hou
Dept. of Phys., Taiwan Univ., Taipei, Taiwan
Tuesday afternoon *1F-B*
1:30 p.m.

1:30

DG 1* A Two-dimensional Analogue Model for QCD
Hisakazu Minakata, Dept. of Phys., Tokyo Metropolitan Univ., 1-1 Minami-Osawa, Hachioji, Tokyo 192-0397, Japan

2:00

DG 2* Fermion Transmutation--a Renormalization Effect in Gauge Theory
Sheung Tsun Tsou, Math. Inst., Oxford Univ., UK

2:30

DG 3* Implementing Unitarity in Perturbation Theory
Chi-Sing Lam, McGill Univ., Canada

3:00

DG4* QCD Phase Transition-Laboratory and Microsecond Universe
Bikash Sinha, Variable Energy Cyclotron Centre, 1/AF, Bidhan Nagar, Calcutta-700 064,India, Saha Institute of Nuclear Physics, 1/AF, Bidhan Nagar, Calcutta-700 064, India

3:30 Coffee Break

DI
FORUM ON SCIENTIFIC COLLABORATION AMONG ASIA PACIFIC REGIONS
Chairman : T. K. Lee
Institute of Phys., Academia Sinica, Taipei, Taiwan
Tuesday afternoon *5F*
3:45 p.m.

DI 1 Introduction to University Mobility in Asia and the Pacific (UMAP) Activity
Hisakazu Minakata, Dept. of Phys., Tokyo Metropolitan Univ., Japan

DI 2 Recent JSAP Activities for Future
Nobuyoshi Koshida, Tokyo Univ. of A&T, Japan

DI 3 Information Technology Based Physics Education
Keum Hwi Lee, Asian Physics Education Network

DI 4 International Graduate Student Program in Academia Sinica
H. Y. Cheng, Inst. of Phys., Academia Sinica, Taipei, Taiwan

E
Plenary
Chairman : S. K. Gupta

Nuclear Physics Division, BARC, India
Wednesday morning *1F-A*
9:00 a.m.

9:00

E 1 Relativistic Many Body Theory for Unstable Nuclei and Supernova
Hiroshi Toki, RCNP, Osaka Univ., Japan

9:40

E 2 Superhigh Brightness Photon Beams for Extra-Nuclear Research
Lee C. Teng, Argonne National Lab., U.S.A.

10:20 Coffee Break

Chairman : D. M. Yanga
National Inst. of Phys. College of Science, Philippines

10:40

E 3 Perturbative QCD and Parton Structure of the Nucleon
Wu-ki Tung, Dept. of Phys. And Astro, Michigan State Univ., U.S.A.

11:20

E 4 A Novel Optical Memory Effect Using Multiple Light Scattering
Atusi Kurita[1], Takashi Kushida[2], [1]Dept. of Phys., Osaka Univ., Japan, [2]Graduate School of Materials Science, Nara Inst. of Science and Technology, Japan

12:00 Lunch

EG
ACFA-LC3
Chairman : Shih-Chang Lee
Academia Sinica, Taipei, Taiwan
Wednesday morning *1F-B*
9:00 a.m.

9:00

EG-1 BES Recent Results and Future Plans
Z.G. Zhao, IHEP, Beijing, China

9:30

EG-2 First Results from BELLE
P. T. Chang, NTU, Taiwan

10:00

EG-3 What Can We Learn from Charmless Rare B Decays: the Past/Next 3Years
George W. S. Hou, NTU, Taiwan

10:30 Coffee Break

Chairman : Kiyotomo Kawagoe
Kobe University, Japan

10:50

EG-4 First Results from K2K Experiment
H. Park, KEK, Japan

11:20

EG-5 Resent Results from Super-Kamiokande
S. Moriyama, ICRR, Japan

11:50

EG-6 Results from the 1998 Shuttle Flight of the AMS Experiment
Yuan-Hann Chang, NCU, Taiwan

12:20 Lunch

FA
APPLIED PHYSICS
Chairman : J. Joo
Dept. of Phys., Korea Univ., Seoul, Korea
Thursday morning *1F-A*
9:00 a.m.

9:00

FA 1* Ultrathin Fe-GeAs Layer Structure for Wideband Microwave Devices
Chen S. Tsai[1,2], Chin C. Lee[2], [1]Center for Applied Sci. and Engineering Res. Academia Sinica, Taipei, Taiwan 11529, [2]Dept. of Electrical and Computer Engineering, Univ. of California, Irvine, CA 92697, U.S.A.

9:24

FA 2* Dielectric Superlattice Engineered Ferroelectric Domain Structures
N. B. Ming, Y. Y. Zhu, National Lab. of Solid State Microstructures, Nanjing Univ., Nanjing 210093, China

9:48

FA 3* Volumetric Optical Disk Recording
Han-Ping D. Shieh, Institute of Electro-Optical Engineering, National Chiao Tung Univ., Hsinchu, Taiwan 300

10:12

FA 4 Experimental Demonstration of Two-Dimensional Interaciton-Free Imaging
Hiroyuki Watanabe, Sinichiro Inoue, Sci. and Tech., Nihon Univ., Tokyo, Japan

10:24

FA 5 High Freguency Impedance Spectra in Chromium Dioxide Film
C. M. Fu[1], C. J. Lai[1], Z. C. Wu[1], S. G. Shyu[2], J. C. A. Huang[3], [1]Phys. Dept., National Kaoshiung Normal Univ., Kaoshiung, Taiwan, [2]Inst. of Chemistry, Academia Sinica, Taipei, Taiwan, [3]Phys. Dept., National Cheng Kung Univ., Tainan, Taiwan

10:36 Coffee Break

Chairman : N. B. Ming
National Lab. of Solid State Microstructures, Nanjing Univ., China
Chairman : C. M. Fu
Phys. Dept., National Kaoshiung Normal Univ., Kaoshiung, Taiwan

10:48

FA 6* Solid State Amorphization in Metal-Si Systems
L. J. Chen, Dept. of Materials Science and Engineering, National Tsing Hua Univ., Hsinchu, Taiwan

11:12

FA 7* Charge Transport and Insulator-Conductor Transition of Li Salt Doped Polyaniline
J. Joo[1], J. H. Jung[1], B. H. Kim[1], B. W. Moon, S. H. Chang[2], K. S. Ryu[2], [1]Dept. of Phys., Korea Univ., Seoul 136-701, Korea, [2]Electronics and Telecommunication Research Institute, Taejon 305-350, Korea

11:36

FA 8* Mechanism of Epitaxial Growth on Si(100) Surfaces
Sukmin Jeong, Atsushi Oshiyama, Inst. of Phys., Univ. of Tsukuba, 1-1-1 Tennodai, Tsukuba 305-8571, Japan

12:00 Lunch
12:40 Poster Session

FC
ATOMIC, MOLECULAR, OPTICAL PHYSICS, AND PLASMA PHYSICS
Chairman : T. S. Yih
National Central Univ., Chung-Li, Taiwan
Thursday morning *1F-D*
9:00 a.m.

9:00

FC 1* An Overview of Research at Taiwan Light Source
K. S. Liang, Synchrotron Radiation Research Center, Hsinchu, Taiwan

9:24

FC 2* Multimode Higher-Order Squeezing in Multiwave Mixing Processes
Nguyen Ba An, Institute of Phys., P.O.Box 429 Bo Ho, Hanoi 10000, Vietnam

9:48

FC 3* Photon Correlation Spectroscopy as a Probe of Self-Diffusion and Interactions of Polymer Blends in Solution
C. H. Wang, National Sun Yat-sen Univ., Dept. of Phys., Kaohsiung, Taiwan

10:12

FC 4 Recent Results at the Tokyo EBIT
Nobuyuki Nakamura, Chikashi Yamada, Shunsuke Ohtani, Cold Trapped Ions Project, ICORP, JST, Chofu, Tokyo 182-0021, Japan, Univ. of Electro-Communications, Chofu, Tokyo 182-8585, Japan

10:24

FC 5 Status of the Korea Superconducting Tokamak Advanced Research Project

M. Kwon, G. S. Lee, the TSTAR Project Team, National Fusion R&D Center, Korea Basic Science Institute, Taejeon, Korea

10:36 Coffee Break

Chairman : M. Kwon
The TSTAR Project Team, National Fusion R&D Center, Korea Basic Science Institute, Taejeon, Korea

10:48

FC 6* Absolute Photoabsorption Cross Section of Alkaline Earth Metal Atoms
Tai-Sone Yih, Hok-Sum Fung, Ching-Chi Chu, Dept. of Phys., National Central Univ., Chung-Li 32054, Taiwan

11:12

FC 7* The Origin and Fundamental Mechanism of Wear of Materials
T. Sasada, Chiba Inst. of Technology, Japan

11:36

FC 8* Synchrotron Experiments of X-Ray Multi-Wave Interaciton in 2-D and 3-D Crystals
S. L. Chang, Y. S. Hunag, C. S. Chao, Yu. P. Stetsko, Y. R. Lee, C. Y. Hung, T. C. Lin, G. Y. Lin, C. H. Ching, Dept. of Phys., National Tsing Hua Univ., Hsinchu 300, Taiwan

12:00 Lunch
12:40 Poster Session

FE1
CONDENSED MATTER PHYSICS
Chairman : N. P. Thuy
Cryogenic Lab., Faculty of Phys., Hanoi National Univ., International Training Inst. for Materials Sce., Hanoi, Vietnam
Thursday morning *B2-B*
9:00 a.m.

9:00

FE1-1* Quantum Confinement and Coulomb Charging Effect of Holes in Self-Assembled Ge Dots on Si(100)
Fang Lu, Xun Wang, Surface Physics Lab., Fudan Univ., Shanghai 200433, China

9:24

FE1-2* Magnetic Domain Images of Nanometer-Size Magnetic Features
Sy-Hwang Liou, Univ. of Nebraska, Lincoln, NE 68588-0111, U.S.A.

9:48

FE1-3* Bulk Nd-Fe-Al Amorphous Alloy with Hard Magnetic Properties
Nguyen Chau[1], Nguyen hoang Luonga[2], Do thi Kim Anh[2], [1]Center for Materials Sci., Univ. of Sci., [2]Cryogenic Lab., Univ. of Sci., 334 Nguyen Trai, Thanh Xuan, Hanoi, Vietnam

10:12

FE1-4 Magnetic and Moessbauer Studies of Inteface Magnetism in Fe/X (X=Ti, V, Zr, Y and Gd) Multilayers
N. H. Duc, Cryogenic Lab., Vietnam National Univ., Hanoi 334 Nguyen Trai, Thanh Xuan, Hanoi, Vietnam

10:30 Coffee Break

Chairman : X. Wang
Surface Physics Lab., Fudan Univ., Shanghai, China
Chairman : Sy-Hwang Liou
Univ. of Nebraska, Lincoln, NE 68588-0111, U.S.A.

10:48

FE1-5* Tunneling Magnetoresistance Study in NiFe/Co/Insulator/Co
C. H. Ho[1], M. -T. Lin[1], Y. D. Yao[2], S. F. Lee[2], Y. Liou[2], S. U. Jen[2], I. C. Kao[3], [1]Dept. of Phys., National Taiwan Univ., 106, Taipei, Taiwan, [2]Inst. of Phys., Academia Sinica, 115, Taipei, Taiwan, [3]Dept. of Phys., Fu Jen Univ., Taipei, 242, Taiwan

11:12

FE1-6* Mossbaüer Evaluation of Ferrite Nanoparticles
James C. Ho, H. H. Hamdeh, Dept. of Phys., Wichita State Univ., Wichita, Kansas, U.S.A.

11:36

FE1-7* Magnetic Properties and Magnetocaloric Effects in Several $R_5(Si_{0.5}Ge_{0.5})_4$ Compounds

N.P. Thuy[1,2], N. V. Nong[2], L. T. Tai[1,2], N. T. Hien[1,2], T. Q. Vinh[1,2], P. D. Thang[2], T. P. Nauyen[3], P. Molinie[3], [1]Cryogenic Lab., Faculty of Phys., Hanoi National Univ., [2]International Training Inst. for Materials Sce., Hanoi, Vietnam, [3]Inst. des Materiaux de Nantes Jean Rouxel, Universite de Nantes, France

12:00 Lunch
12:40 Poster Session

FE2
CONDENSED MATTER PHYSICS THEORY
Chairman : N. A. Viet
Institute of Physics, NCNST of Vietnam, Bo Ho, Hanoi, Vietnam
Thursday morning *B2-C*
9:00 a.m.

9:00

FE2-1* Control of Decoherence and Relaxation in Quantum Systems
G. S. Agarwal, Physical Res. Lab., Navrangpura, Ahmedabad-38000, India

9:30

FE2-2* Model Transmission-Line Theory of Photonic Band-Gap Structures
K. M. Leung, C. H. Lin, Polytechinc Univ., Brooklyn, NY 11201, U.S.A.

10:00

FE2-3 Irreversible Energy Flow in One-Dimensional Disordered Systems Coupled with a Few Phonon Modes
Hiroaki Yamada, Dept. of Material Sci. and Tech., Faculty of Engineering, Niigata Univ., Ikarashi 2-Nocho 8050, Niigata 950-2181, Japan

10:15

FE2-4 The Electron Mobility in a Modulation-Doped Quantum Wire with Correlated Impurities
Doan Nhat Quang[1],Nguyen Huyen Tung[2], Tran Doan Huan[2], [1]Centre for Theoretical Physics, P. O.Box 429 Boho, Hanoi 10000, Vietnam, [2]Institute of Engineering Physics, Hanoi Univ. of Technology 1 Dai Co Viet Road, Hanoi, Vietnam

10:30 Coffee Break

Chairman : G. S. Agarwal
Physical Res. Lab., Navrangpura, Ahmedabad, India

10:45

FE2-5* Excitons in Low Dimensional Systems
Nguyen ai Viet, Institute of Physics, NCNST of Vietnam, P.O. Box 429, Bo Ho, Hanoi 10000, Vietnam

11:15

FE2-6 Spin-Dependent Electron Corrections of a System with Broken Spin Symmetry
K. S. Yi, J. Kim, J. S. Kim, Dept. of Phys., Pusan National Univ., Pusan 609-735, Korea

11:30

FE2-7 On The Mystery of the Giant Moments of Fe and Co in Cs Films
Guang-Yu Guo, Dept. of Phys., National Taiwan Univ., Taipei 106, Taiwan

11:45

FE2-8 Investigation of Surface Critical Behavior of Random Systems at the Oridinary Transition
Z. Usatenko, Inst. for Condensed Matter Phys., 1 Svientsitskii Str., 79011, Lviv, Ukraine

12:00 Lunch
12:40 Poster Session

FF
NUCLEAR PHYSICS
Chairman : O. Hashimoto
Dept. of Phys., Tohoku Univ., Sendai, Japan
Thursday morning *1F-C*
9:00 a.m.

9:00

FF 1* A New AMS Facility in Korea
Jong Chan Kim, C. H. Lee, J. H. Park, J. Kang, Y. D. Kim, C. B. Moon

9:30

FF 2* KNY Form Factors in the Chiral Bag Model
Il-Tong Cheon[1], Moon Taeg Jeong[2], [1]Dept. of Phys., Yonsei Univ., Seoul 120-749, [2]Dept. of Phys., Dongshin Univ., Naju 520-714, Korea

10:00

FF 3 Relativistic Calculation on Pion Condensation
Masahiro Nakano[1], Toshitaka Tatsumi[2], Liang-gang Liu[3], Hiroyuki Matsuura[4], Yoshitaka Iwasaki[5], Hiroaki Kouno[5], Akira Hasegawa[5], [1]Univ. of Occupational and Environmental Health, Japan, [2]Dept. of Phys., Kyoto Univ., Japan, [3]Dept. of Phys., Zhungshan Univ., China, [4]Res. Center for Advanced Sci. and Tech., Univ. of Tokyo, [5]Dept. of Phys., Saga Univ. Japan

10:15

FF 4 Heavy Atoms Based on Schwinger-Dyson Formalism
Hiroyuki Matsuura[1], Masahiro Nakano[2], [1]National Graduate Inst. for Policy Studies, [2]Univ. of Occupational and Environmental Health, Japan

10:30 Coffee Break

Chairman : I. T. Cheon
Dept. of Phys., Yonsei Univ., Seoul, Korea

10:45

FF 5* Weak Decay of Medium-Heavy Λ Hypernuclei
O. Hashimoto, Dept. of Phys., Tohoku Univ., Sendai, Japan

11:15

FF 6* The Study of Nuclei Far from Stability in IMP
Yi-Xiao Luo, Inst. of Modern Phys., CAS, China

11:45

FF 7 A New Derivation of the Energy-Time Uncertainty Relation
Nguyen Vinh Quang, Inst. of Phys., P.O.Box 429, Bo Ho 10000, Hanoi, Vietnam(and Lebedev Physical Institute, Noscow 11733, Russia)

12:00 Lunch
12:40 Poster Session

FG
ACFA-LC3
Chairman : Shinhong Kim
University of Tsukuba, Japan
Thursday morning *1F-B*
9:00 a.m.

9:00

FG-1 Physics at Fermi Lab
G.P. Yeh, FNAL/AS, U.S.A.

9:40

FG-2 LEP-II
S. Komamiya , Tokyo, Japan

10:20 Coffee Break

Chairman : Xiao-Gang He
National Taiwan University, Taipei, Taiwan

10:40

FG-3 Physics Potential of LHC
R. Godbole, Bangalore, India

11:20

FG-4 Linear Collider Physics
T. Takahashi, Hiroshima University, Japan

12:00

FG-5 Status of the High-Intensity Proton Accelerator Project in Japan
S. Nagamiya, KEK

12:30 Lunch

G
Plenary
Chairman : S. Komiyama
Dept. of Basic Sci., Univ. of Tokyo, Tokyo, Japan
Thursday afternoon *1F-A*
1:30 p.m.

1:30

G 1 Prospect of Accelerator-related Sciences in Asia
Won Namkung, Dept. of Phys., Pohang Univ. of Sci. & Tech., Korea

2:10

G 2 Higgs and SUSY Search in Next Decade
Kaoru Hagiwara, KEK, Tsukuba 305-0801, Japan

2:50 Coffee Break

Chairman : Keum Hwi Lee
Asian Physics Education Network

3:10

G 3 Experimental Search for Extra Space Dimensions
Michael E. Peskin, Theory Group, MS 81, Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA 94309 U.S.A.

3:50

G 4 Molecular beam epitaxy-scanning tunneling microscopy of wurtzite GaN
Qi-Kun Xue, Institute of Physics, Chinese Academy of Sciences, Beijing, China

4:30

G 5 Result from DONUT First Direct Evidence for Tau Neutrino
Kaoru Hoshino, Dept. of Phys., Nagoya Univ., Nagoya, 464-8602, Japan

(Poster Session including 72 articles, omitted)

Seminars

中央研究院物理所八十九年度演講一覽表

（2000 年 1 月~2000 年 12 月）

演講題目	演講者姓名	所屬機構	日期
Magnetic properties, structure and alloy formation of ultrathin materials	蔡志申	Institut fur Physilalische und Theortisch`e Chemie der Universitat Bonn, Germany	01/03/2000
Weak interacting particles in the medium	林貴林	交通大學物理所	01/07.2000
Coherent Phonon Spectroscopy Using Time-Resolved Second-Harmonic Generation	張玉明	東華大學物理系	01/07/2000
Soft-condensed Matter Journal Club: Bending and Base-stacking Interactions in Double Stranded DNA	黎璧賢	國立中央大學物理系	01/17/2000
Fast Estimation of Evoke Potential by Adaptive Filtering	陳和晏	香港大學生物醫學工程中心	01/18/2000
Lattice statistics: dimers, polymers and spanning trees	V. B. Priezzhev	Lab. Of Theoretical Physics, Joint Institute for Nuclear Research	01/18/2000
Synchromous chaos in coupled map lattices with extensive interactions	P.M. Gade	中央研究院物理所	01/18/2000
Inclusion-exclusion method in Exactly Solvable Models	V. B. Priezzhev	Lab. Of Theoretical Physics, Joint Institute for Nuclear Research	01/18/2000
MEMS for Flow Control	李國賓	成功大學工程科學系	01/19/2000
Bose Einstein Condensation in Atomic Traps	葉崇傑	新竹國家科學理論研究中心	01/19/2000
A Microscopic theory of High Tc Superconductivity	張爲民	成功大學物理系	01/21/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Height Probabilities in Abelian Sandpile Model	V. B. Priezzhev	Lab. Of Theoretical Physics, Joint Institute for Nuclear Research	01/24/2000
Interfacial Roughening With Surface-Relaxation and Quenched Disorder	龐寧寧	台灣大學	01/24/2000
Eulerian Walks on Two-Dimensional Lattice	V. B. Priezzhev	Joint Institute for Nuclear Research Dubna, Russia	01/24/2000
Upper Critical Dimension of the Abelian sandpile Model	V. B. Priezzhev	Joint Institute for Nuclear Research Dubna, Russia	01/25/2000
Pattern Selection in a Self-Organized	梁鈞泰	中央研究院物理所	01/25/2000
Anomalous Finite-size effect Induced by Boundary Condition	黃敏章	中原大學物理系	01/25/2000
Minimal Configurations in the Random Manna Model	V. B. Priezzhev	Joint Institute for Nuclear Research Dubna, Russia	01/25/2000
Inversion Symmetry and Exact Critical Exponents of Dissipation Waves in the Sandpile Model	林財鈺	中央研究院物理所	01/25/2000
Introduction to Perturbative QCD	李湘楠	成功大學物理系	01/26/2000
X-ray Observation of Pulsars	張祥光	清華大學物理系	01/28/2000
Spin-related physics in integer quantum Hall system	張明哲	師範大學物理系	02/18/2000
Faster than the speed of light? Testing EPR v.s. Quantum Mechanics in Particle Physics	葛道寧	中央大學物理系	02/18/2000
Monte Carlo simulation of membrane protein fdding	陳啓明	東華大學物理系	02/22/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Quantum Mechanical Approach in ESEEM Spectra Simulation	柯學初	國立東華大學物理系	02/22/2000
1.微重力流體力學研究進展 2.液橋的流體力學穩定理論	徐碩昌	中國科學院力學研究所	02/23/2000
Distant Learning	陳立祥	教育部電算中心	02/23/2000
1.微重力流體力學研究進展 2.液橋的流體力學穩定理論	徐碩昌	中國科學院力學研究所	02/24/2000
From Exotic Matter to Spacetime Travel	郭中一	東吳大學物理系	02/25/2000
Recreating the Big Bang in the Lab-Physics at the Relativistic Heavy Ion Collider	Prof. Richard Seto	U. C. Riverside	03/01/2000
Soft-Condensed Matter Journal Club: Oscillatory Neurocomputers with Dynamic connectivity	陳昭安	中央研究院物理研究所	03/06/2000
Novel Concept and Applications in the Photorefractive Semiconductors	蕭又新	中央研究院物理研究所	03/08/2000
Atmospheric Secondary Particles in Near Earth Orbit	黃明輝	中央研究院物理研究所	03/10/2000
Soft-Condensed Matter Journal Club: Renormalization Group Study of Sandpile	林財鈺	中央研究院物理研究所	03/13/2000
Superconductor Insulator Transition in a Single Isolated Josephson Junction	Prof. Mikko Paalanen	Low Temperature Lab., Helsinki University of Technology	03/13/2000
Interplay of nonlinear Compton and Raman scattering in laser plasma interaction and electron acceleration	劉全生	University of Maryland	03/14/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
微液珠噴射系統	曾繁根	清華大學工程與系統科學系	03/15/2000
Searching for the Early Life on Earth	李家維	清華大學生命科學系	03/15/2000
結構生物學：一塊生物物理學家的良田	黃太煌	中央研究院生物醫學科學研究所	03/22/2000
A New Method to Derive Low-lying N-dimensional Quantum Wave Functions based on Orbit-Integration	李政道	Columbia University, USA	03/25/2000
以高頻技術研究超導體薄膜特性及其應用	洪東興	中央研究院應用科學與工程研究所籌備處	03/27/2000
非均勻流中的柱體尾流	朱佳仁	中央大學土木系	03/29/2000
北京高能物理所之研究項目與北京譜儀實驗	李　金	中國科學院高能物理所	03/29/2000
A New Approach to Texture Analysis of Quark-Lepton Mass Matrices	吳國鴻	Inst. Of Theo. Sci., U. of Oregon	03/31/2000
Polydispersity Effect and Universality of Finite-size Scaling Function	馬文忠	中央研究院數學所	04/10/2000
Randomness-Induced Evolution of First-Order to Second-Order Phase Transition	姜一民	中山大學	04/10/2000
Modeling and Multi-Scale Simulation in Materials Science: Diffusion, Nucleation,…	Dieter Heermann	Institut fuer Theoretische Physik, Universitaet Heidelberg	04/10/2000
Protein Folding in Presence of Power-law Correlations	E.Sh. Mamasakhlisov	中央研究院物理所	04/10/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Computer Simulations of nano-indentation into polymer films	Dieter Heermann	Institut fuer Theoretische Physik, Universitaet Heidelberg	04/10/2000
CP Violation and B Decays	吳岳良	中國科學院理論物理所	04/11/2000
Ultrafast studies in chemistry and biology femtochemistry and femtobiology	王俊凱	台灣大學凝態中心	04/12/2000
微流體系統技術	蔡明杰	工業技術研究院機械所微機電系統技術組	04/12/2000
晶粒物質在電場中之行爲	陸坤權	北京中國科學院物理所	04/12/2000
Matter and Energy in the Universe– an Elementary Introduction	林文隆	台灣師範大學物理系	04/14/2000
半浮區液橋熱毛細對流研究	唐澤眉	中國科學院國家微重力實驗室	04/19/2000
GaSb 單晶生長即時控制模擬	葛培文	中國科學院物理研究所	04/19/2000
Neutrinos in Extra Dimension	黃岳華	TRIUMF & NCTS	04/21/2000
Network Society	瞿海源	中央研究院社會科學研究所	04/26/2000
The folding and reduction of complexity of protein	Wei Wang	南京大學	04/28/2000
Cascade Decays of Charged Higgs Bosons at LEP2	Andrew Akeroyd	日本 KEK 實驗室	04/28/2000
Digital Media and Culture Change	謝清俊	中央研究院資訊所	05/03/2000
1.Model for CS-S and S-LS transitions in langmuir 2.Introduction to Doi Project	Jiunn-Ren Roan	Computer Aided Materials Design Joint Research Japan Chemical Innovation Institute	05/04/2000
NCHC PC Cluster Project 簡介	張西亞	國家高速電腦中心	05/05/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Vacuum Interpretation for Supergravity M-branes	陳江梅	中央大學物理系	05/05/2000
Two-Photon Fluorescence Microscopy and Magnetic Tweezers as Novel Techniques in Probing Biophysical Phenomena in Tissue, Cells, and Single Molecules	Chen-Yuan Dong	Massachusetts Institute of Technology	05/05/2000
Bose-Einstein Condensation of Rb-87 Atoms	余怡德	清華大學物理系	05/10/2000
Metal-Insulator transition in two dimensional electron systems	Sergey Kravchenko	Northeastern University	05/11/2000
Chiral Fermions on a Finite Lattice	趙挺偉	台灣大學物理系	05/12/2000
Self Organization of a 2-D Bacteria Culture	吳小倫	University of Pittsburgh	05/15/2000
Global Virtual Teams: Applications for Collaborative Research	D. J. Pauleen	Dept. of Communications Victoria University New Zealand	05/16/2000
Turbulence Generation in Homogeneous Dilute Particle-Laden Flow	陳政宏	University of Maryland	05/17/2000
New Development in Electrophysiology of the Brain	嚴震東	台灣大學動物學系	05/17/2000
Charge and Transition Form Factors of Light Mesons with LFQM	黃建文	交通大學物理所	05/19/2000
Aperiodicity-Induced Second-Order Phase Transition in the8-State Potts Model	楊朝順	中山大學物理系 中研院物理所	05/23/2000
Synchronizing hyper chaotic systems using a single drive	陳義裕	台灣大學物理系	05/24/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Novel Effects in Few-Electron Quantum Dots	Albert M. Chang	Dept. of Physics, Purdue University	05/25/2000
Applications of Information Economics on Agricultural Marketing	梁高榮	交通大學	05/30/2000
Rotary pump 剖析	李明山	崴碁企業有限公司	05/30/2000
後基因時代的物理學應用 Applications of physical science in the post-genome era	洪榮一	工研院生物醫學工程中心	05/31/2000
Large Magnetoresistance in Magnetic Heterostructures, Nanowires and Single-Crystal Films of Bismuth	錢嘉陵	The Johns Hopkins University	06/01/2000
Chiral Anomaly and Quantum Transport	高涌泉	台灣大學物理系	06/02/2000
Universal expression for localization length in metallic carbon nanotubes	董錦明	南京大學物理系	06/02/2000
Numerical Solution of Poisson-Boltzmann Equation for Protein Structures	Edik Hayryan	Joint Institute for Nuclear Research, Dubna,Russia	06/02/2000
Noncommutative Geometry String Theory	賀培銘	台大物理系	06/08/2000
Surface Plasmon Enhanced Super-resolution near-field optical storage	蔡定平	台大物理系	06/09/2000
New mechanism of X-ray radiation from a relativistic charged particle in dielectric random medium	陳晉平	本所	06/12/2000
Mesoscopic Superconducting Devices: Noise Properties	Yuri M. Galperin	University of Oslo, Norway	06/14/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
幽默的藝術. 藝術的幽默	石瑞仁	新竹師範學院	06/14/2000
Charmless B-Decay in PQCD Method	琴龍淵	本所	06/16/2000
台灣光電半導體產業技術介紹	紀國鐘	中央大學物理系暨光電科學研究所	06/21/2000
Phenomenology of a Supersymmetric Model with Inverted Scalar Mass Hierarchy	高鐘	U. Wisconsin, Madison	06/23/2000
Finite-size scaling for the Ising model on the Mobius strip and the Klein bottle	Yutaka Okabe	Department of Physics, Tokyo Metropolitan University	06/26/2000
Universal Amplitude rations for the ising Model and a Quantum Spin Chain	Izmailian Nikolay	本所	06/26/2000
Probability-changing cluster algorithm for Potts models	Yutaka Okabe	Department of Physics, Tokyo Metropolitan University	06/26/2000
Critical Behavior of Binary Mixture with Polymer	杜其永	本所	06/26/2000
Surface Critical Behavior of Random System	Z. E. Usatenko	本所	06/26/2000
Renormalization Group Approach to a Sandpile Model	林財鈺	本所	06/27/2000
Low-and High-temperature Series Expansions for the Square-lattice Ising Model with First and Second Neighbour Interactions	林克瀛	清華大學物理系	06/27/2000
Coherent Dynamics and Collective Modes in Optical Excitations in Semiconductors	L. J. Sham	University of California	06/29/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Exact green's Function via Perturbation Expansion	林德鴻	交通大學電子物理系	06/30/2000
Kondo Effect in Restricted Geometry (I)	李榮章	SUNY-Buffalo & NCTS	07/10/2000
Kondo Effect in Restricted Geometry (II)	李榮章	SUNY-Buffalo & NCTS	07/11/2000
PhysioNet: A Research Resource for Complex Physiologic Signals	彭仲康	Medical School, Harvard University	07/11/2000
Characterization of Singularity and Renormalization Parameters with Wavelets	Wen-Liang Hwang	Institute of Information Science, Academia Sinica	07/11/2000
Multifractal Characterization of Stochastic Resonance	Alexander Silchenko	Institute of Physics, Academia Sinica	07/11/2000
Scaling Analysis of Bio-Medical Time Series	彭仲康	Medical School, Harvard University	07/11/2000
Self-sustained Current Oscillation in Semiconductors with S- and N-shaped Negative Differential Conductivity	蕭又新	Institute of Physics, Academia Sinica	07/11/2000
A Random Walk on Stock Market	彭仲康	Medical School, Harvard University	07/12/2000
Network Bifurcation Phenomenon and Its Implications to Collective Organizational Behaviors	張復	Institute of Information Science, Academia Sinica	07/12/2000
Transition in A Lid-driven Cavity Flow	Yih-Ferng Peng	Institute of Physics, Academia Sinica	07/12/2000
Operational Wind Wave Prediction	陳炫杉	美國海洋及大氣總署	07/13/2000

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Phase Transition between Ferroelectric and Antiferroelectric States in Perovskite Compounds: PLLZT solid solutions and tetragonal modification of $Yba_2Cu_3O_{6+x}$	V. L. Sobolev	Minot State University	07/14/2000
Nonlinear Optical properties of Ferroelectromagnet $YMnO_3$ studied By Numerical Simulation Methods	董錦明	南京大學物理系	07/14/2000
Introduction to the CDF Production Farm a Parallel Computing System for High Energy Physics Experiment	陳彥竹	中研院物理所	07/26/2000
Numerical Computation of Interface Flows	趙修武	聯合船舶設計發展中心	08/02/2000
Scale-free dynamics of awakenings during sleep	羅中泉	Boston University	08/22/2000
Neutrino Oscillations with Atmospheric Neutrinos	M. Honda	Institute of Cosmic Ray Research University of Tokyo, Japan	08/25/2000
Multi-Fluid Algorithms and Application to Erosion Predictions	牛仰堯	中華大學機械與航空研究所	08/30/2000
淺談資訊安全	吳宗成	台科大資訊管理系	09/06/2000
Self-diffuion on fcc(100) Surface and Si(III)-7X7 Surface	張俊明	National Center for High-performance Computing	09/08/2000
Numerical micromagnetics of soft ferromagnetic platelets and wires	N. A. Usov	Troitsk Institute for Innovation and Fusion Research, Russia	09/13/2000
Baryon Symmetric Universe, Its signature, Search and Consequences	S. A. Stephens	University of Tokyo	09/15/2000
Magnetism Beyond 2000	Arthur J. Freeman	Northwestern University	09/20/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
漫談「人類基因體計畫」	蔡世峰	國家衛生研究院及國立陽明大學	09/20/2000
Andreev Reflection & Optical Phase Conjugation	C. Beenakker	Institute-Lorentz, University Leiden, The Netherlands	09/25/2000
Laser-Driven Particle Acceleration	黃衍介	清華大學電機工程學系	09/27/2000
Final State Interactions and the Gamma Angle	楊桂周	中原大學物理系	09/29/2000
New Approach to Strong Field QED	林貴林	交通大學物理所	10/06/2000
Towards Ratuonal Design of a High Efficiency Thermoelectric Material	John S. Tse	Steacie Institute for Molecular Science National Research Council of Canada	10/06/2000
A Random Walk down Wall Street: Models of Physics for Financial Markets	Johannes Voit	University of Bayreuth, Germany	10/11/2000
Mass Spectra of N=2 Supersymmetric SU(n) Chern-Simons-Higgs Theories	高賢忠	淡江大學物理系	10/13/2000
Electronic Structure of One-Dimensional Superlattices	Johannes Voit	University of Bayreuth, Germany	10/17/2000
聖經真的藏有密碼嗎？ <<一場統計論戰>>	魏慶榮	中研院統計所	10/18/2000
Q-Number essence of the Time and Time-Energy Uncertainty Relation	Nguyen Vinh Quang	Institute of Physics, Vietnam	10/18/2000
Recent Development on Turbulent Soap Film Flows	溫志湧	大葉大學機械系	10/23/2000
Biofluid Mechanics and Athoroscroloses	陶祖萊	科學院國家微重力實驗室	10/25/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
AMS Physics Results	黃明輝	中研院物理所	10/27/2000
High Magnetic Fields: Driving New Science and Technology	Jack E. Crow	Florida State University	10/27/2000
Single Charged Higgs Production at a Muon Collider	Andrew Akeroyd	日本 KEK 實驗室	11/03/2000
Developments and Observation Results of Balloon Borne Hard X-ray Telescope---EXITE2	周翊	Harvard University	11/03/2000
Nanoscale Field-Induced Qxidation	果尙志	清華大學物理系	11/04/2000
不可與詩	王靖獻	東華大學人文社會科學學院	11/08/2000
A Theory of Consciousness: From the Cognitive Point of View	張復	中研院資訊科學所	11/09/2000
String Tension, Stability, and Electronic Structure of Magic Tip-Suspended Nanowires	E. Tosatti	SISSA, and ICTP, Trieste Italy	11/13/2000
Supernova Neutrinos	Petr Vogel	California Institute of Technology	11/15/2000
The Metal-Insulator Transition in Quasicrystalline AlPdRe Films	Rosenbaum	School of Physics, Tel Aviv University	11/17/2000
DNA 與蛋白質的關係	紀豐民	中科院理論所(北京)	11/18/2000
Neutrino Masses in Supersymmetric SO(10) Models	周志隆	中研院物理所	11/23/2000
Determinism at the Planck scale	Gerard't Hooft	University of Utrecht	11/29/2000
Lepton Flavor Mixing, Majorana Neutrino Masses and Neutrino Oscillation`	Sin Kyu Kang	韓國 KIAS 研究中心	12/01/2000

演　講　題　目	演講者姓名	所　屬　機　構	日　期
Artificial Flux Pinning Centers on Superconducting Thin Film	洪連輝	彰化師範大學物理系	12/01/2000
Fabrication and Characterization of Patterned Magnetic Field Sensors	吳仲卿	彰化師範大學物理系	12/01/2000
Earthquake Physics Research	王錦華	中研院地球科學研究所	12/06/2000
Ab Initio Investigation of Particle-hole Response, and quasiparticle states, in correlated solids	Adolfo G. Eguiluz	University of Tennessee	12/08/2000
Introduction to Ferromagnetic Semiconductor	林秀豪	清華大學物理系	12/08/2000
Self-breaking of the Standard Model Gauge Symmetry	Hsin-Chia Cheng	University of Chicago	12/15/2000
Self Assembled Monolayers on Metals: Structures and Applications	陶雨臺	中研究化學研究所	12/16/2000
大氣聲學概論	楊訓仁	中國科學院聲學所	12/20/2000
Combinatorial MBE synthesis and characterization of magnetic alloys or Multicomponent alloys - Novel properties and combinatorial synthesis	徐天方	北卡大學物理系	12/22/2000
CP Violation in a Charged Higgs Production	白勝元	國立台灣大學	12/22/2000
連續電泳流體力學地基模擬	陶祖萊	科學院國家微重力實驗室	12/27/2000
Twist Expansin for Charmless B decays	葉聰文	國立交通大學	12/29/2000

Visiting Scholars

中央研究院物理所八十九年度訪問學人表

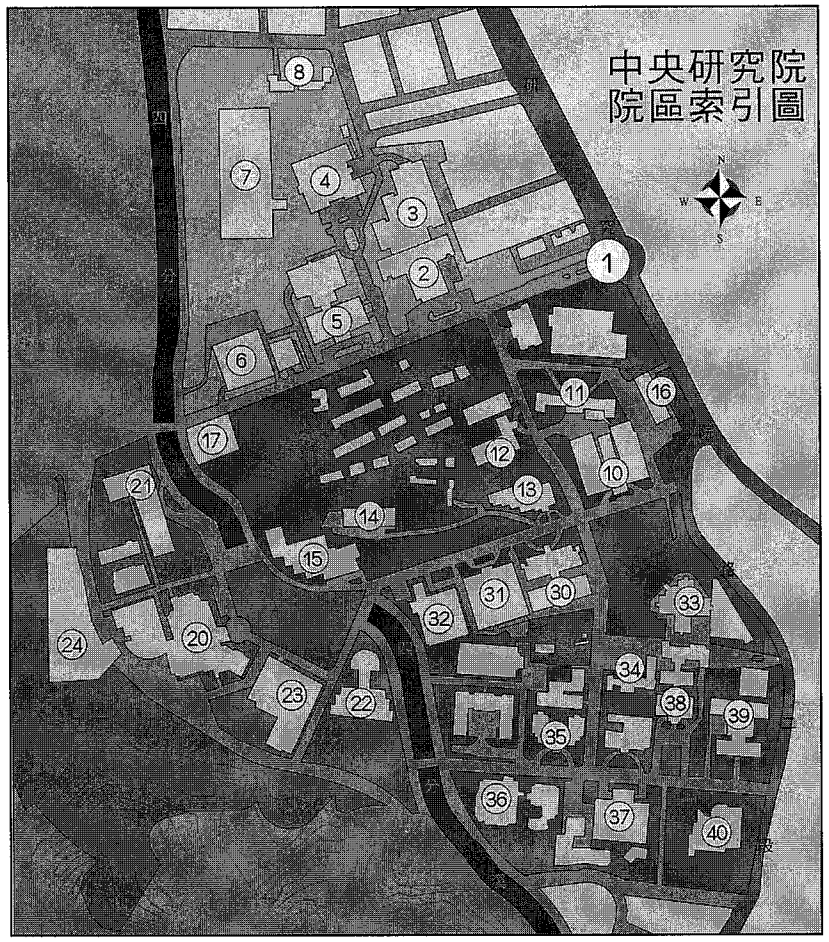
(2000 年 1 月~2000 年 12 月)

訪 問 學 人	所 屬 機 構	訪 問 期 間
沈元壤（本院院士）	UC Berkeley	01/08/2000-01/11/2000
Viatcheslav B. Priezzhev	Labor. of Theoretical Phys. Dubna Russia	01/13/2000-02/12/2000
劉延	中國科學高能物理研究所	01/15/2000-03/31/2000
倪達(Noltán Néda)	Babes-Bolyai University	02/10/2000-03/11/2000
Ulrich H.E. Hansmann	Michigan Technological Univ.	02/20/2000-03/02/2000
周祖英	中國原子能科學研究院	03/01/2000-04/15/2000
何健民	Wichita State Univ.	03/15/2000-04/03/2000
喬玲麗	美國加州大學	03/26/2000-03/27/2000
Sin Kyu Kang	韓國 KIAS 研究中心	03/26/2000-03/28/2000
陳廷楊	南京大學	03/26/2000-03/31/2000
葛培文	中國科學院	04/10/2000-04/26/2000
唐澤眉	中國科學院	04/11/2000-04/26/2000
董錦明	南京大學	04/16/2000-07/15/2000
Andrew Gerard Akeroyd	日本 KEK 實驗室	04/24/2000-05/06/2000
Tsuyoshi Masumoto	日本科學院	04/26/2000-04/29/2000
Edik Hayryan	Senior Scientific Researcher	05/03/2000-06/04/2000
Chia-Ling Chien	John Hopkins Univ.	05/30/2000-06/07/2000
李匡邦	美國麻州大學	06/03/2000-09/02/2000
何健民	Wichita State Univ.	06/07/2000-07/03/2000
劉正山	山西輻射防護院	06/09/2000-06/29/2000
Yutaka Okabe	Tokyo Metropolitan Univ.	06/20/2000-06/29/2000
高鐘	美國威斯康辛大學	06/26/2000-06/26/2000
沈呂九（本院院士）	UC Sandiego	06/27/2000-07/01/2000
李湘楠	成功大學	06/29/2000-07/01/2000

訪 問 學 人	所 屬 機 構	訪 問 期 間
崔瑩鎮	韓國 Inha 大學	06/29/2000-07/09/2000
Alfred T. Goshaw	CDF 國際合作計畫負責人	07/15/2000-07/19/2000
何健民	Wichita State Univ.	07/28/2000-08/21/2000
劉思煌	美國 Nebraska 大學	08/01/2000-08/30/2000
Ulrich H.E. Hansmann	Michigan Technological Univ.	08/02/2000-08/24/2000
陳丕燊	美國史丹佛加速器中心	08/04/2000-08/13/2000
梁培德	美國波特蘭大學	08/07/2000-08/26/2000
Vladimir F. Morozov	Yerevan State Univ.	08/09/2000-09/08/2000
Honda	日本東京大學	08/21/2000-08/28/2000
Hyun Seok Yang	韓國 Sogang 大學	09/07/2000-09/13/2000
Ingrid-Maria Gregor	德國 Wuppertal 大學	09/13/2000-09/20/2000
熊詩杰	南京大學	10/01/2000-01/31/2001
侯龍	北京原子能研究院	10/01/2000-01/31/2001
Johannes Voit	德國 Bayreuth Univ.	10/04/2000-10/31/2000
梁宗嶽	美國 Delaware 大學	10/11/2000-11/10/2000
陶祖萊	中國科學院	10/16/2000-12/31/2000
Letessier-Selvon	法國巴黎大學	10/17/2000-10/21/2000
Chia-Ling Chien	John Hopkins Univ.	10/25/2000-10/26/2000
Andrew Gerard Akeroyd	日本 KEK 實驗室	11/02/2000-11/06/2000
Sin kyu kang	韓國 KIAS 研究中心	11/26/2000-12/06/2000
李匡邦	美國麻州大學	12/26/2000-01/29/2001

中央研究院院區圖
Map of Academia Sinica

1. 院區大門
Main Entrance
2. 生物醫學科學研究所
Institute of Biomedical Sciences
3. 國家衛生研究院
National Health Research Institutes
4. 動物研究所
Institute of Zoology
5. 分子生物研究所
Institute of Molecular Biology
6. 生物化學研究所
Institute of Biological Chemistry
6. 生命科學圖書館
Life Science Library
6. 天文及天文物理研究所
Institute of Astronomy
and Astrophysics
7. 國家實驗動物繁殖
及研究中心
Animal Breeding
and Research Center
8. 幼稚園
Kindergarten



10. 行政大樓及計算中心
Administration Office
and Computing Center
11. 臺灣史研究所(動、植物所標本館)
Institute of Taiwan History
12. 植物研究所
Institute of Botany
13. 數學研究所
Institute of Mathematics
14. 蔡元培館
Tsai Yuan-Pei Memorial Hall
14. 調查研究工作室
Office of Survey Research
15. 統計科學研究所
Institute of Statistical Science
16. 郵局
Post Office
17. 水生植物生態實驗池

20. 學術活動中心
(中西餐廳、四分溪書坊)
Center for Academic Activities
(Restaurants、Bookstore)
21. 中國文哲研究所
Institute of Chinese Literature
and Philosophy
22. 地球科學研究所
Institute of Earth Sciences
23. 綜合體育館
Gymnasium
24. 汽車停車場
Parking Lot

30. 化學研究所
Institute of Chemistry
30. 生物農業科學研究所
Institute of Bio-Agricultural Sciences
31. 中山人文社會科學研究所
Sun Yat-Sen Institute for
Social Sciences and Philosophy
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Institute of Information Science
★33. 物理研究所
Institute of Physics
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and Engineering Research
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Hu Shih Memorial Hall
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36. 歐美研究所
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American Studies
37. 歷史語言研究所
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Social Science Research Center
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Institute of Ethnology
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中央研究院物理研究所年報

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