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I

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II

Review of Research Projects

HYDRODYNAMICS AND ATMOSPHERIC PHYSICS

1. Review of Research Activities

- (1) Basic Research in Hydrodynamics
 - a. Visualization of air bubble stream in stratified water
 - b. Shear and wall effects on vortex shedding behind an obstacle
 - c. Turbulence intensity and mean flow behind two cylinders
 - d. Diffusion and mixing of buoyant jets
- (2) Numerical Methods
 - a. Numerical investigations of turbulent vortex shedding flows
 - b. Numerical simulations of three-dimensional low-Reynolds number flows
 - c. Numerical experiments of monotone semi-Lagrangian method
- (3) Atmospheric Physics
- (4) Physics of Complex Fluids
 - a. Dynamics of binary mixture with dissolved polymer
 - b. Phase separation of binary mixture in porous medium
 - c. Electrorheological fluid
 - d. Sonoluminescence
 - e. Dynamics of soap films bursting

2. Facilities

- (1) Water Channel Laboratory
- (2) Optical Hydrodynamic Laboratory

3. Future Outlook

- (1) Basic and applied research of turbulence
- (2) Two-dimensional turbulence in soap film
- (3) Physics of complex fluids

1. Review of Research Activities

The members of our group are very active in conducting both basic and applied researches related to the physics of fluids. The basic research projects span the area of turbulence, two-dimensional flow, physics of soap film dynamics, sonoluminescence, phase transitions of complex fluid, fluid properties in porous medium and nonlinear oscillations problem. In applied researches, we are studying environmental fluid mechanics, mixing and diffusion of buoyant jets, numerical scheme for dilute gas-particle nozzle flow and modeling of atmospheric radiation related to remote sensing problems. Brief descriptions of these ongoing projects are given below.

(1) Basic Research in Hydrodynamics

a. *Visualization of air bubble stream in stratified water:*

We are studying the behavior of gas well blowout under sea water. The spreading characteristics of the air bubble stream in density stratified water setup in a water tank is investigated experimentally. A CCD camera is used to observe the flow pattern and the imaged data were analyzed by digital image processing technique. We found that the air bubble stream characteristics were strongly affected by the flow rate air discharge and the ambient stratification. In the future, we shall carried out detail measurement of the flow field of the air bubble stream.

b. *Shear and wall effects on vortex shedding behind an obstacle:*

The motion of flow over a bluff body arises in various engineering problems. It results in the wake frequently associated with unsteady and periodic vortex shedding. When the obstacle is near a wall, the effect of shear due to the wall cannot be ignored. Using numerical method, we investigate the effect of the shear rate of the ambient stream on the Stroke number and the dynamical force over the obstacle. We found that the presence of the wall affects the behavior of vortex shedding such that the frequency and the flow development in the wake are modified. In the future, we are going to extend our study to the turbulent regime by increasing the Reynold number and to compare the flow development when the ambient conditions are changed.

c. *Turbulence intensity and the mean flow behind two cylinders:*

Turbulence has been on of the unsolved problems in physics. Understanding the basic behavior of turbulence is necessary for both academic and practical reasons. Since cylinders in side by side arrangement are commonly encountered in practice, we are studying the turbulence intensity effect on the mean flow behind two cylinders in such arrangement. Using hot wire anemometer and A/D converter, we are able to

in such arrangement. Using hot wire anemometer and A/D converter, we are able to measure the turbulence signal. The statistical properties of the flow field are extracted from the digital turbulence signals by standard statistical methods. By separating the turbulence intensity from the conventional mixing of the mean velocity from our measured data, we found that stronger turbulence intensity is favorable to the development of wake mean velocity profile behind the cylinders. Also the vortex shedding frequency varies with turbulence intensity. We will investigate the Reynold Stress variation under different turbulence intensity case in the future.

d. *diffusion and mixing of buoyant jets:*

Turbulence mixing of buoyant jets is significant and important in practical engineering applications such as dispersion of the plume of smoke from industrial chimney into atmosphere and the use of ocean-outfall to release sewage water into ocean. In order to design waste disposal system we need to understand the mixing and dilution process for buoyant development and to establish the capability of estimating the rise and width of buoyant jet. Using both experimental and numerical approaches, we found that i) ambient density stratification limit the vertical rise and restrict the mixing; and ii) the formation of the secondary and the third pairs of vortices causes the jet flow to oscillate from its maximum height-of-rise. We are planning to improve our numerical scheme of turbulence modeling that can account for the effect of density-stratification. The results of the numerical scheme will be compared to our experimental data.

(2) Numerical Methods

a. *Numerical investigations of turbulent vortex shedding flows:*

Turbulent vortex shedding flows past a square cylinder are numerically investigated. The calculations were carried out both by the second-order turbulence model and the large eddy simulations. The performance of the computations was evaluated by comparing the numerical results with data from available experiments. Results indicate that although the simulations with the second-order closure turbulence model give good agreement in the shedding frequency and mean dray as well as in some phase profiles of the mean velocity, the turbulence model underpredicts the turbulence energy level on the central-line considerably. The agreement of the large eddy simulations of flow structures and turbulence statistics with experimental data is good.

b. *Numerical simulations of three-dimensional low-Reynolds number flows:*

Low Reynolds number flows over a fence in a channel with a large aspect ratio $W/H=18$, are numerically solved both by the two-dimensional approximated and three-dimensional realistic simulations. The result show that the two-dimensional simulations obviously deviate from the experimental data at the symmetrical plane while the three-dimensional simulations fit the experiments well. Flow distributions along the span-wise direction reveal that the main stream motion are nearly two-dimensional, while the flow motions in reversed zone are quit three-dimensional.

c. *Numerical experiments of monotone semi-Lagrangian method:*

In this project, we plan to use a class of monotone interpolation schemes for solving problems arising in semi-Lagrangian method which has the attractive advantage of long time-step. This numerical scheme follows the wind field characteristics backward in time, and then finds the departure point of the last time-step. Since such point is not usually on regular mesh, and some sort of interpolation is needed. However, the conventional procedures applied for interpolation of the departure point often lead to numerical oscillations. Over- and undershoot occur near strong gradients or discontinuities. This numerical oscillations phenomenon can result in nonphysical negative or super-saturation in a cloud model. In this project, we introduce a special monotone interpolation scheme which is capable of preserving the shape of the solution and of suppressing the numerical oscillations. The monotonicity is maintained by limiting the derivative values or using ideas from the FCT (flux corrected transport) schemes. In this work, we tested the algorithms with non-divergent wind field. We found that our algorithms can indeed suppress the wiggles and preserve the shape of the solution for advective process and in the same time possesses the advantage of semi-Lagrangian scheme.

(3) **Atmospheric Physics**

The two meteorological satellite systems that monitor the weather and storms in the East Asia area are the polar-orbiting NOAA satellites and geostationary satellite called GMS. The GMS has the advantage of giving images more frequently, as often as every half-hour and its coverage is large enough for synoptic weather analysis in the East Asia area. Since the atmosphere always masks the satellite images, modeling of radiative transfer to account for the atmospheric effects is needed to obtain cloud parameters. Therefore cloud analysis chart as derived from the satellite image data is valuable in weather analysis and forecasting. First the satellite data and the

radiosonde data were used to make viewing angle correction and the water vapor correction. Then the cloud height and cloud top temperature was derived from the corrected infrared data, and the cloud amount, from the corrected visible data. The sea surface temperature retrieved over the cloudless region was compared with the buoy data collected by NODC. Finally a simple analysis was performed to get the high, middle and low cloud amount, which were in good agreement with the parameterized cloud amount.

(4) **Physics of Complex Fluids**

a. *Dynamics of binary mixture with dissolved polymer:*

Dynamics of a critical binary liquid mixture (2,6-lutidine + water, LW) with a small amount (<1 mg/cc) of dissolved high molecular weight polymer (polyacrylic acid, $M_w=75E4$) near the critical point of LW is studied by light scattering methods. When the sample is in one phase, we observe both the diffusion of the polymer molecules and the critical composition fluctuation of the solvent. We find power law dependence of the decay rate of the critical composition fluctuation on the reduced temperature with exponent $\nu = 0.5$ which is less than that ($\nu = 0.6$) for the pure binary mixture. When the sample is quenched to the unstable state, it phase separates via spinodal decomposition. From the temporal evolution of the spinodal ring we find that the basic mechanism of the early stage growth of the domain size for samples with and without polymer is the same except that the correlation length of the polymer system is much longer than that without polymer.

b. *Phase separation of binary mixture in porous medium:*

The phase separation behavior of a fluid inside porous medium is very different from that of the bulk fluid. Due to the geometrical confinement and the presence of a lot of surfaces, the change in the static and dynamical behavior of phase separation can be significant if the pore size is small. We found that the phase separation temperature T_p s of binary liquid mixture inside random packing of glass beads can be located by measuring the electrical resistance. With this technique we find that T_p s of the binary mixture isobutyric acid and water of near critical composition inside random packing of $40 \mu\text{m}$, $130 \mu\text{m}$ and 1.5 mm diameter glass beads is the same as the bulk. We also find that fluid exchange from the packing to the outside is prohibited for $130 \mu\text{m}$ and $40 \mu\text{m}$ diameter beads packing. Such blockage of fluid exchange suggests that the characteristic domain size inside the packing cannot grow bigger than the capillary length so that gravity assist demixing cannot proceed.

c. *Electrorheological fluid.*

Electrorheological fluids are those whose rheological properties can be changed by an imposed electric field. They are usually suspension of micron size particles in a non-conducting fluid. We have studied the dielectric response of a rheological fluid made of semi-conductive polymer in silicone oil. By comparing the dielectric spectra of two polymers (polyaniline and sulfonated copolyaniline) with similar chemical structure, we hope to clarify the basic mechanism of the observed the electrorheological behavior of these suspensions.

d. *Sonoluminescence.*

We have successfully observed the phenomenon of sonoluminescence of a single bubble. Using photomultiplier and photodiodes, we recorded the intensity of the light emitted and the size of the bubble during sonoluminescence. Pressure sensors and actuators are employed to monitor and control the ambient pressure of the bubble. We find that the luminescence is very sensitive to the change in ambient pressure. Also, we find a new phase of sonoluminescence in which the intensity of the light oscillates in a period of a few seconds. Numerical calculations are being done to understand the mass transport effect of the change in ambient pressure.

e. *Dynamics of soap films bursting.*

In order to study the very fast hydrodynamics in bursting of soap film; especially the formation of aureole ahead of the bursting rim, we used optical interference and line scan CCD photography to record the thickness changes during the bursting process. We found that the formation of the aureole and shock wave on the film depend on the surfactants being used. Furthermore, we are able to record the bursting profile which has never been reported before. Theoretical calculations are now being done to understand the experimental findings.

2. Facilities

(1) Water Channel Laboratory

In the Water Channel Laboratory, we have a water channel to study the hydrodynamic phenomena of under water flow when controlled air current is imposed above the water surface. The channel has a cross section of 60cm X 60cm and 8m long. Flow can be realized by a towing track mounted on the channel or by a closed loop type pumping system that circulate the fluid inside the channel. A wave generator is installed for making wave of various amplitude and frequency. The flow

can be measured using hot wire, hot film and salinity gauge. Recently a particle imaging velocimetry system with high resolution camera and digital imaging capability has been developed for quantitative measurement of the flow field in the water channel.

(2) Optical Hydrodynamic Laboratory

We have an optical hydrodynamic laboratory for studying the basic phenomena in complex fluids and non-linear phenomena in hydrodynamics systems. The research instruments include a two dimension laser Doppler velocimeter, a commercial goniometer for static and dynamic light scattering measurement, two digital correlators, an optical microscope, a fluorescent microscope, several image acquisition and analysis systems, a fast line scan camera, ..., etc. There are also many home made instruments for particular experiments. We have several computer controlled programmable temperature air and water bath for studying phase transitions of complex fluids, a laser scanning reflectometer for measuring the shape of liquid interfaces, an automatic film pulling setup with synchronized electric spark and video capture system to observe the rupturing of soap film. A light scattering setup for sonoluminescence experiment. Recently we are building a rotating stage in vacuum chamber to study two-dimensional flow separation.

3. Future Outlook

It has been decided that our institute should concentrate our efforts in the area of non-linear physics and nano-scale physics. Our ongoing researches are indeed important topics of the non-linear physics such as the basic and applied researches on turbulence as well as the dynamics of complex fluids. Some of our planned researches are given below.

(1) Basic and applied research of turbulence

Turbulence is a fascinating phenomenon that one can observe in daily life. It also gets in the way of many engineering problems. Complexity and randomness are the two properties of turbulence. Nevertheless, it follows some general laws which are comprehensible. Theoretically, turbulence can be described by the Navier-Stokes equation, which is non-linear and difficult to solve. Thus, it is very important to develop an accurate, effective and practical numerical scheme for predicting turbulence. On the other hand, precise turbulence experiments and measurement of

the turbulence flow field are essential for the development of the theoretical and numerical approaches to the problem of turbulence. With the completion of our new wind tunnel laboratory, better wind tunnels and water tunnels suitable for high Reynold number investigation will be built for the experimental studies of turbulence.

(2) Two-dimensional turbulence in soap film

A soap film, which is created by surfactants, is a novel quasi two-dimensional system suitable for studying basic hydrodynamics phenomena in two-dimension. In the soap film experiments described in the previous sections, we have already mastered the technique of generating stable soap films. We are planning to construct a two-dimensional eccentric Couette cell and a two-dimensional soap film water tunnel. The soap film water tunnel, which will be installed in the new wind tunnel laboratory, will be 10 meter high in order to reach the turbulence regime. The flow field in the soap film water tunnel will be measured using our LDV and PIV systems.

(3) Physics of complex fluids

Complex fluids include polymer, surfactant, liquid crystal, binary mixtures, granular systems, ..., etc. These materials are very common in industrial processes and studies of these complex fluids originate from the industrial needs and the emphasis of these investigations is put on the engineering aspect. Basic research on complex fluids is difficult because of the internal degree of freedom of the complex fluid and one cannot deduce their dynamical behavior from their static structure. Nevertheless, due to the advance of non-linear science, basic research on the complex fluids is getting more attention. Therefore, we shall continue our works on binary mixture phase separation, polymer solution, soap film, electrorheological fluids and granular systems.

NUCLEAR PHYSICS AND ACCELERATOR-BASED PHYSICS

1. Experimental Nuclear Physics and Accelerator-Based Physics

- (1) Neutrino oscillation, pilot experiment
- (2) ${}^7\text{Li}$ - ${}^{45}\text{Sc}$ reactions below Coulomb barrier
- (3) Structure and life times of the excited states of ${}^{55}\text{Cr}$ nucleus via ${}^{54}\text{Cr}(\text{d},\text{pr}){}^{55}\text{Cr}$ reaction at $E_p=4.5$ MeV
- (4) Charge state dependence of copper L-shell x-ray production by 4-14 MeV oxygen ions
- (5) Stopping powers of MeV energy ions ${}^7\text{Li}$, ${}^{12}\text{C}$, ${}^{16}\text{O}$ and ${}^{28}\text{Si}$ in some common target materials.
- (6) Effect of irradiation on the physical properties of some advanced material
- (7) L X-ray production in lanthanide elements by 1-5 MeV helium ions
- (8) Applied studies of PIXE in elemental analysis
- (9) Study of p- ${}^{11}\text{B}$ reaction associated with clean fusion fuel and analysis of boron targets

2. Theoretical Nuclear Physics

- (1) Theoretical Studies of Hypernuclei and Meson Systems
- (2) Hadron Gas Model in Heavy Ion Collisions

1. Experimental Nuclear Physics and Accelerator-Based Physics

(1) Neutrino oscillation, pilot experiment

The Nuclear Power Reactors of Taiwan Power Company can potentially provide the most ideal and powerful antineutrino $\bar{\nu}_e$ sources for researches on neutrino oscillation. Its results will lead to definitive answers to the questions on fundamental properties of the neutrinos, as well as, on cosmological puzzles such as the deficit of solar neutrinos and the properties of Dark Matter.

Searching for neutrino oscillation is the most sensitive and effective measurement on neutrino mass and flavour mixing. We intend to carry out a pilot experiment to study the feasibility of a full scale neutrino oscillation experiment with the $\bar{\nu}_e$'s provided by Power Plant-II of the Taiwan Power Company.

Several kinds of scintillation material have been developed and tested with boron loaded. The bulk light yield and attenuation length of these materials seems to be satisfactory for small detector cell. Background investigation, DAQ design, and neutron transport simulation are almost completed. A table top detector module has been constructed for large scale scintillation material manipulation training. Experimental site has been selected. It is expected that the phase I data taking will start before mid-1998.

(2) ${}^7\text{Li}$ - ${}^{45}\text{Sc}$ reactions below Coulomb barrier

${}^7\text{Li}$ ion beam and ${}^{45}\text{Sc}$ target collisions have been carried out in the energy range 4.57 to 11.90 MeV with energy steps 210 to 840 keV depending on incident energies. Gamma-rays emitted from excited residual nuclei were measured by using a large volume high purity Ge detector. At higher incident energies, radiation from low-lying excited states of mass number 50,27,26,25 and 44 nuclei dominate the measured spectra, suggesting that the $2n$, np , $n\alpha$, $2n\alpha$, 2α , evaporation and inelastic scattering are the main reaction mechanisms in this energy range.

(3) Structure and life times of the excited states of ${}^{55}\text{Cr}$ nucleus via ${}^{54}\text{Cr}(d,pr)$ ${}^{55}\text{Cr}$ reaction at $E_p=4.5$ MeV

The ${}^{54}\text{Cr}(d,pr)$ ${}^{55}\text{Cr}$ reaction at deuteron incident energy of 4.5 MeV has been

carried out at IPAS. The proton spectra, p - γ spectra, the γ - γ coincidence spectra and the γ - γ correlation functions for the cascade transition in ${}^{55}\text{Cr}$ are obtained. The lifetimes of the excited states of ${}^{55}\text{Cr}$ nucleus are determined by using the Doppler Shift Attenuation Method (DSAM).

(4) Charge state dependence of copper L-shell x-ray production by 4-14 MeV oxygen ions

Charge state dependence of L-shell x-ray production cross sections in ${}^{28}\text{Cu}$ bombarded by 4-14 MeV ${}^8\text{O}^q$ ions with charge states from $q=3+$ to $8+$ was measured using a Si(Li) x-ray detector with a resolution of 96 eV at 1 keV. An ultra-thin copper foil was used to ensure single collision conditions. The data for the total L x-ray production cross sections are compared to the predictions of the first Born and the ECPSSR calculations for L-shell ionization converted to x-ray production cross sections using a single-hole fluorescence yield. Except at the lowest projectile velocity, the ECPSSR theory gives satisfactory agreement with the data while the first Born theory overpredicts all the data in the investigated energy range by almost two orders of magnitude. Measurements of the charge state dependence of the target L-shell x-ray production cross sections allowed separating contributions of the electron capture (EC) and the direct ionization (DI) to the inner-shell ionization. The EC contributions were extracted from the x-ray measurements with two, one, and no K-shell vacancies in the oxygen ions. These EC cross sections are compared with the results of an OBK approximation and the ECPSSR theory, and found to be significantly smaller than both electron capture calculations.

(5) Stopping powers of MeV energy ions ${}^7\text{Li}$, ${}^{12}\text{C}$, ${}^{16}\text{O}$ and ${}^{28}\text{Si}$ in some common target materials

Stopping powers of 0.4-8.5 MeV ${}^7\text{Li}$ -ions, 0.4-10 MeV ${}^{12}\text{C}$ -ions, 0.3-14 MeV ${}^{16}\text{O}$ -ions and 0.5-11.5 MeV ${}^{28}\text{Si}$ ions in four commonly used materials (Al, Cu, Ag and Au) have been determined by using the backscattering method. Elastic backscattering spectra were measured at a laboratory detection angle 170° using a passivated implanted planar Si (PIPS) detector. Energy dependence of stopping

powers were obtained and compared to the semiempirical model (TRIM-91 and SRIM-96) predictions. The SRIM-96 calculations generally reproduce the experimental data more closely and lead to a significant improvement of the agreement of the ${}^7\text{Li}$ data when compared to TRIM-91.

(6) Effect of irradiation on the physical properties of some advanced material

We have used 3 MeV O-ion generated from 3MeV Tandem accelerator to bombard two kinds of advanced material high-Tc superconducting YBCO and Giant magnetoresistive Ag-Co. The irradiation source was 3 MeV O-ion with the dose of 10^{13} and $10^{14}/\text{cm}^2$, respectively. For YBCO, we study the irradiation effect on its Hall resistivity ρ^{xy} and longitudinal resistivity ρ^{xx} . It was observed that the peak value of the negative ρ^{xy} increases significantly at 1 tesla, but decreases at 2 and 3 tesla after the irradiation, while ρ^{xx} varies in the opposite direction. For Ag-Co granular film, we observed that the resistance R varied over 50% after the irradiation of O-ions, but the field dependence of the normalized magnetoresistance ratio $[R(H)-R(O)]/R(O)$ was nearly constant with irradiation. From these two examples, we have demonstrated a wide possibility of using the irradiation as a probe to detect physical properties of solids.

(7) L X-ray production in lanthanide elements by 1-5 MeV helium ions

L x-ray production in ${}_{57}\text{La}$, ${}_{60}\text{Nd}$, ${}_{64}\text{Gd}$, ${}_{68}\text{Er}$ and ${}_{71}\text{Lu}$ was measured for He^+ bombardment in the energy range 1-5 MeV. Very thin target foils were used, and x-ray yields were measured simultaneously with elastically scattered ions. The L-shell and individual $L\alpha$, $L\beta$, $L\gamma$, and L_I production cross sections and their ratios were extracted. These cross sections are compared to the results of the ECPSSR theory (energy-loss and Coulomb deflection effects, perturbed stationary state approximation with the relativistic correction), its united-atom (UA) extension UA-ECPSSR, and the UA-ECPSSR-MI which also accounts for multiple ionization (MI). With a few exceptions, the standard ECPSSR appears to be better than its modifications when $L\beta/L\alpha$ and $L\gamma/L\alpha$ ratios are analyzed. $L\alpha$, $L\beta$, $L\gamma$ and L_I and total L-x-ray production cross sections, however, are in the best overall agreement with the UA-ECPSSR-MI theory.

(8) Applied studies of PIXE in elemental analysis

In this work, recent applied studies of PIXE in elemental analysis were made. Using PIXE technique, measurements for a collection of precious ancient Chinese artifacts have been performed with use of 3 MeV protons from 9SDH-2 tandem accelerator. From the elemental determination with external-beam PIXE and vacuum-beam PIXE, the main and minor elemental contents of ancient bronzes and potsherds were obtained. The samples studied include fragments of bronze weapons of Yin-Shang and Chou dynasties, and Penghu potsherds recently recovered from the sea bottom in the Penghu coast near Taiwan. Details of experimental results are discussed.

(9) Study of p- ${}^{11}\text{B}$ reaction associated with clean fusion fuel and analysis of boron targets

Using PIPS and ΔE detector system, spectra of ${}^{11}\text{B}(p,2\alpha){}^4\text{He}$ sequential decay via the first excited state of ${}^8\text{Be}$ were measured for the first time. Backscattering spectra of natural boron target were also measured. Good energy resolution (13.9keV) of the detection system achieved in this work enables us to separate clearly various peaks from elements contained in the target. Results of composition analysis are obtained and discussed.

2. Theoretical Nuclear Physics

(1) Theoretical Studies of Hypernuclei and Meson Systems

The proposed collaborative research program is aimed at investigating the dynamics of hadron systems accessible to new experimental facilities RHIC and CEBAF. The Program has two main components: (1) Calculation of pion equation of state at high density and high temperature, (2) Hypernuclei with three-body force. The focus of the investigation is the correlation effects in pion systems results from the hadronization of the quark-gluon plasma and hypernuclei produced by GeV electron scattering. The investigation will be carried out by combining the many-body methods developed by Kuo, Tzeng, Tsay and the dynamical models for meson-meson scattering developed by Lee.

(2) Hadron Gas Model in Heavy Ion Collisions

The experiment 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 will be 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.

PARTICLE PHYSICS

1. Experimental of High Energy Physics

2. Particle Phenomenology

- (1) Nonleptonic Weak Decays of Bottom Baryons
- (2) A Phenomenological Analysis of Heavy Hadron Lifetimes
- (3) Sea Quark or Anomalous Gluon Interpretation for $P_1(x)$
- (4) Mesonic Form Factors and the Isgur-Wise Function on the Light-Front
- (5) Weak Decay Process of $B \rightarrow \rho \ell \bar{\nu}_\ell$: A Varying External Field Approach in QCD Sum Rules

3. Gravitation and Cosmology

- (1) CMB Anisotropy and Polarization
- (2) Scale Invariance and Gravity

1. Experimental of High Energy Physics

With the discovery of the top quark in March 1995, the Fermilab collider RunI comes to an end in August 1996. The fixed target run starts right afterwards. The CDF operation now focuses on analyzing existing RunI data, for which our group play a major role in its production, and on the detector upgrade, for which we have a major role in producing the optical readout system. The next collider run (RunII) is expected to start by the end of 1999.

During the year, Jaroslav Antos (安德斯) and Ping Yeh (葉平) obtained the top mass employing the dilepton top quark events of CDF, using a method they developed earlier. Ping had his thesis finished and successfully defended in June. He served in the Military for three months, joined us again after the compulsory military service, and was elected one of the ten Academia Sinica Fellows. Their analysis of the top quark mass is expected to be published in 1997.

Paoti Chang (張寶棟) chose to work on QCD related topics. He analysed the 6-jet events with large total transverse energy and found that Herwig Monte Carlo can fit the data well. This work enables him to understand all the details of jet-analysis at CDF. It also enables us to understand the QCD background and paves the way for us to search for new physics with the current CDF data. Paoti's result is expected to be published in 1997 also.

Paoti's work as well as Jaroslav and Ping's work represent the first physics analysis results out of our group member's initiatives. We hope that more are to come.

On the physics front, Ming-Jer Wang (王明哲) worked on applying the method developed by Jaroslav and Ping to the lepton-jet top quark events. Paul Chang (張博舜) worked very hard trying to measure the Λ_b life time through alternative decay channels than the one already published by CDF. We wish them success in the near future.

As Jaroslav went back to Slovakia and H.Y. Chao (趙效瀛) left our group, Paul Chang became the only expert on SVXII simulation using CDFSIM. He played an important role in the preparation of the TDR for CDF upgrade project. Ping and

Paoti continued to be responsible for CDF data production. Their job comes to a happy end soon after the collider RunI finished.

The development of the DOIM(Dense Optical Interface Module) for the SVXII upgrade progresses slowly. The bipolar transmitter chips designed by Ming Lee Chu (朱明禮) worked the first time they arrive from CIC (Chip Implementation Center 國科會晶片設計製作中心). This is the first attempt of Ming Lee in chip design and we congratulate him for the success. The receiver chips failed due to some misunderstanding of the design rule. The design of the first version of MESFET GaAs driver and receiver chips was completed by Steve Beccue. The first batches from Hexawave (漢威光電) failed, partly due to design errors and partly due to software compatibility problem resulting in undetected errors in the layout. The second version of GaAs chips is now under processing at Hexawave.

A radiation hardness test for the bipolar chips was performed at Fermilab by Y.C. Liu (劉以正) and M.T. Cheng (鄭茂桐). Due to an unexpected high intensity of the beam, the results are not easy to interpret. A more careful radiation hardness study should be performed next year.

The progress at the Telecommunication Laboratory (TL 電信研究所) is also slow. The re-organization of the Telecommunication Division of the Ministry of Transportation, which TL belongs, into a corporation as a first step toward privatization has caused some confusion that affected our project. We sent one of our research assistant C.R. Kao (高長瑞) to work full time at TL to help producing the photo-detectors.

The R&D of DOIM needs to be finished soon and production has to start the summer of 1997. We need to watch closely the progress at TL and worked very hard on chip development.

In total, CDF published 13 papers in Physical Review Letters and 4 in Physical Review D. The proposal for Tevatron RunII to observe the top spin correlation through the lepton correlated asymmetries in the top dilepton events by D. Chang (張達文) S.-C. Lee (李世昌) and A. Sumarokov also appears in Physical Review Letters.

Jaroslav represented CDF and our group to give the top-quark talks at the "Hadron Structure '96" and the "26th International Symposium on Multiparticle Dynamics". Ming-Jer also represented CDF to give the top-quark talk at the "XIII International Seminar on High Energy Physics Problems". Yi-Cheng gave the DOIM talks at the "5th International Conference on Advanced Technology and Particle Physics" as well as the "IEEE Nuclear Science Symposium" November, 1996.

This is a busy year for E871 to set up the hyperon spectrometer. Thanks to the hard work of Chili Ho (何其力), C.S. Yu (于傳松), P.K. Teng (鄧炳坤) and J.P. Sheng (盛俊鵬), the muon chambers together with its readout by FEM, was the first subsystem to function properly and to take the beam. Yen-Chu Chen (陳彥竹) was responsible for DAQ software. By the end of the year, the E871 spectrometer was ready to take beams for engineering runs.

In order to get ourselves ready for E871 data analysis, Antonio W. Chan (黃達年) analyzed the E756 data, which is the hyperon experiment preceeding the E871. He obtained the world's first measurement result on the α -parameter of the anti-Omega and presented a talk of his result in the X XVIII International Conference on High Energy Physics". Tony also worked hard on the development of the reconstruction code for E871. This code was adopted from the code for E756 but needs major revisions since the spectrometer is new and the major physics goals are different.

E871 is now ready to take data for physics. We are going to collect a billion or so of Cascade and anti-Cascade events. This is more than three orders of magnitude over the existing data combined and provides us with unprecedented opportunities. We are looking forward to analysing the data to get great physics result.

With the launching date of the shuttle flight of the "Alpha Magnetic Spectrometer" (AMS), set at May 28, 1997, the design of the AMS electronics system progress steadily during the year. J.P. Sheng participated in the design of JL3A data processing board. The procurement of the components started with the help of A.C. Wang (汪安群). We held the AMS electronics meeting in early June

at the newly established Lung Yuan Research Park of CSIST (中山科學院). The financial supports from the National Space Project Office (太空計畫室) and the CSIST are indispensable for the meeting. The situation of the AMS electronics system was thoroughly reviewed, milestones was set, major design concepts were frozen and the preliminary component list generated.

Since CSIST is responsible for the production of most of the electronics boards, this first meeting between the design team and the manufacturing team with NASA consultants around is very essential for the AMS project. With key persons of other subsystems around, it also helped the CSIST team to have a global picture of the project. G.L. Dai (戴貴亮) was responsible for designing the test boards for many components which are used exclusively in space projects or are so new that CSIST can not test them. H.Y. Wang (王煥玉) joined us in September and worked with Guiliang for AMS components test and screening.

It is by no means trivial to procure and test the components for space projects. A lot of experiences were accumulated for the AMS project during this year.

We recruited James Y.T. Oyang (歐陽彥堂) from Caltech as a faculty member who will work mainly for AMS. He was the key person in the Aerogel Threshold Counter (ATC) project of the BaBar collaboration and will play a role in the ATC for AMS.

The feasibility study of the Taiwan Neutrino Oscillation Experiment formally started with the grant of some 5 Million NT dollars from the National Science Council. Our work this year focuses on the R&D of liquid scintillator. With the help of T.I. Ho (何東英), professor of chemistry at the National Taiwan University, we prepared our own liquid scintillator Ho-1. Light yield, attenuation length and the n - γ separation characteristics of Ho-1 was thoroughly studied and compared to commercially available ones such as NE213. Ho-1 was found to be quite acceptable. The main force behind the effort is Ribi W.S. Leung (梁穎珊) with the guidance of Chung-Yun Chang (張仲濤) P.K. Teng, Z.P. Mao (毛澤普) and Z.Q. Yu (郁忠強) who visited us for three months this year. She was also helped by the assistant Y.C. Shih (施逸君). Ribi got her master degree in the summer for this nice work.

Extensive GEANT simulation done by Z.P.Mao helped to fix the conceptual design for a 3x3 test module to be produced by the Institute of Nuclear Energy Research of the Atomic Energy Commission. The nuclear physics group of the Institute joined the project actively and helped in measuring the radiation level of the materials to be used in the detector.

In March, Chung-Yun and Shih-Chang visited Beijing and a memorandum of understanding for IHEP (Institute of High Energy Physics, Chinese Academy) to join the neutrino project was signed as a result of the visit.

Chung-Yun had to stay at US for the later half of the year due to the diagnosis of an unexpected illness of his wife. The pace of the neutrino project slowed down quite a bit as a result. We are in the process of recruiting a young faculty Henry Tsz-King Wong (王子敬) to lead the effort in this project. He is expected to join us in the January of 1997.

On the front of detector R&D, Alexei Sumarokov, with the help of Ming Lee and Ping Kun, developed the asymmetric multiwire proportional chamber where the gap between anode and cathode is as small as 130 micron, a world record. Beam best using the X-ray machine of the Institute was performed and the chamber with a 180 micron gap can detect X-ray photons at a rate of more than 1MHz per millimeter squared with a stable gain over 10^4 . The energy resolution was estimated to be around 20 per cent. This seems to be a promising detector for fast X-ray imaging or for high rate charge particle detection. It is unfortunate that Alexei decided to quit physics and explore a new career in the industry. We hope to continue R&D on the asymmetric MWPC when we have enough manpower.

As usual, we have group members leaving and new members joining. Besides those mentioned above, trigger experts D.X. Zhao (趙棟新) from IHEP joined us in November. She will help on the neutrino project as well as AMS. Our secretary H.J. Chang (張惠珍) decided to leave us to prepare for the examination to enter a college. She was succeeded by T.S. Liu (劉翠霞). We welcome all the new comers and wish the best for those who leave.

2. Particle Phenomenology

(1) Nonleptonic Weak Decays of Bottom Baryons

While many new data of charmed baryon nonleptonic weak decays became available in recent years, the experimental study of hadronic weak decays of bottom baryons is just beginning to start its gear. This is best illustrated by the decay mode $\Lambda_b \rightarrow J/\psi \Lambda$ which is interesting both experimentally and theoretically. Its branching ratio was originally measured by the UA1 Collaboration to be $(1.8 \pm 1.1) \times 10^{-2}$. However, both CDF and LEP Collaborations did not see any evidence for this decay. The theoretical situation is equally ambiguous: The predicted branching ratio ranges from 10^{-3} to 10^{-5} . Two early estimates based on several different approaches for treating the $\Lambda_b \rightarrow \Lambda$ form factors yield a branching ratio of order 10^{-3} . This issue is finally settled down experimentally. Needless to say, more and more data of bottom baryon decay data will be accumulated in the near future.

Encouraged by the consistency between experiment and our nonrelativistic quark model calculations for $\Lambda_b \rightarrow J/\psi \Lambda$, we present a systematic study of exclusive nonleptonic decays of bottom baryons. Cabibbo-allowed two-body hadronic weak decays of bottom baryons are analyzed. Contrary to the charmed baryon sector, many channels of bottom baryon decays proceed only through the external or internal W -emission diagrams. Moreover, W -exchange is likely to be suppressed in the bottom baryon sector. Consequently, the factorization approach suffices to describe most of the Cabibbo-allowed bottom baryon decays. We use the nonrelativistic quark model to evaluate heavy-to-heavy and heavy-to-light baryon form factors at zero recoil. When applied to the heavy quark limit, the quark model results do satisfy all the constraints imposed by heavy quark symmetry. The decay rates and up-down asymmetries for bottom baryons decaying into $\frac{1}{2}^+ + P(V)$ and $\frac{3}{2}^+ + P(V)$ are calculated. It is found that the up-down asymmetry is negative except for $\Omega_b \rightarrow \frac{1}{2}^+ + P(V)$ decay and for decay modes with ψ' in the final state. The prediction $\beta(\Lambda_b \rightarrow J/\psi \Lambda) = 1.6 \times 10^{-4}$ for $|V_{cb}| = 0.038$ is consistent with the recent CDF measurement. We also present estimates for $\Omega_c \rightarrow \frac{3}{2}^+ + P(V)$ decays and compare with various model calculations.

(2) A Phenomenological Analysis of Heavy Hadron Lifetimes

The lifetime differences among the charmed mesons D^+ , D^0 and charmed

baryons have been studied extensively both experimentally and theoretically since late seventies. It was realized very early that the naive parton model gives the same lifetimes for all heavy particles containing a heavy quark Q and that the underlying mechanism for the decay width differences and the lifetime hierarchy of heavy hadrons comes mainly from the nonspectator effects like W -exchange and Pauli interference due to the identical quarks produced in heavy quark decay and in the wavefunction. The nonspectator effects were expressed in eighties in terms of local four-quark operators by relating the total widths to the imaginary part of certain forward scattering amplitudes. With the advent of heavy quark effective theory (HQET), it was recognized in early nineties that nonperturbative corrections to the parton picture can be systematically expanded in powers of $1/m_Q$. Subsequently, it was demonstrated that this $1/m_Q$ expansion is applicable not only to global quantities such as lifetimes, but also to local quantities, e.g. the lepton spectrum in the semileptonic decays of heavy hadrons.

We have performed a phenomenological analysis of lifetimes of bottom and charmed hadrons within the framework of the heavy quark expansion is performed. The baryon matrix element is evaluated using the bag model and the nonrelativistic quark model. We find that bottom-baryon lifetimes follow the pattern $\tau(\Omega_b) \cong \tau(\Xi_b^-) > \tau(\Lambda_b) \cong \tau(\Xi_b^0)$. However, neither the lifetime ratio $\tau(\Lambda_b)/\tau(B_d)$ nor the absolute decay rates of the Λ_b baryon and B mesons can be explained. One way of solving both difficulties is to allow the presence of linear $1/m_Q$ corrections by scaling the inclusive nonleptonic width with the fifth power of the hadron mass m_{HQ} rather than the heavy quark mass m_Q . The hierarchy of bottom baryon lifetimes is dramatically modified to $\tau(\Lambda_b) > \tau(\Xi_b^-) > \tau(\Xi_b^0) > \tau(\Omega_b)$. The longest-lived Ω_b among bottom baryons in the OPE prescription now becomes shortest-lived. The replacement of m_Q by m_{HQ} in nonleptonic widths is natural and justified in the PQCD-based factorization approach formulated in terms of hadron-level kinematics. For inclusive charmed baryon decays, we argue that since the heavy quark expansion does not converge, local duality cannot be tested in this case. We show that while the ansatz of substituting the heavy quark mass by the hadron mass provides a much better description of the charmed-baryon lifetime ratios, it appears unnatural and unpredictable for describing the absolute inclusive decay rates of charmed baryons, contrary to the bottom case.

(3) Sea Quark or Anomalous Gluon Interpretation for $g_1^P(x)$

Although the issue of whether or not gluons contribute to Γ_1^P was resolved five years ago that it depends on the factorization convention chosen in defining the quark spin density and the hard cross section for the photon-gluon scattering. The fact that the interpretation of Γ_1^P is still under dispute even today and that many recent articles and reviews are still biased towards or against one of the two popular implications of the measured $g_1^P(x)$, namely sea quark or anomalous gluon interpretation, demands a further clarification on this issue. In the present paper, we will point out that, irrespective of the soft cutoff, the $2(1-x)$ term actually arises from the axial anomaly, i.e., from the region where $k_\perp^2 \sim \mu_{\text{fact}}^2$. Consequently, many criticisms to the gauge-invariant factorization scheme are in vain.

Contrary to what has been often claimed in the literature, we clarify that the hard photon-gluon cross section $\Delta\sigma_{\text{hard}}^{\mathcal{G}}(x)$ in polarized deep inelastic scattering calculated in the gauge-invariant factorization scheme does not involve any soft contributions and hence it is genuinely hard. We show that the polarized proton structure function $g_1^P(x)$ up to the next-to-leading order of α_s is independent of the factorization convention, e.g., the gauge-invariant or chiral-invariant scheme, chosen in defining $\Delta\sigma_{\text{hard}}^{\mathcal{G}}(x)$ and the quark spin density. Thereby, it is not pertinent to keep disputing which factorization prescription is correct or which definition for the spin-dependent quark distribution is superior. The hard-gluonic contribution to Γ_1^P , the first moment of $g_1^P(x)$, is purely factorization dependent. Nevertheless, we stress that even though hard gluons do not contribute to Γ_1^P in the gauge-invariant scheme, the gluon spin component in a proton, which is factorization independent, should be large enough to perturbatively generate a negative sea polarization via the axial anomaly. We briefly comment on how to study the Q^2 evolution of parton spin distributions to the next-to-leading order of QCD in the chiral-invariant factorization scheme.

(4) Mesonic Form Factors and the Isgur-Wise Function on the Light-Front

The hadronic matrix element of weak $P \rightarrow P$ transition (P : pseudoscalar meson) is described by two form factors, whereas in general it requires four form factors to parametrize the weak matrix element for $P \rightarrow V$ transition (V : vector meson). Heavy quark symmetry predicts that, all the mesonic form factors in the infinite quark mass

limit $m_Q \rightarrow \infty$ are related to a single universal Isgur-Wise function. The symmetry breaking $1/m_Q$ corrections can be studied in a systematic framework, namely the heavy quark effective theory. The Isgur-Wise function is normalized to unity at zero recoil, but otherwise remains unknown. Phenomenologically, the hadronic form factors can be evaluated in various models among which the quark model is a popular one. However, since usual quark-model wave functions best resemble meson states in the rest frame or where the meson velocities are small, hence the form factors calculated in the non-relativistic quark model or the MIT bag model are trustworthy only when the recoil momentum of the daughter meson relative to the parent meson is small.

Within the light-front framework, form factors for $P \rightarrow P$ and $P \rightarrow V$ transitions due to the valence-quark configuration are calculated directly in the entire physical range of momentum transfer. The behavior of the form factors in the infinite quark mass limit are examined to see if the requirements of heavy-quark symmetry are fulfilled. We find that the Bauer-Stech-Wirbel type of light-front wave function fails to give a correct normalization for the Isgur-Wise function at zero recoil in $P \rightarrow V$ transition. Some of the $P \rightarrow V$ form factors are found to depend on the recoiling direction of the daughter mesons relative to their parents. Thus, the inclusion of the non-valence contribution arising from quark-pair creation is mandatory in order to ensure that the physical form factors are independent of the recoiling direction. The main feature of the non-valence contribution is discussed.

(5) Weak Decay Process of $B \rightarrow \rho \ell \bar{\nu}_\ell$: A Varying External Field Approach in QCD Sum Rules

A varying external field approach in QCD sum rules is formulated in a systematic way to treat the weak decay form factors and their q^2 dependence in the process of $B \rightarrow \rho \ell \bar{\nu}_\ell$. From the form factor sum rules, we can also obtain the mass sum rules both for the B meson and for the ρ meson, which can help us determine the reliable Borel windows in studying the relevant form factor sum rules. In this way, we thus demonstrate that some QCD sum rule calculations in the existing literature are less reliable. We also include induced condensate contributions, which have been ignored, into the relevant sum rules. We obtain the ratios $\Gamma(\bar{B}^0 \rightarrow \rho^+ e^- \bar{\nu}_e) / \Gamma(\bar{B}^0 \rightarrow \pi^+ e^- \bar{\nu}_e) \approx 0.94$ and $\Gamma(\bar{B}^0 \rightarrow \rho^+ \tau^- \bar{\nu}_\tau) / \Gamma(\bar{B}^0 \rightarrow \pi^+ \tau^- \bar{\nu}_\tau) \approx 1.15$. We apply this approach to revisit the case of the D meson decay.

3. Gravitation and Cosmology

(1) CMB Anisotropy and Polarization

We compute numerically the scalar- and tensor-mode induced Stokes parameters of the cosmic microwave background, by taking into account the basis rotation effects. It is found that the tensor contribution to the polarization power spectrum get enhanced and dominates over the scalar contribution for low multipoles in a universe with or without recombination. Furthermore, we show that all full-sky averaged two-point cross-correlation functions of the Stokes parameters vanish, and calculate the expected signal to noise ratio for the polarization experiment currently underway.

(2) Scale Invariance and Gravity

We attempt to include the scale-invariance as an additional fundamental symmetry of the space-time. This gives birth to a new scalar-tensor theory of gravity, in which the scalar is an auxiliary field. For a pure gravity theory without matter field, the symmetric phase represents an equivalent class of gravity theories, which the Einstein gravity plus a cosmological constant belongs to under a special gauge choice. The one-loop quantum correction of the theory is calculated by using the Vilkovisky-DeWitt's method. We find that the scale symmetry is broken dynamically, and that the Einstein gravity is the ground state of the broken phase. We also discuss the consequent cosmological implications. It is found that the model admits an inflation via the Hawking-Moss bubbling, but the inflation rate remains undetermined due to the strong gravity limit. In light of this, scale-invariant metric perturbations having a dominant tensor component can be generated without slow-rollover. Also, the time-delay experiment restricts the present universe to be very close to the ground state.

SOLID STATE AND BIOPHYSICS

1. Surface Science

- (1) Self-Diffusion and Dynamic Behavior of Atoms at Step-Edges of Iridium Surfaces
- (2) Strain-Direction-dependent Growth Morphology of Vicinal Si(001) Surface
- (3) Anisotropic interaction of Ag-induced Missing Dimer Vacancies on Si(001) Surfaces
- (4) Dynamics of oxygen molecules on Si(111)-7x7 surfaces:
- (5) Epitaxial growth of Ge on Si(111) surfaces mediated by Pb:
- (6) Synchrotron Radiation Application:
- (7) Diamond thin films:
- (8) Metal thin films and superlattices:

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

- (1) Single Crystal Growth and Their Optical Properties:
- (2) Semiconductor Spectra Study:

3. Magnetism:

- (1) Magneto-Impedance in Amorphous Materials:
- (2) Magnetic, Optical and Electric Properties of Magnetic Alloy Films:
- (3) Magneto-Kerr Effect:
- (4) Magnetic fluid study:
- (5) Magnetic alloy films with perpendicular anisotropy

4. High-Pressure Specific Heats of Heavy Fermion Compounds and High T_c Superconductors

5. Superconductivity

6. Biophysics

1. Surface Science

(1) Self-Diffusion and Dynamic Behavior of Atoms at Step-Edges of Iridium Surfaces

Steps are an integral part of a surface. Many surface phenomena are to a very large extent affected or even determined by the existence of lattice steps. We have done a study of the dynamic behavior of atoms at step-edges and on stepped surfaces of iridium. The subjects investigated include diffusion of ledge atoms along steps of different atomic structures, detachment or dissociation of step edge atoms, descending and ascending motion of atoms at step edges, upward movement of in-layer atoms, and stable structure of nanometer size islands etc. Quantitative data derived include the activation barrier height of various atomic processes occurring at lattice steps. We also present parameters of adatom diffusion on the terrace of the Ir(113) and (331) surfaces to compare with ledge atom diffusion along step edges of the Ir(111). Possible implications of the behavior of atoms at lattice steps, particularly to ultra thin film epitaxy, are discussed. These interesting results have been published in Phys. Rev. B and Surf. Sci. Lett.

(2) Strain-Direction-dependent Growth Morphology of Vicinal Si(001) Surface

The shape dependence of vicinal Si(001) surfaces on the applied uniaxial strain direction is studied. This dependence is intimately related to the anisotropic nature of the intrinsic strain field which originates from the surface dimerization. The strain relief mechanism is shown to be different in two orthogonal directions. Normal to the steps, step-pair bunching and waving lead to formation of hillocks and pits. Along the step direction, bending of step pairs forms a cusp which later develops into a deep groove. This result is published in Phys. Rev. Lett.

(3) Anisotropic interaction of Ag-induced Missing Dimer Vacancies on Si(001) Surfaces

Ag-induced missing dimer vacancies on Si(001)2x1 surfaces are shown to form vacancy lines when the vacancy concentration is larger than ~10%. The formation of the vacancy lines is driven by the short-range attractive interaction between the

vacancies in adjacent dimer rows and the long-range repulsive interaction between them in the same dimer row. The form and magnitudes of the interactions are derived from the thermally-excited wandering of the vacancy lines. This result is published in Surf. Sci. Lett.

(4) Dynamics of oxygen molecules on Si(111)-7x7 surfaces

We study the dynamic behavior of single O₂ molecules on Si(111)-7x7 surfaces using a variable-temperature scanning tunneling microscope. We have found the hopping motion of a molecular species between neighboring adatom sites, which is mediated by two intermediate states. We also determine the activation energies of different hopping paths and the relative binding energies of different states. We have also observed the chemical reaction process of two adsorbed O₂ molecules to form an atomic species. These results will appear in Phys. Rev. Lett. and other journals.

(5) Epitaxial growth of Ge on Si(111) surfaces mediated by Pb

We use a scanning tunneling microscope to study the morphology and the mechanism of the surfactant-mediated epitaxy: Ge on Si(111) mediated by a Pb overlayer. Pb terminates the surface dangling bonds and reduces the surface energy significantly. Due to the fact that Pb does not intermix with Si and Ge in the bulk, Pb segregates at the surface during the growth of Ge films. We found that Pb overlayer enhances the mobility of deposited Ge atoms, which can travel a large distance and get incorporated into step edges. Below a critical temperature, 3D Ge islanding can be suppressed and the growth is basically layer-by-layer.

(6) Synchrotron Radiation Application

Synchrotron radiation from the Synchrotron Radiation Research Center (SRRC) storage ring is used to perform 1) Photoemission spectroscopy, 2) X-ray absorption spectroscopy and 3) Photoelectron imaging spectromicroscopy. The combination of these techniques provided detailed information in two research areas 1) detection and characterization of surface chemical inhomogeneities related to segregation and diffusion and 2) advanced and non-destructive characterization of novel materials,

such as low dimensional and nanostructured materials. Considerable effort on the development of the technique of synchrotron spectromicroscopy has also resulted in a unique high energy resolution version of the spectromicroscopy.

(7) Diamond thin films

Boron and nitrogen doped diamond films for field emission study have been grown by microwave and hot-wired plasma enhanced chemical vapor deposition techniques. Boron doped diamond films exhibit semiconducting characteristic behavior, but nitrogen doped diamond films behaved like intrinsic diamond films with high threshold voltages. The effect of amorphous carbon incorporated in the diamond film is still unclear. Crystalline silicon carbides grown together with diamond crystals have been observed due to the melting of silicon substrate in hot-wired system.

(8) Metal thin films and superlattices

Metal thin films and superlattices have been grown by molecular beam epitaxy and sputtering methods. Co,Ni,Fe,NiFe,Cu,Cr,V..... etc. have been used. X-ray diffraction, reflection high energy electron diffraction, atomic force microscopy are used to characterize the film structure. Magneto-optical Kerr effect, four-probe and superconducting quantum interference device are used to characterize the magnetic and transport properties. Giant magnetoresistance effect and magnetic anisotropy are studied. Influence of the Fe buffer layer on the magnetoresistance of NiFe/Cu superlattices has been observed. The magnetic coupling in the NiFe/Cu superlattices is enhanced by the Fe buffer layer.

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

(1) Single Crystal Growth and Their Optical Properties

Crystal growth is a science of high application. The various crystals can be used in manufacturing electronic, semiconductor as well as solid state laser devices and also are important materials for optical and instrument industry. Lithium Niobate single crystal was first successfully grown using the Czochralski technique in 1965

and its possible applications include optical storage, second harmonic generator, SAW, OPO, phase conjugation and integrated optics devices. Due to its important scientific and business potential, it is suitable to choose $LiNbO_3$ crystal as the starting material for studying the growth of nonlinear optical crystals. We hope the success of this research can provide crystals to other research institutes for academic and technical research.

The aim of this research is to grow large diameter $LiNbO_3$ single crystals using Czochralski pulling method. X-ray diffraction and laser Raman scattering techniques are employed to identify its structure and to inspect the quality of $LiNbO_3$ crystal. 1.06 μm light of Nd: YAG laser is also used to study the second harmonic generation effect. It is hoped that the experience obtained from this research could be used for further nonlinear crystals study, such as SBN, LBO, BBO and other new crystals.

(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 spin-orbit splitting of the valence band of silicon. We are going to use the high-temperature diffusion technique to introduce beryllium, a group II element, into silicon. Beryllium is a substitutional acceptor and has several impurity centers in silicon. Due to the spin-orbit splitting of the valence band, each impurity center of beryllium will have two series of energy levels. From the infrared spectrum obtained from the optical transitions from the ground state to excited states, we plan to identify the existence of the splitting of the valence band as well as to calculate the magnitude of the splitting.

Magnesium in germanium is another subject being studied at present. We have observed for the first time a group of very weak but unambiguous absorption lines which have never been reported. The relative positions of these additional lines are in good agreement with excitation spectra observed for other well-established acceptor impurities in germanium, which strongly suggests that they are due to a magnesium-related acceptor impurity. The ionization energy and other properties of this new acceptor center are being calculated and studied.

3. Magnetism

(1) Magneto-Impedance in Amorphous Materials

Magneto-impedance is a high frequency phenomenon in ferromagnetic materials. It means the change of impedance (including the resistance and the reactance), if an external field is applied on the sample. At low frequencies it is mostly resistive, and at high frequencies it becomes inductive. The samples used include some commercialized metallic glasses, and some rapidly quenched ones. They are all in ribbon forms. It is found that magneto-impedance effect is closely related to the saturation magnetostriction in the material. Consequently, the stress and domain distribution in the sample should play a vital role. This subject has caught people's attentions, because its potential use as a sensor. Our test showed that among the metallic glasses, the bias field could be below 50 Oe, the highest magneto-impedance ratio is about 150%, and the sensitivity is around 10%/Oe.

(2) Magnetic, Optical and Electric Properties of Magnetic Alloy Films

The main goal of this research is to study the magnetic, optical and electric properties of magnetic alloy films. Especially, we shall pay attention to those physical properties at various temperatures. As the magnetic properties, the measured quantities include magnetization, magnetoresistance, and magnetostriction etc. As to the electric properties, electrical resistivity and heat capacity of these specimens will be measured. For optical properties, the measured quantities include absorption, transmittance and reflectance etc.

(3) Magneto-Kerr Effect

A Magneto-Kerr effect apparatus has been built. With this instrument we have observed the magnetised state in the Co/Cr, NiFe/Cu and Co/Mo etc. system at room temperature. For example, the inplane anisotropy of these bilayers were determined by the longitudinal MOKE as a function of the azimuthal angle which is the angle between the in-plane applied field and Co[0001]. The uniaxial anisotropy is consistent with the crystalline anisotropy of the hcp-Co. The magnetic hysteresis major and minor loops taken with the field along the easy axis were rather square suggesting that the bilayers consist of an ensemble of very well aligned uniaxial in-plane hcp-Co columns which comprise the Co layer. Generally speaking, the magnetic behavior depends on the structure of the Co films.

(4) Magnetic fluid study

The diverse structures of ferrofluid etc magnetic fluids subject to magnetic fields have attracted considerable interest. We will prepare a series of magnetic fluids, e.g. Fe₃O₄ ferrofluid emulsions with varying droplet size etc. and will study their pattern formation etc. by the mutually interacting ferrofluid droplets in the emulsion function of applied magnetic field of given strength and orientation. Besides, the quantum size effect and the dimensional problem etc. will be studied under this research plan.

(5) Magnetic alloy films with perpendicular anisotropy

We have made a series of Co-Po alloy films. Film thickness ranges from 80 to 2500 angstrom. This topic is interesting, because the Pd-rich Co-Pd films exhibit both the perpendicular anisotropy K_u and large polar Kerr effects. Following measurements have been carried out in order to obtain the structural, transport, and magnetic properties of the film samples: AES depth, XRD, AFM, Moke, SQUID, AMR, saturation magnetostriction, and Hall effect. We have found that K_u is closely related to the degree of (111) texture. AMR can be used to detect the magnetic anisotropy readily. Some of the samples were post-annealed. Hence, the growth of grain sizes, the change of texture, and the variation of macro-stresses in each film at each stage can be assessed systematically. From a purely transport perspective, we were able to

make a full analysis on the subjects of surface, grain-boundary, and impurity scatterings respectively.

4. High-Pressure Specific Heats of Heavy Fermion Compounds and High T_c Superconductors

Due to the complicated interactions between magnetic moments, electrons and phonons in heavy fermion compounds, heavy fermion compounds exhibit an abundance of physical properties, such as Fermi liquid behavior, Kondo effect, coherence and the coexistence of magnetic ordering and superconducting. These unusual phenomena attract scientists' attention and make heavy fermion become an important candidate for last two decades. The other which interesting materials are the high T_c superconductors which were first discovered in 1987. After about ten-year development the superconducting temperature is raised from about 30-90 K to about 150 K. This field did attract more scientists to participate in it. The more we learned, the more questions we were asked. The s-wave and d-wave pairing is one of such the examples.

It is a common method in the study of heavy fermions and high T_c superconductors through element impurity substitution. To study the role of a certain element in an alloy, partially substitution of the element is used quite often. In the case of heavy fermions a non-magnetic element is usually used to replace the magnetic element which is studied, an example is the alloy of $(Ce_{1-x}La_x)_3Al$. In the case of high T_c superconductor the elements with different valence are used to replace the one to be investigated, an example is the alloys of $(La_{2-x}Sr_x)CuO_4$. The importance of this technique is evident by the fact that about 90% of the published papers in these fields had used the technique.

A question is asked frequently in element substitution experiments, that is how to distinguish the difference between the valence difference (or the magnetic moment) effect or the atomic chemical pressure effect. To solve the problem the external pressure has been applied by using high pressure cell, it actually works quite well in resistivity measurements and magnetic susceptibility measurements, whereas the pressure cell is hardly success in the experiment for heat capacity measurements, one

of the main problems is the huge background of the pressure cell, i.e., from the big mass of beryllium copper pressure. The background of the heat capacity can be 40-200 times as big as that of the sample, thus to extract the net heat capacity is difficult.

The goal of this proposal is to study the mechanism of heavy fermion compounds and high T_c superconductors. We plan to extend the existing high pressure techniques to heat capacity measurement and then we will set up a high-pressure heat-capacity apparatus for the study.

5. Superconductivity

For research in superconductivity, we plan to study in details about the magnetic and electric etc. properties of some YBCO high- T_c and Ag/Pb etc. metallic superconductivity superlattices within three years. Up to now, almost one and half years have been passed, and we have reported some of the transport current density studies under magnetic fields about the mixed state of high- T_c YBCO films and the surface, electrical, and magnetic properties of Ag/Pb metallic films. Under this last year of the project, we will finish the construction of a sputtering system for preparing metallic superconductivity superlattice systems. From both high- T_c and metallic superconductivity multilayers, we can study the difference between them. The experimental results will be discussed according to the theoretic analyses. Of course, we will cooperated with the other three professors from other universities and to discuss the results from the other laboratories, and hope to discover some new effects or concepts etc. in the near future.

In recent years, much interest has been focused on the effect of a magnetic field on the destruction of superconductivity in e.g. uniformly disordered films and granular films. The application of a magnetic field enables us to tune continuously through the zero-temperature superconductor-insulator transition in disordered superconducting films. In this study, we plan to study with the lead system with different materials as the intermediary layers. The stacking sequence of the layered structure will show the influence on their highly anisotropic superconducting properties. An original way to address some of the questions related to the importance of anisotropy in superconductors consists of modifying this stacking

sequence in a controlled manner. For this goal, thin-film growth is a powerful technique which has led to numerous studies of artificial multilayers consisting of superconducting-nonsuperconducting materials grown on different substrates. Under this project, we will finish the study of vortex dynamics in superconducting multilayers and the proximity coupling behaviors.

6. Biophysics

Organs influence on the blood pressure wave propagation:

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 will derive the transverse wave propagation equation in the artery and study 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 will be performed to evaluate the accuracy of the equation. In clinical application, because the swelling of an organ, blocking of the small artery, changing of elasticity of the arterial wall... all will be shown in the resonant frequency of this organ. The resonance model will be evaluated about the possibility of using resonance frequencies to study the cardiac artery disease.

STATISTICAL AND COMPUTATIONAL PHYSICS

1. Equilibrium Statistical Physics

- (1) Boundary conditions and scaling functions
- (2) Universal scaling functions in percolation problems
- (3) Percolation on self-dual lattices
- (4) Percolation and quantum Hall effect
- (5) Continuum percolation of soft disks and hard disks
- (6) Exact correlation functions for spin models

2. Nonequilibrium Statistical Physics

- (1) Models for fracture phenomena
- (2) Two-species lattice gas model
- (3) Dynamic critical phenomena

3. Strong Correlated Quantum Systems

- (1) Low-energy excitations in t-J model
- (2) van Hove singularity and d-wave pairs of spinons
- (3) Phase separation state in the 2D t-J model
- (4) Mechanism of particle-flux separation for double-layer fractional quantum Hall effect
- (5) Nonlinear sigma model for generalized antiferromagnetic Heisenberg spin ladders

4. Surface and Interface

- (1) Self-diffusion on Ir(111) stepped surface
- (2) Dissociation of H₂ on a sulfur covered Pd(100) surface
- (3) Depinning transition of 1D crystalline interface in random environment
- (4) Equilibrium dynamics of roughening transition in 1+1 dimensional systems

5. Computational Biological Physics

6. Other Research

- (1) Bilingual intranet-based document management system
- (2) Hybrid electric-field domains leading to spatio-temporal chaos in n-GaAs

During 1 July 1996-30 July 1997, in the Institute of Physics of Academia Sinica there were two research fellows (Chin-Kun Hu and Ting-Kuo Lee), three associate research fellows (Simon C. Lin, Ching-Ming Wei, and Kwan-tai Leung), five postdoctorals (Chi-Ning Chen, Jau-Ann Chen, Izmailian Nikolay, Yuo-Hsien Shiau, and Yan-Chi Tsai), one visiting scholar (Fu-Gao Wang), and one Ph.D. student (Chai-Yu Lin) in the research group of statistical and computational physics. The main research results are listed as follows.

1. Equilibrium Statistical Physics

(1) Boundary conditions and scaling functions

We pointed out that Hu, Lin and Chen (HLC) and Hovi and Aharony (HA) used different definitions of periodic boun-ary conditions (pbc), so that HLC and HA found different finite-size scaling functions (FSSF) for the existence probability E_p . This result also shows that FSSF depends sensitively on boundary conditions (C-K Hu).

(2) Universal scaling functions in percolation problems

Using a HMCSM and nonuniversal metric factors of a recent Letter (Phys. Rev. Lett. 75, 193, 1995), we find that the probability for the appearance of n top to to bottom percolating clusters on finite square (sq), planar triangular (pt), and honeycomb (hc) lattices fall on the same universal scaling functions, which show many interesting behavior as the aspect ratio of the lattice increases (C.-K. Hu and C.-Y. Lin). Very recently, we found that by using appropriate scaling variable we may have universal scaling functions for bond percolation on sq, pt, and hc lattices without using nonuniversal metric factors (C.-K. Hu, J.-A. Chen, and C.-Y. Lin).

(3) Percolation on self-dual lattices

We consider bond percolation with a bond probability p on a $L_1 \times L_2$ self-dual sq lattice with periodic boundary conditions in the horizontal direction and free boundary conditions in the vertical direction. We define the number M of alternating percolation clusters as the minimum of n_p and n_n , where n_p is the number of independent percolating clusters connecting sites on the top and bottom edges, and n_n is the number of percolating clusters in the complementary configuration on the dual lattice, a bond being present in the complementary configuration if and only if it is absent in the original configuration. We evaluate the probability $W_M^a(L_1, L_2, P)$ for

finding a given value of M and find that, for a given aspect ratio L_1/L_2 all data of W_M^a (L_1, L_2, P) near the critical point p_c fall on the same scaling function F_M^a , which is symmetric with respect to the scaling variable for all M (C-K Hu).

(4) Percolation and quantum Hall effects

A recent theory of quantum Hall effects relates the non-universal conductance peak-heights to the "number of alternating percolation clusters" of a continuum percolation model defined on the spatially-varying local carrier density. We discuss the statistical properties of the number of alternating percolation clusters for Corbino disc samples characterized by random density fluctuations which have a correlation length small compared to the sample size. This allows a determination of the statistical properties of the low-temperature conductance peak-heights of such samples. We focus on a range of filling fraction at the center of the plateau transition for which the percolation model may be considered to be critical. We appeal to conformal invariance of critical percolation and argue that the properties of interest are directly related to the corresponding quantities calculated numerically for bond-percolation on a cylinder. Our results allow a lower bound to be placed on the non-universal conductance peak-heights, and we compare these results with recent experimental measurements (C-K Hu).

(5) Continuum percolation of soft disks and hard disks

Many interesting problems in solid state and condensed matter physics are represented more appropriately by continuum percolation model (CPM) rather than lattice percolation model (LPM). However, our understanding of CPM is far less than LPM due to difficulty in the analytic and numerical studies of CPM. We use a random deposition process and a multiple-labeling technique to study continuum percolation of soft disks and hard disks in two dimensions. We find strong evidences that critical exponents of soft disks and hard disks are in the same universality class as percolation models on planar lattices. Our results also indicate that soft disks, hard disks, and planar lattice percolation models have universal finite-size scaling functions (C-K Hu and F-G Wang).

(6) Exact correlation functions for spin models

We develop a transfer matrix method to compute exactly the spin-spin correlation functions for Bethe lattice. Ising model and BEG model in the external

magnetic field h and for any temperatures. The correlation length $\xi(T, h)$ obtained from the spin-spin correlation function shows interesting scaling and divergent behavior as $h \rightarrow 0$ and T approaches the critical temperature T_c . Our method may be applied to other spin models on the Bethe lattice (C-K. Hu and N. Izmailian).

2. Nonequilibrium Statistical Physics

(1) F models for fracture phenomena

The cracking of brittle materials is not only of industrial importance, but also of academic interests for the rich physics it contains. We study the collective behavior of interacting cracks from a statistical physics point of view. A simple and robust spring-block model for an overlayer interacting with a substrate is introduced. It features the competition between stick-slip motion and fracture, resulting in a novel phase transition in the crack morphology and fragment-size statistics when the strain and the substrate coupling are varied. We also find that disorder is a relevant field, leading to tricritical behavior in the characterization of the precursor events in the cracking process (K-t Leung).

(2) Two-species lattice gas model

We continue our theoretical research on non-equilibrium phase transitions. We study the transport properties in the ordered phase of a two-species lattice gas model which is driven out of equilibrium by an external force. A one-parameter continuum model is analysed in details. Its predictions are confirmed by computer simulations concerning the finite-size scaling and the nature of transport (K-t Leung).

(3) Dynamic critical phenomena

We use heat bath dynamics to evaluate the dynamic critical exponent z and the dynamic finite-size scaling function of an Ising model on sq, pt, and hc lattices. We find convincing evidences that z is universal and, by choosing an aspect ratio and a nonuniversal metric factor for the scaled time of each lattice, we can obtain a universal dynamic finite-size scaling function for the Ising model on the planar lattices (F-G Wang and C-K Hu).

3. Strong Correlated Quantum Systems

Most of our research efforts are continuing our research in studying the two-

dimensional t-J model and its relation to high temperature superconductivity. There are also other research activities involving collaboration with several experimental groups in understanding new novel superconductors, magnetic systems, and materials with small particles. In the area of studying the two-dimensional t-J model, we have obtained several interesting results:

(1) Low-energy excitations in t-J model

Using the exact diagonalization method, we have found that the low-energy excitations have a very simple scaling relationships with the parameters t and J . In one dimension, this is understood in terms of spin and charge separation in the Luttinger liquid. Observation of the similar behavior in two dimensions strongly suggests a non-conventional metallic state (T-K Lee).

(2) van Hove singularity and d-wave pairs of spinons

Using a simple mean field theory with d-wave resonating-valence-bond states and long-range antiferro-magnetic order, we show that we can derive the dispersion of a single hole in the t-J model which was previously obtained by exact result or much more elaborate calculations. The most interesting part is that we are able to explain the extended van Hove singularity in terms of d-wave pairs of spinons. This seems to be related to the observed spin gap in the undersoped region of high temperature superconductors (T-K Lee).

(3) Phase separation state in the 2D t-J model

We just sent out a paper for publication. In this paper my Ph.D. student Dr. Shih has used our "power-Lanczos" method to determine the phase boundary of the phase separation state in the 2D t-J model. This result shows that for the physical regime corresponding to the high temperature superconductors, the t-J model does not exhibit phase separation as claimed by some recent works. This work really demonstrates the better numerical accuracy of our method than other's (T-K Lee).

(4) Mechanism of particle-flux separation for double-layer fractional quantum hall effect

We utilize the hopping expansion technique to study the flux-particle separation double-layer fractional quantum hall effect. Based on the Chern-Simon field the transition of flux-particle separation is found as a Kosterlitz-Thouless like

transition. The major findings are their similar critical behavior as the single layer case the irrelevance of the inter layer electron interaction (Y.-C. Tsai).

(5) Nonlinear sigma model for generalized antiferromagnetic Heisenberg spin ladders

We utilize the path-integral technique to derive the non-linear Sigma model (NL σ M) for generalized antiferromagnetic spin-ladder systems, which contain diagonal (next-to-next neighbor) interactions in addition to the nearest neighbor interaction. The topological term (Berry phase) of the NL σ M is absent for the ladders with even-number legs and is equal to $2\pi S$ for ladders with odd-number legs, where S is the spin of each chain. The spin wave velocity is calculated. We also consider the case with the diagonal interactions occurring only in the even (or odd) sites. The Berry phase and the spin wave velocity are also obtained. By using non-abelian bosonization technique we demonstrate that the Berry phase of three-leg spin ladders is consistent with the existing theory (Y.-C. Tsai).

4. Surface and Interface

(1) Self-diffusion on Ir(111) stepped surface

Using molecular dynamics simulations and molecular statics calculations with embedded-atom potential, the self-diffusions on Ir(111) stepped surface are investigated. We find the adatoms will be attracted to the step edges when they approach toward descending and ascending steps, resulting in trapping at low temperature. When adatoms be trapped to the ledge sites, the activation energies for them to diffuse along step edges are much higher than the barriers for adatoms diffusing on flat terrace, causing irregular island edges at low temperature. The diffusion path along {111}-faceted step is found through the bridge path inward to the step not through the bridge path away from the step. We also find that, for the {111}-faceted step, short and irregular island edges can have much lower exchange descent barrier than long, straight edges and even lower than the activation energy for single adatom diffusing on flat terrace. These results are consistent with the hypothesis made by Kunkel *et al.* [Phys. Rev. Lett. 65, 733 (1990)] that small and irregular islands provide lower barriers for adatom descent, which may explain the reentrant layer-by-layer growth observed experimentally (C-M Wei).

(2) Dissociation of H₂ on a sulfur covered Pd(100) surface

The presence of sulfur atoms on Pd(100) surface is known to hinder the dissociative adsorption of hydrogen. Using density-functional theory and a full-potential linear augmented plane-wave method, we investigate the potential energy surface (PES) of dissociative adsorption of H₂ on S covered Pd(100) surface. The calculated results for hydrogen dissociation show that a strong repulsive interaction exists between H and S atoms. This changes the PES dramatically for hydrogen close to the S atoms compared to the clean Pd surface. For (2x2) sulfur adlayer (coverage $\theta_s = 0.25$), our results indicate that non-activated dissociation of H₂ at clean Pd(100) surface is inhibited with a large energy range of energy barriers that strongly depends on the distance between H₂ and S atom. For c(2x2) sulfur adlayer ($\theta_s = 0.5$), the hydrogen adsorption becomes purely repulsive for all different adsorption geometries due to the short distance between H₂ and S atom inside c(2x2) unit cell. We conclude that the poisoning effect of sulfur adatoms for H₂ dissociation at low sulfur coverage ($\theta_s \leq 0.25$) is governed by the formation of energy barriers (C-M Wei).

(3) Depinning transition of 1D crystalline interface in random environment

A 1D long-range interactive growth model which describes the deposition of particles on a disordered substrate is investigated. The stochastic growth equation was recast in terms of the Martin, Siggia, and Rose (MSR) action, with which the renormalization analysis is performed. By changing the temperature (or the inherent noise of the deposition process), two different regimes with a transition between them at T_{pc} are found. For $T > T_{pc}$ substrate disorder is irrelevant and the surface has the scaling properties of the surface growing on a flat substrate in a rough phase. The height-height correlations are calculated. While the linear response mobility is finite in this phase it vanishes as the temperature is approaching the transition point from above. When the temperature is below the transition point the flows of the coupling constant are driven toward a line of fixed points. The equilibrium correlations function is also obtained, and short time dependence and the dynamic exponent are yielded as well (Y.-C. Tsai).

(4) Equilibrium dynamics of roughening transition in 1+1 dimensional systems

The dynamics of the 1+1 dimensional crystalline surface with long-range interactions is investigated using the renormalization group (RG) technique. The

system in question displays a roughening transition which is forbidden for systems with short-range interactions. The linear macro-mobility continuously decreases to zero as temperature lowers down to the critical temperature in contrast to the usual 2D roughening transition with an universal jump of the mobility at the transition point. The nonlinear mobility is also derived in light of the RG recursion relations. Two different RG schemes are employed and their differences are addressed (Y.-C. Tsai).

5. Computational Biological Physics

Starting October 1996, C.-N. Chen and I are beginning the new project of using the simulated annealing method to speed up the determination of protein structures by using x-ray diffraction data. For large molecules like proteins it is very time consuming and sometimes impossible to use x-ray diffraction data to determine the structure. Recently it was proposed that using the simulated annealing method we may speed up this process. We have now shown that the method indeed can resolve the structures of molecules with about 100 atoms with ease. We have also created programs that treat the peptide units of protein, instead of individual atoms, as a fundamental building block. The results are very encouraging. We are now in the process of preparing a paper (T.-K. Lee and C.-N. Chen).

6. Other Research

(1) Bilingual intranet-based document management system

Intranet technology simplifies the network architecture within the organization and extends the connection access to client ends. Therefore, it provides an enabling technology to build a platform that is capable of delivering IT solutions required to client ends. Document management system tends to be the most obvious implementation of the Intranet technology. However, the deployment of the bilingual Intranet-based Document Management System (IDMS) suffers from technology, culture and even political difficulties in Han-character regions where most of the previous research and development in Chinese text processing focus on the operating system level. We argue that a well thought out bilingual IDMS on the Middleware level would provide the beginning of a resolution to the deployment of Intranet technology in these regions where most of the current existing software systems cannot prevail due to the rapid marketing and technology changes (S.L. Lin).

(2) Hybrid electric-field domains leading to spatio-temporal chaos in n-GaAs

It has been shown that a Gunn diode may exhibit a transition from an oscillation (travelling domain) to a non-oscillating(stationary domains) state when the electron density in the metal-semiconductor contact at the cathode can be controlled experimentally [Shiau and Cheng, *Solid State Commun.* **99** 305 (1996)]. In this report it is found that spatio-temporal chaos may occur in the Gunn diode when a small ac added to drive the above-mentioned stationary domains. The route to spatio-temporal chaos is found to be period-doubling. The bifurcation feature and the spatio-temporal behavior of the electric field are studied in detailed (Y.-H. Shiau).

III

List of Ongoing Research Projects

List of Ongoing Research Projects
中研院物理所八十六年度計畫清單一覽表

(1996 年 7 月~1997 年 6 月)

主持人	計畫名稱	執行期間	計畫編號
王明哲	重夸克及強作用物理之實驗探討(子計畫三): CDF 實驗之電腦模擬與數據分析(III)	08/01/96-07/31/97	NSC86-2112-M-001-025
王建萬	微中子振盪之先行性實驗	08/01/96-07/31/97	NSC86-2811-M-001-001R
王唯工	生物能場-脈波診斷與腎臟異常-脈波頻譜與腎臟微循環之關連	08/01/96-07/31/97	NSC86-2314-B-001-028-M01
王唯工	血液波共振方程式在脈波診病之應用	08/01/96-07/31/97	NSC86-2213-E-001-011
王唯工	以脈診研究中醫藥之歸經原理	08/01/96-06/30/97	CCMP86-RD-007
王唯工	模擬性之氣功外氣對血液壓力波頻譜之影響研究	08/01/96-07/31/97	NRICM-86102
仲國慶	利用低速重離子求電子阻止本領之研究: 小於 20MEV 之 MG 離子在半導體材料中	08/01/96-07/31/97	NSC86-2112-M-001-036
任盛源	鈷-鈹薄膜之磁性與電子傳輸性研究	08/01/96-07/31/97	NSC86-2112-M-001-027
江紀成	在 Ed=75KeV 時, $^1\text{H}(d,r)^3\text{He}$ 反應之研究	08/01/96-07/31/97	NSC86-2112-M-001-005
何侗民	鍺中鎂受者雜質之研究	08/01/96-07/31/97	NSC86-2112-M-001-013
余岳仲	原子內層游離截面積與重離子荷電態的關係研究	08/01/96-07/31/97	NSC86-2112-M-001-008-Y
余海禮	規範場論、強作用及其相關物理之研究(子計畫一): 小 X 與重強子物理(III)	08/01/96-07/31/97	NSC86-2112-M-001-017
吳建宏	宇宙微波背景輻射的各向不同與偏極之相關性	08/01/96-07/31/97	NSC86-2112-M-001-009

主持人	計畫名稱	執行期間	計畫編號	主持人	計畫名稱	執行期間	計畫編號
李世昌	沙堆模型及其它非線性系統之研究 (III)	08/01/96-07/31/97	NSC86-2112-M-001-000	曾忠一	半拉格朗日法在雲模式上的應用 (I)	06/01/96-07/31/97	NSC85-2612-M-001-001
李世昌	重夸克及強作用物理之實驗探討 (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 (III)	08/01/96-07/31/97	NSC86-2112-M-001-002	曾詣涵	介子系統與超核之理論研究 (I)	08/01/96-07/31/97	NSC86-2112-M-001-006
李世炳	規範場強、強作用及其相關物理之研究 (子計畫三) : 尺度不變與標準模型中一些基本問題的探討 (III)	08/01/96-07/31/97	NSC86-2112-M-001-001	黃榮鑑	海岸污染及防治 (I) (子計畫一) : 密度污染海洋放流之擴散研究	08/10/96-07/31/97	NSC86-2611-E-001-002
李定國	二維 t-J 模型的相圖	02/01/97-07/31/97	NSC86-2112-M-001-042	黃榮鑑	複雜紊流場流況之數值研究	08/01/96-07/31/97	NSC86-2611-E-001-001
杜其永	二元混合液中鏈狀聚合物之研究 (II)	08/01/96-07/31/97	NSC86-2112-M-001-002	劉 鏞	單晶金屬薄膜、多層膜及超晶格, 其磁異向性與結構的關係	08/01/96-07/31/97	NSC86-2112-M-001-028
林爾康	重離子背向散射及質子 X-螢光放射	08/01/96-07/31/97	NSC86-2112-M-001-000	歐陽彥堂	以精密質譜儀探測宇宙中反物質之含量 (子計畫一) : 宇宙中反物質含量之量測 (I)	08/01/96-07/31/97	NSC86-2112-M-001-026
姚永德	納米晶鎘之低溫物理特性研究	08/01/96-07/31/97	NSC86-2112-M-001-001	鄭天佐	晶體表面原子動力學與量子物理性質之研究 (II)	08/01/96-07/31/97	NSC86-2112-M-001-037
胡宇光	顯像式光電子能譜顯微術 (III)	08/01/96-07/31/97	NSC86-2613-M-001-000	鄭海揚	粒子物理現象學之探討 (I)	08/01/96-07/31/97	NSC86-2112-M-001-020
胡進錕	統計物理與非線性動力學	08/01/96-07/31/97	NSC86-2112-M-001-000	鄧炳坤	重夸克及強作用物理之實驗探討 (子計畫二) : CDF 及相關實驗粒子偵測器之研製 (III)	08/01/96-07/31/97	NSC86-2112-M-001-023
胡進錕	以數值方法研究臨界現象	08/01/96-07/31/97	NCHC-86-02-008	鄧炳坤	重夸克及強作用物理之實驗探討 (子計畫四) : 奇異重子衰變中 CP 不守恆現象之探討 (III)	08/01/96-07/31/97	NSC86-2112-M-001-024
張志義	重夸克對稱與手徵動力學	08/01/96-07/31/97	NSC86-2112-M-001-000	謝雲生	三硼酸鋰晶體之拉曼光譜與長晶研究 (II)	06/01/96-07/31/97	NSC85-2112-M-001-046
梁鈞泰	斷裂現象之統計物理模型	08/01/96-07/31/97	NSC86-2112-M-001-000	顏迪佑	以準實驗法決定原子核物質之能量密度及其於天文物理之應用 (II)	08/01/96-07/31/97	NSC86-2112-M-001-010
陳志強	物質傳輸對聲誘發光效應影響之研究	08/01/96-07/31/97	NSC86-2112-M-001-000	魏金明	相位修正的原子尺度電子全像術	08/01/96-07/31/97	NSC86-2112-M-001-039
陳洋元	重費米化合物之量子尺寸效應	08/01/96-07/31/97	NSC86-2112-M-001-000	魏金明	以第一原理計算過渡金屬表面之原子擴散機制	08/01/96-07/31/97	NCHC-86-02-004

IV

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10. B. Hu, B. Li and Wei-Min Zhang 1997. The quantum Frenkel-Kontorova model: a squeezed state approach, CNS-9702, Hong-Kong Baptist Univ., submitted to *Phys. Rev. Lett.*

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Appendix: Statistics of Publications in 1996 SCI Journals

Keywords	Number of Items
Physics, Academia Sinica, Taiwan	107
Physics, Taiwan.....	501
Academia Sinica, Taiwan	578
Physics, Seoul National University.....	143
Physics, University of Tokyo.....	1036
Physics, Kyoto University.....	317
Physics, Hong Kong Univ. of Science and Technology.....	92
Physics, National University of Singapore.....	98
Physics, Academia Sinica, Peoples R. China.....	548
Physics, Beijing University, Peoples R. China	190
Physics, Tata Institute of Fundamental Research, India.....	61
Physics, The University of Melbourne.....	106
Physics, Tel Aviv University.....	294
Physics, University of Toronto	211
Physics, Harvard University.....	178
Physics, Cornell University.....	174
Physics, University of California, Berkeley.....	284
Physics, Princeton University.....	260
Physics, University of Chicago.....	142
Physics, Columbia University.....	459
Physics, Yale University.....	120
Physics, Leiden University.....	23
Physics, University of Cambridge.....	251
Physics, Technical University of Berlin.....	100
The Niels Bohr Institute, Copenhagen.....	169
Physics, University of Vienna.....	172
Physics, University of Oslo.....	129

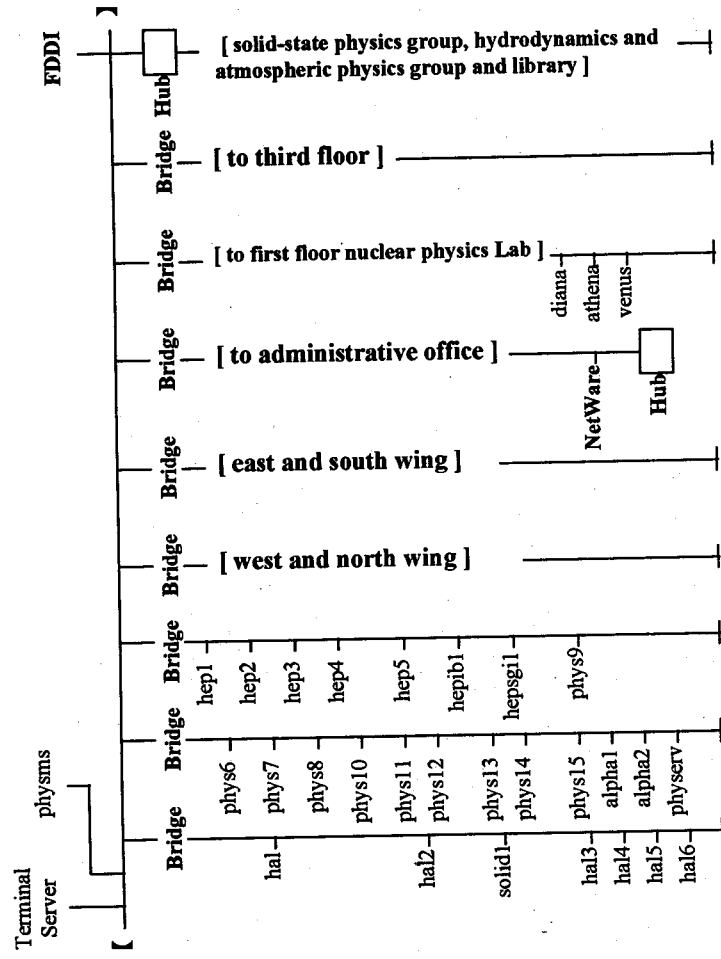
V

Supporting Facilities

Computing Facilities

After years of development and devotion by a few colleagues, starting with a few desktop computers, our institute now enjoys the services of a well-equipped computer room with knowledgeable staff. The primary tasks of the computer room are four-fold: first, to provide high-speed work stations to meet our computational needs, such as computer simulations, numerical analysis and symbolic manipulations; second, to maintain the connectivity and conductivity of the Ethernet network in our institute, so that speedy access to the outside world through the Internet and e-mails are possible; third, to maintain automation in the administrative office and the library, and fourth, to provide general hardware and software consultations to our colleagues as well as technical assistances in network-related matters. At present, the computer room is equipped with a 4-cpu AlphaServer (model 2100 4/275) an Alpha workstation (model 1000A-5/400), a cluster of Pentium processors running Linux operating system, and two clusters of workstations: one for the six IBM RISC-6000 (three 3CT's, one 550, 370, 350), and another for the ten SUN Sparc stations. Several general-purpose Pentium and MacIntosh personal computers are also provided. Hubs and bridges connect all these machines as well as each office and laboratory to the backbone of our network, which in turn is linked to the Computer Center of the Academia Sinica by optical cables, thus enabling fast access to other institutions. The computer room also hosts a wide range of peripheral devices, and maintains and updated selections of original software.

Ethernet Configuration of the Institute of Physics



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.

As a part of the Institute of Physics, the institute director is automatically the head of the library. Under our director is a library committee which supervises and assists in policy making and daily affairs concerning the library. Members of the committee include research colleagues of the institute as well as full time librarians.

The library is located on the 3rd floor of the physics building and has a total area of over 6,100 sq. ft. There are reserved areas for the users to read books, journals and other library materials as well as a room for displaying preprints and reprints from colleagues within the institute.

For the fiscal year of 1998, the library has a total budget of NT\$8.5 million; 85% for journals and 15% for books.

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 of which 18 are from mainland China. In recent year, the library has been increasing its collections at an annual rate of 700 new books and 1500 newly bound volumes of journals. The library is currently subscribing 200 plus journals. Besides books and journals, the library also has a collection of microfiche (with back issues of 32 journals) and four CD-ROM databases. All the above mentioned items are easily accessible to research members of institute as well as scholars within the physics community in Taiwan.

OPERATION OF THE PHYSICS LIBRARY

The operation of the Physics library can be grouped into 3 main categories.

(I) Technical Services

The services we provide here include the collection and processing of library materials:

(a) Collection of Library Materials

- (i) The research members of the institute make suggestions for purchases, the library committee will then review and make recommendations to the director for final decisions.
- (ii) To have a fast grasp of new information in this modern era is an important topic for our research members. For this reason, the

librarians spend much of their time to enhance the collection of related information through various channels such as

---The library has "standing orders" on 30 plus reputable book series such as: Lectures notes in Physics, in order to reduce the time spent through correspondence.

---Beginning 1992, all foreign books purchased are sent to the library by air mail.

---There is also a plan to purchase back issues of certain journals that are valuable to the research members here.

---The library is constantly aware of publication news from most reputable publishing companies as references for new purchases.

(b) Processing of Library Materials

In order to facilitate the management and utilization of library materials, it is necessary to have a systematic way to take care of the library materials arrived. The physics library adopts the following methods:

(i) Cataloguing

We here use the Chinese Cataloguing Rules (CCR) and the Anglo-American Cataloguing Rules (AACR II) Systems to catalogue the library books and journals written in Chinese and foreign languages respectively. These rules catalogue the materials according to the title, author and other publishing related items. The cataloguing helps both the librarians and the users search the materials they need when they already have the name of the author, the title of the book or even the subject headings.

(ii) Classification

The library materials are also classified according to the "New Classification Scheme for Chinese Libraries" and "Library of Congress Classification" for books written in Chinese and foreign languages respectively. In this way, it allows both the librarians and the users to have a better understanding of the allocation of library materials in various fields and thus the direction of future purchases of the library. The organization of library materials is a job that needs a lot of thinking, judgments as well as man power. With the rapid advance of the computer technology, the man power problem is now partially solved.

(II) Referencing 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. New books are displayed on specific shelves twice every month. Reservation can be made during these periods.

---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 "Scitech 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".

---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 is also a fax machine in the library in order to reduce the amount of time for the transfer of information needed by the library users.

---Other facilities. There are four PCs(all with CD-ROM drivers) and a laser printer. There is a "feedback" mailbox where comments and criticisms from users are welcome for the improvement of library services.

(III) Library Automation

The Physics Library has just finished its library automation program. The goal of this program is to speed up the processing of library materials and thus improve the ability of information exchange. The Academia Sinica adopted the "INNOPAC" library automation system in 1991. The Physics Library, being a member of the "on-line" library system on campus, started an automation program in September, 1991. This program includes:

(a) The filing of library materials.

This is the core work of the first stage of the automation program. In order to reduce the man power we need and to speed up the filing work, the library adopted the CD-ROM database to help trace back some of the existing but old library materials and also as a reference for the cataloguing of new books.

(b) "On-line" processing of journals.

By the end of 1992, newly arrived journals are processed both "on-line" and manually. Journals check in, claim, etc. can all be done "on-line". Users can also use the INNOPAC system to find out the most

recent arrived journals.

(c) Circulation of library books.

The library has a user database of over 100 user records. All the check out books are recorded in this database. A user is able to obtain information of his/her own records through networks.

(d) Other features of the automation program.

---There are now more and more journals which have "on-line" versions. Examples are: *Journal Review Letters* (started July, 1995), *Nuclear Physics A, B* and *Nuclear Physics B Supplement*. The Physics Library has made subscriptions of all the above mentioned "on-line" journals and will inue 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.

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

CONCLUDING REMARK

To provide the best information service and to assist research workers in the institute on their research work is goal and responsibility of the Physics Library. In order to achieve this, the library needs both encouragement and surveillance from all of us.

APPENDIX

The following is a list of the information systems and CD-ROM databases in the library.

(1) Information Systems:

(a) LAS (Library Automation System)

One can look up library materials within the Academia Sinica Library System and other library information systems around the world.

(b) PINET (The Physics Information Nwork of the American Institute of Physics).

This information system is developed by the American Institute of Physics (AIP). It provides updated Physics news, papers in physics related areas which will soon be published in journals and other useful information.

(2) CD-ROM Database Collections:

(a) Thomas Register 1995 Edition

This database contains a list of US and Canadian corporations.

(b) SCI (Science Citation Index) with A bstract, 1980-present

Citations of more than three thousand journals are included here. An authoritative database to evaluate the usefulness of a scientific article.

(c) INSPEC (Physics Section), 1989-present

An electronic version of Physics Abstracts, over three thousand journals, conference proceedings and technical reports in physics related areas are included.

(d) PDF-2 Database (Power Diffraction File) 1992 Edition

A database that contains information on properties of various materials.

Technical Workshops

A technical group has been established since 1993 to manage the technical personnel and facilities for supporting the research activities in our institute. The works of the technical group includes: 1. fabrication and repairing of electronic equipment, 2. fabrication and assembly of mechanical parts, 3. making sample cells and testing tools, 4. support of vacuum facilities, 5. management and supplies of gases and liquids, 6. operation and maintenance of complex and specialized research facilities, 7. management and handling of radioactive materials and 8. technical support of power supplies and communication facilities. The technical group consists of three workshops: electronics workshop, mechanical workshop and electrical power workshop.

1. *Electronics Workshop:*

The electronic workshop provides services for the whole institute on design, fabrication and repairing works related to electronic parts and equipment. We experience difficulties in maintaining and repairing because of incomplete documentation and supplies of rare parts. To improve the situation, we are going to collect and to categorize related documentation and data books. From these materials we plan to build a database and to stock rare but important parts and devices. If necessary we may ask our colleague to buy these parts and devices from abroad directly. We hope that we can maintain an adequate supply of parts and that an up-to-date inventory will be available for our colleagues. In 1995, we purchased a precision LCR meter and more equipment will be purchased next year. Table 1 is a list of our equipment. Table 2 lists the research facilities that has been repaired and maintained. Table 3 shows the equipment and special parts that have been designed and fabricated in the workshop.

2. *Mechanical Workshop:*

It has been five years since the mechanical workshop was established. To meet the increasing need of our institute, we expanded the number of technical staff in the workshop by hiring a work-student. We also installed several new equipment: a line saw, a milling machine and a cutting machine, Table 4 is a list of the equipment in the mechanical workshop. Next year we plan to purchase a lathe and a folding machine. In the past five years, we designed and made numerous parts and assemblies for our research staff. We also helped to solve problems in various laboratories in our institute. At present, we are upgrading our technical support for vacuum systems. These include design, fabrication and assembly of vacuum chambers, maintenance and repair works of vacuum pumps. We also make some effort to stock commonly used vacuum parts and materials (See Table 5). To meet the need of our research staff, we make available various materials such as Ta, Ti,

Al₂O₃ for used in UHF systems. The staff 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.

3. *Electrical Workshop:*

Our duties include regular maintenance of our electrical power system, fire facilities, central air conditioning, communication systems (including telephone network, fax, short wave and radio wave systems), illuminating system, audio-visual equipment. In conferences and seminars, it is our job to make audio and video tapes records if needed. We also help our colleagues to improve the quality of the electrical power, grounding facilities and peripherals in their laboratories. Besides, we are also responsible for the detection and safety precaution of radioactive materials. We also keep track of dosage badges and handling of radioactive waste.

In summary, the work of the technical group is heavy and high-tech related. We are still evolving towards maturity and the main hurdle is lack of man power. 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.

Table 1

Electronic Equipment :

Equipment	Model
Curve tracer	Tektronix 571
Multimeter	HP 3458A
LCR Meter	HP 4284A
Waveform Analyzer	SENCORE SC61
Power Supply	GW 3615 GW 1830 GW 3030
OSCILLOSCOPE	TAS 485

Table 2

Maintenance and Repaired Works :

Equipment	User
Magnet Controller	Yeong-Der Yao
Vacuum Gauge	Chia-Seng Chang
Walker's Magnet Power Supply	Shien-Uang Jen
Thickness Monitor	Shien-Uang Jen
Power Line	Ping-Kun Teng
Power Supply	Yeong-Der Yao
PS Series Power Supply	Wei-Kung Wang
Accelerator Tobe	Chang-Wan Wang
High Speed Power Supply	Tien-Tzou Tsong
Temperature Controller	Yang-Yuan Chen

Table 3

Designed and Fabrication :

Equipment & Parts	User
20KV & 30KV Power Supply	Tien-Tzou Tsong
±15KV Power Supply	Ge-Cheng Kiang
PreAmp	Ing-Shouh Hwang
PCB	Ping-Kun Teng
Delay Box	Ki-Wing To
Signal Cables	Ki-Wing To
GND Cable	Chang-Wan Wang
PreAmp	Chia-Seng Chang
High Voltage BNC Cable	Chia-Seng Chang
DC 300 Power Supply	Yueh-Chung Yu

Table 4

Machinery :

Equipment	Quantity	Equipment	Quantity
Lathe Machine	2	Portable Grinding Machine	2
Wire Sawing Machine	1	Portable Electrical Drilling Machine	1
Vertical Wire Sawing Machine	1	Portable Electrical Sawing Machine	1
Drilling Machine	1	Delicate Platform	1
Drilling and Milling Machine	2	Height Gauge	1
Electric Welding Machine	1	Highly Delicate Measuring Table	1
Abrasive Machine	1	Computer 586	1
Abrasive Cut-off Machine	1	Milling Machine	1
Electric arc Welding Machine	2	High Speed Drilling Machine	1
Ion Cutter	1	Wood Sawing Machine	1
Lathe Machine	1	Vertical Drilling Machine	1
Surface Grinding Machine	1	Shearing Machine	1
Slant Machine	1		

Table 5

Vacuum Parts :

Gasket	Blank	Bellow	Oring	Vent Valve	Four way	Three way	90 ELBOW
16CF	NW16 16CF	NW25	U.S.A.	NW-16	NW-50	35CF	NW25
35CF	NW25 35CF	NW50	Parker	NW-40	35CF	NW25	
63CF	NW40 63CF		Viton				
100CF	NW50 100CF						
160CF	160CF						

VI

Academic Activities

Attendance in International Conferences

中研院物理所八十六年度出席國際會議表

(1996 年 7 月~1997 年 6 月)

會議名稱	會期	舉辦地點	出席人員	經費來源
第八屆國際表面科學會議	07/01/96-07/05/96	日本大阪	盧志權	主題+自理
第八屆國際表面科學會議	07/01/96-07/05/96	日本大阪	Ivo Klik	主題+自理
相關電子系統中的理論問題	07/08/96-07/27/96	日本東京	曾文哲	本所+自理
第二十一屆國際紅外線及毫米會議	07/14/96-07/19/96	德國柏林	何侗民	國科會
第四十三屆國際場發射研討會	07/14/96-07/19/96	俄羅斯莫斯科	鄭天佐	主題
第二十三屆國際半導體物理會議	07/21/96-07/26/96	德國柏林	何侗民	本所
第二十八屆國際高能物理會議	07/24/96-07/31/96	波蘭華沙	黃達年	本所
物質質譜儀 (AMS) 國際合作組會議	07/26/96-07/31/96	瑞士日內瓦	李世昌	本所
澄光核反應研討會	07/28/96-08/02/96	美國 Tilton	顏迪佑	本所
二十一世紀華人天文會議	08/01/96-08/04/96	香港	吳建宏	本所
二十一屆國際低溫物理研討會	08/08/96-08/14/96	捷克布拉格	陳洋元	國科會
十七屆國際晶體學大會	08/08/96-08/17/96	美國西雅圖	魏金明	本院

會議名稱	會期	舉辦地點	出席人員	經費來源
一九九六年美國物理學會粒子與場論會議	08/10/96-08/15/96	美國明尼亞波利斯	鄭海揚	國科會
第二屆亞洲 STM 及第一屆亞太近場光學會議	08/16/96-08/18/96	韓國漢城	羅榮立	主 題
第二屆亞洲掃描穿隧顯微術會議	08/16/96-08/17/96	韓國漢城	張嘉升	本 所
第二屆亞洲 STM 及第一屆亞太近場光學會議	08/16/96-08/18/96	韓國漢城	陸念華	主 題
NATO ASI 表面擴散：原子與集體程序講習會	08/25/96-09/05/96	西 臘	鄭天佐	主 題
國際無線電科學聯合會第十五屆大會	08/26/96-09/05/96	法國 Lille	王唯工	國科會
第三屆國際重整群會議	08/26/96-08/31/96	俄羅斯 Dubna	胡進錕	國科會
第十屆國際水利研究學會亞洲太平洋分區學術研討會	08/26/96-08/29/96	馬來西亞	蕭葆義	本 所
第十四屆國際希土磁鐵及其應用研討會	09/01/96-09/04/96	巴西聖保羅	姚永德	國科會
第十三屆國際高能物理研討會	09/02/96-09/07/96	莫斯科近郊 JINR	王明哲	本 所
第一屆兩岸中高能物理研討會	09/02/96-09/06/96	中國大陸北京	張志義	本 所
第一屆兩岸中高能物理研討會	09/02/96-09/06/96	中國大陸北京	鄭海揚	本 所
第一屆兩岸中高能物理研討會	09/02/96-09/06/96	中國大陸北京	楊桂周	本 所

會議名稱	會期	舉辦地點	出席人員	經費來源
第九屆國際希土合金磁異向性研討會	09/05/96-09/05/96	巴西聖保羅	姚永德	國科會
第七屆歐洲鑽石、類鑽與相關材料會議與第五屆國際新鑽石技術聯合會議	09/08/96-09/13/96	法國圖爾	劉 鏞	本所+自理
第四屆國際奈米尺寸科學及技術會議	09/08/96-09/12/96	中國大陸北京	張嘉升	主 題
第六屆國際流場模擬與紊流量測會議	09/08/96-09/10/96	美國佛羅里達	黃榮鑑	國科會
第十七屆國際 x-射線及內殼層作用會議	09/09/96-09/13/96	德國漢堡	余岳仲	國科會
計算模型及計算物理國際會議	09/16/96-09/21/96	俄羅斯 Dubna	胡進錕	國科會
第二十二屆國際純粹及應用物理聯盟大會	09/18/96-09/21/96	瑞典	鄭天佐 姚永德	本 院
第三屆微重力科學會議	10/02/96-10/05/96	大陸西安	簡來成	本 院
第四十七屆國際太空聯盟年會	10/07/96-10/11/96	大陸北京	簡來成	本 院
國際未來加速器協會	10/15/96-10/18/96	日本	李世昌	本 院
Oji 研討會及福岡衛星會議	10/25/96-11/02/96	日本東京	鄭天佐	主 題
中國高等科學技術中心及北京現代物理研究中心十周年報告會議	11/03/96-11/03/96	中國大陸北京	謝雲生	本 所
第十四屆加速器應用於研究及工業之國際會議	11/06/96-11/09/96	美國德州達拉斯	林爾康	國科會

會議名稱	會期	舉辦地點	出席人員	經費來源
第四十一屆磁性及磁性材料研討會	11/12/96-11/15/96	美國亞特蘭大	姚永德	本所+主題
第四十一屆磁性及磁性材料研討會	11/12/96-11/15/96	美國亞特蘭大	Ivo Klík	主題+自理
一九九六年美國材料學會秋季會議	12/02/96-12/06/96	美國麻州波士頓市	黃英碩	本所+自理
反物質磁譜儀 (AMS) 會議	01/06/97-01/10/97	中國大陸北京	李世昌	本所+自理
第七屆理論固態物理會議	02/03/97-02/05/97	韓國大田	胡進錕	韓方
頂夸克物理研討會	01/09/97-01/10/97	中國大陸北京	葉平	本所
亞太理論物理中心委員會	01/11/97-01/12/97	韓國漢城	李世昌	本所+自理
亞太理論物理中心第一屆評議會	01/11/97-01/14/97	韓國漢城	鄭天佐	本院+韓方
歐洲粒子物理中心 AMS 技術協調會	01/23/97-02/04/97	瑞士	歐陽彥堂	本所
反物質磁譜儀合作組會議	01/25/97-01/27/97	瑞士日內瓦	李世昌	本所
第二十一屆凝態物理年會	02/03/97-02/08/97	紐西蘭 Hauraki Gulf	鄭天佐	主題
第二屆亞洲未來加速器委員會	02/22/97-02/23/97	泰國 Nakhon Ratchasima	李世昌	本院
第十屆以電腦研究凝態近代發展會議	02/24/97-02/28/97	美國喬治亞	胡進錕	本所
中日小型加速器及其應用研討會	03/02/97-03/04/97	日本東京	林爾康、江紀成、王建萬、余岳仲	日方+國科會

會議名稱	會期	舉辦地點	出席人員	經費來源
物理學校--尺度不變性與未來方向冬季會議	03/10/97-03/14/97	法國	梁鈞泰	本所+自理
改進中子電雙極矩量度討論會	03/13/97-03/14/97	美國	江紀成	本所
一九九七年美國物理學會三月會議	03/17/97-03/21/97	美國堪薩斯	陳洋元	本院
一九九七年美國物理學會三月會議	03/17/97-03/21/97	美國堪薩斯	龐文濤	國科會
一九九七年美國物理學會三月會議	03/17/97-03/21/97	美國堪薩斯	李定國	國科會
統計物理新發展會議	03/25/97-03/26/97	日本	胡進錕	日方
一九九七年材料學會春季年會	03/31/97-04/04/97	美國舊金山	任盛源	國科會
一九九七年國際磁學研討會	04/01/97-04/04/97	美國新奧爾良	姚永德	主題
一九九七年國際海洋會議	05/12/97-05/14/97	新加坡	黃榮鑑	國科會
第七屆國際海域與極地工程研討會	05/25/97-05/30/97	美國夏威夷	蕭葆義	本所
第七屆國際海洋工程會議	05/25/97-05/30/97	美國夏威夷	黃榮鑑	本所
第三屆海內外華人航天科技研討會	05/28/97-05/31/97	澳門	簡來成	自理
第四屆國際計算物理會議	06/02/97-06/04/97	新加坡	陳志強	本所
第四屆國際計算物理會議	06/02/97-06/04/97	新加坡	李定國	本所
第五十七屆物理電子學會議	06/18/97-06/21/97	美國 Eugene Oregon	鄭天佐	本所

會議名稱	會期	舉辦地點	出席人員	經費來源
低能粒子物理會議	06/19/97-06/21/97	瑞士 Nenchatel	王子敬	本所
弱作用力及微中子國際會議	06/22/97-06/28/97	意大利 Capri	王子敬	本所

Institute Sponsored Meetings

1. First Asia Pacific Workshop and Conference on Strong Interactions, Taipei
2. 第三次北區重力與宇宙論研討會
3. The Third International Workshop on Particle Physics Phenomenology
4. Mini-Workshop on Protein Structure Determination
5. 第一屆海峽兩岸磁性物理研討會
6. 分子動力學模擬法小型研討會
7. 國際表面及薄膜科學研討會(Taipei International Symposium on Surfaces and Thin Films)
8. 第二屆超晶格物理性質研討會(1997 Symposium on Superlattice Physics)
9. 力學與現代科技研討會(Workshops for Mechanics and Modern Sciences & Technologies)
10. The 6th. Academia Sinica Workshop on Statistical Physics and Numerical Simulation: Monte Carlo Method and Computational Biology
11. 應用科學及工程技術新趨勢研討會(Taipei International Symposium on Recent Trends in Technological Developments)

Institute Sponsored Meetings

FIRST ASIA PACIFIC WORKSHOP AND CONFERENCE ON STRONG INTERACTIONS, TAIPEI

1-31 August 1996, Institute of Physics, Academia Sinica, Taipei

Jungil Lee

- (1) Derivation of the NRQCD effective Lagrangian.
- (2) Velocity scaling in NRQCD effective theory.
- (3) Old fashioned method to deal with the quarkonium production and decay.
- (4) NRQCD method to deal with the quarkonium production and decay.
- (5) Some applications on J/ψ production and decay.

Igor Dremin

- (1) Introduction
- (2) Quarks:
flavor, color, currents, symmetries.
- (3) QCD:
gauge invariance, asymptotic freedom, confinement, perturbation theory, Feynman diagrams, Space-time evolution, angular ordering
- (4) Hard processes:
 1. e^+e^- (jets, heavy quarks, bound states, potential models)
 2. ep scattering (scaling, partons and QCD)
- (5) multiple production in QCD:
equations for generating functions, multiplicity distributions, rapidity "plateau".
- (6) The chiral model and disorder chiral condensate:
"Baked Alaska", coherent and squeezed states, charge asymmetry.
- (7) The gluon radiation:
effects of the finite radiation length in QCD and QCD, heavy quarks, ring-like events, LPM-effect, high E_T jets.

Chi-Sing Lam

- (1) Introduction:
 1. Overview

2. Conventions
3. Feynman rules
- (2) High-Energy Elastic Scattering:
 1. Energy dependence and Regge poles
 2. QCD to $O(g^6)$
- (3) Factorization and Eikonal Formulas:
 1. Factorization formulas and applications
 2. Eikonal formula and the sum of QCD s-channel-ladder diagrams
- (4) Nonabelian Cut Diagrams:
 1. Multiple commutator formula
 2. Nonabelian cut diagrams
 3. Large- N_c QCD
 4. High-energy quark-quark scattering to $O(g^6)$
- (5) The Reggeized Factorization Hypothesis

Jianwei Qiu and George Sterman

- (1) Review and Introduction [1 lecture]:
 1. Deep Inelastic Scattering and Parton Model
 2. QCD and Asymptotic Freedom
 3. Renormalization in QCD
 4. Dimensional Regularization (Minkowski vs. Euclidean Space and Analyticities)
- (2) Infrared Safety and Jets [1 lecture]:
 1. Landau Equations (Pinches and Physical pictures)
 2. Time-ordered perturbation theory and unitarity
 3. IR safety and Jet cross sections
 4. e^+e^- annihilation and 1-Loop σ_{2jet}
- (3) Factorization and Evolution [4 lectures]:
 1. Quark DIS and NLO; Quark DY at NLO
 2. factorization for DIS and DY
 3. Evolution: AP equation
 4. Fragmentation and single particle production

*Direct photon (massless)
*single hardron (massive)
*heavy quarkonium (heavy mass)

- 5. QCD global analysis
- 6. Elastic scattering

(4) Resummation [4 lectures]:

- 1. Sudakov Resummation for
*thrust $T \rightarrow 1$

* Q_T factorization for DY, DIS and BFKL resummation.

(5) Power corrections [4 lectures]:

- 1. DIS, OPE and high twist
- 2. IR renormalization and OPE
- 3. Power correction in hadronic scattering
- 4. Spin physics

中央研究院物理研究所
第三次北區重力與宇宙論研討會

時間：1996年10月28日

地點：中央研究院物理研究所一樓演講室

倪維斗教授 (清華大學物理系)

On the Recent Status of Experimental Gravitational Wave Research

曹慶堂教授 (淡江大學物理系)

Post-Newtonian Gravitational Wave Generation from Spinning Particles

吳建宏博士 (中研院物理所)

Primordial Gravitational Wave

**The Third International Workshop on Particle Physics
Phenomenology**

14-17 November 1996, Chin-Shan Youth Activity Center, Taipei, ROC

11/15/96

H.Y. Cheng (Academia Sinica)
Opening Talk

Benjamin Grinstein (UC, San Diego)
Introduction to the Theory of Heavy Mesons and Baryons(I)

Ernest Ma (UC, Riverside)
Broken Supersymmetric U (1) Gauge Factor at the TeV Scale

E. Braaten (Ohio State)
Heavy Quarkonium (I)

John N. Ng (TRIUMF)
Supersymmetry and CP violation in meson decays

Benjamin Grinstein (UC, San Diego)
Introduction to the Theory of Heavy Mesons and Baryons(II)

Shin-Nan Yang (National Taiwan Univ.)
Signals of Heavy Ion Collision and Phobos Physics

Yuan-Hann Chang (National Central Univ)
Phobos experiment of RHIC

Takao Inagaki (KEK)
Measurement of the $K_L \rightarrow \pi^0 \nu \bar{\nu}$ Decay at KEK

11/16/96

E. Braaten (Ohio State)
Heavy Quarkonium(II)

Lay Nam Chang (VPI&SU)
Chiral Invariance and Inconsistency of the Minimal Standard Model

P. Q. Hung (Virginia)
Anatomy of the Higgs mass spectrum

Benjamin Grinstein (UC, San Diego)

Keh-Fei Liu (Kentucky)
Quark and Parton Models from Lattice QCD

E. Braaten (Ohio State)
Heavy Quarkonium (III)

Y. Kuno (KEK)
Search for T-violation in $K_{\mu 3}^+$ decay

Pierre Depommier (Montreal)
Reviews on Rare Pion and Muon Decays

G. L. Lin (National Chiao Tung Univ.)
Probing Flavor Changing Neutral Higgs Couplings at LHC

11/17/96

Chia-Hung Chang (National Tsing Hua Univ.)
Factorization, Effective Field Theory and Nonleptonic Heavy Meson Decay

Xiao-Gang He (Melbourne)
Penguins and CP Violation in B decays

Dae Sung Hwang (Sejong, Korea)
Calculation of Heavy-Light Meson Decay Constants in Mock-Meson Approach

C S Kim (KEK and Yonsei, Korea)
Determinations of the CKM Parameters

Hsiang-Nan Li (National Chung Cheng Univ)
Determinations of the HQET Parameters from the $B \rightarrow X_S \gamma$ Decay

Wei-Min Zhang (National Tsing Hua Univ)
The Parton Picture of Transverse Component of Bilocal Currents in DIS

S. C. Lee (Academia Sinica)
Status of High Energy Experimental Activities of Academia Sinica Group

Y. Kuno (KEK)
Status of Japan Hadron Project (JHP)

Wei-Shu Hou (National Taiwan Univ.)
Taiwan BELLE: Status of KEK B Factory Participatio

Darwin Chang (National Tsing Hua Univ.)
Closing Talk

Mini-Workshop on Protein Structure Determination

時間：1996年12月9日

地點：中央研究院行政大樓四樓，計算中心視聽教室

盧天惠教授 (清大物理系)、廖彥銓博士、袁小玲博士、蕭傳鏗博士 (中研院分生所)

Protein Structure Determination by MIR, SIR and Molecular Replacement
Methods

張石麟教授 (清大物理系)

Phase Extension Using X-Ray Multiple Diffraction and Maximum Entropy
Method

蘇武沛教授 (Dept. of Phys., Univ. of Houston, Houston, Texas)

X-Ray Phase Problem and Simulated Annealing

黃太煌博士 (中研院生醫所)

Protein Structure Determination by Nuclear Magnetic Resonances

林小喬 (中研院生醫所)

Accuracy & Precision of NMR Relaxation Experiments and MD Simulation
for Characterizing Protein Dynamics

第一屆海峽兩岸磁性物理研討會

時間：1996年12月9-10日

地點：中央研究院物理研究所、台灣大學凝態中心及物理系

12/9/96

Registration

鄭天佐所長 (中研院物理所)、貴賓致詞: 國科會古處長煥球

Welcome and Opening Remarks

Session I

戴道生 (北京大學): Chairman

趙見高 (北京中科院)

大陸的高分子磁性研究情況 (有機磁性材料)

古煥球 (清華大學)

Metal-insulator Transition and Anomalous Pr-ordering in High-Tc Superconductors

Session II

古煥球 (清華大學): Chairman

戴道生 (北京大學)

稀土錳氧化物的結構、電磁性質和巨磁電阻效應 (CMR)

李文獻 (中央大學)

Triple Magnetic Transitions in CMR Compound NdMnO₃

彭維鋒 (淡江大學)

Magnetic Orientation of Ni in Zn-Ni Ferrites Studies by Soft-X-Ray Magnetic Circular Dichroism

陳洋元 (中研院)

Magnetic Interaction in Heavy Fermion Compound (Ce_{1-x}La_x)₃Al

Session III

林水田 (成功大學): Chairman

梅良模 (山東大學)

FeB 基材料的巨磁-阻抗(GMD)研究

黃榮俊 (成功大學)

Structure, Morphology and Magnetism of Metastable hcp (1100) Permalloy Films Grown by MBE

劉鏞 (中研院)

Structural and Magnetic Properties of Co-Thin Films and Superlattices

沈青嵩 (師範大學)

Magnetic Anisotropy of Ni/Pt (111) Thin Film Studies by MOKE

Session IV

梅良模 (山東大學): Chairman

林水田 (成功大學)

Magnetic Properties of Quasicrystals

任盛源 (中研院)

Magnetic Domain Walls in Fe_{100-x}Ni_x Films

田聰 (成功大學)

Magnetic Properties of CeRu₂(Si_xGe_{1-x})₂

姚永德 (中研院)

Mechanism Study of Magnetic Coupling

杜鴻模 (高雄師範大學)

Magnetic Properties of Rare Earth Alloy TbFe₂Si₂

12/10/96

Session V

趙見高 (北京中科院): Chairman

梅良模 (山東大學)

Fe(Co)/pd 多層膜的 pd 層磁極化和磁性

黃昭淵 (台灣大學)

Physical Properties of Some Novel Magnetic Materials

Session VI

黃暉理 (台灣大學): Chairman

戴道生 (北京大學)

摻稀土的錳鈷(Mn-Bi)薄膜的磁光效應

劉如熹 (台灣大學)

The Chemical Control of Colossal Magnetoresistance Effect in Manganites

陳恭 (中正大學)

Structural and Magnetic Ordering in $\text{Fe}_3\text{O}_4/\text{MgO}$ Superlattices

管惟炎 (清華大學)

$\text{R}_{1-x}\text{Ba}_{2-x}\text{Cu}_3\text{O}_7$ 正常態之反常磁行爲(R=Nd,Eu)

Session VII

陳銘堯 (台灣大學):Chairman

趙見高 (北京中科院)

稀土基軟磁薄膜及硬磁薄膜的研究

陳建德 (同步輻射研究中心)

軟 X 光磁圓偏振二向性與磁學研究

Session VIII

黃昭淵 (台灣大學):Chairman

黃暉理 (台灣大學)

Characteristics of Domain Wall Structure and Domain Wall Dynamics

林志忠 (台灣大學)

Low-temperature Magnetoresistances of Thin Cu Films in Proximity to nm-Scale Ni Particles

陳銘堯 (台灣大學)

Studies of $\text{Bi}_3\text{Fe}_5\text{O}_{12}$

黃暉理與黃昭淵 (台灣大學)

Discussing & Closing Remarks

分子動力學模擬法小型研討會

時間：1996年12月27日

地點：中央研究院物理研究所一樓演講室

蔡秀芬 (中山大學物理系)

Molecular Dynamics Simulations: General Introduction

吳式玉 (Univ. of Louisville, USA)

M D Approach to Materials Research

馬文忠 (中山大學物理系)

Molecular Dynamics Simulation of Supercooled Dimer Liquid

國際表面及薄膜科學研討會

Taipei International Symposium on Surfaces and Thin Films

時間：1997年3月25-28日

地點：IAMS, Taipei and SRRC, Hsinchu, Taiwan

3/25/97

T. J. Chuang (莊東榮)

Welcome and Opening Remarks

Session I

鄭天佐:Chairman

J. W. Lyding

UHV-STM Nanofabrication and Semiconductor Interface Characterization :
Transitions to Technology

H. Brune

Kinetics of Metal Epitaxy and Application to the Growth of Nanostructures

K. Matsumoto

STM/AFM Nano-Oxidation Process for Room Temperature Operated Single
Electron Devices, Ultra-fast Optical Switch and High Electron Mobility
Transistor

Session II

C. C. Chang (張哲政):Chairman

W. Ho

Angstrochemistry and Femtochemistry at Surfaces: A Journey in the Extreme
of Space, Time, and Vacuum

A. W. Kley

Molecular Beam Studies of the Elementary Steps in Gas-Surface Interactions

M.-H. Tsai (蔡民雄) and Y.-Y. Yeh

Energetics and Geometries of the Steps on the Diamond C(001) Surface

I. W. Lyo

Identification and Manipulation of Molecular Oxygen on Si(111)

I. S. Hwang (黃英碩)

Atomic View of the Reaction Pathway to Oxidation of Si(111)-7x7 Surfaces

**Cheng-Hao Ko (柯正浩), Ruth Klauser, Tung J. Chuang, Der-Hsin Wei,
Hei-Hing Chan, Chia-Hao Chen and M. M. Sarker**

Soft X-Ray Photoemission Spectromicroscopy Project at the Synchrotron
Radiation Research Center

S. Gwo (果尙志), S. Miwa and H. Tokumoto

Atomic Origin of the (3x3)-Ordered GaAs(001): N Surface Prepared by
Nitrogen-Plasma Assisted Molecular-Beam Epitaxy

3/26/97

Buses leaving for Hsinchu from Nankang and IAMS

Session III

R. Klauser (柯陸詩):Chairman

Introduction to SRRC by Y. C. Liu/ R. Klauser (劉遠中/柯陸詩)

D. D. Bhawalkar

Synchrotron Radiation Sources INDUS-1 and INDUS-2

C. J. Jacobsen

High Resolution Imaging and Microscopy Using a Scanning Transmission X-
Ray Microscope

Session IV

C. H. Hsu (徐嘉鴻):Chairman

G. Schütz

Magnetic Absorption

C.-C. Kao

X-Ray Resonant Magnetic Scattering Study of Thin Films and Multilayers

K. Horn

Photoemission from Semiconductor Interfaces: Band Structure, Quantum Size
Phenomena and Structural Effects

M.-T. Tang (湯茂竹)

Surface X-Ray Scattering Research Activities at SRRC

3/27/97

Session V

W. F. Pong (彭維鋒):Chairman

C. D. Bain

Vibrational Spectroscopy at Interfaces by Sum-Frequency Generation

A. S. Lagutchev, K. J. Song, J. Y. Huang, P. K. Yang and T. J. Chuang

Vibrational Spectroscopy of Alkylsiloxane Monolayers Self-Assembled on

Fused Silica

W. S. Fann (范文祥)

Nanometer Optical Properties of Conjugated Polymers

C.-L. Cheng, J.-C. Lin and H.-C. Chang (張煥正)

The Absolute Absorption Strength and Vibrational Coupling of CH Stretching on Diamond C(111)

M. H. Cho, S. W. Whangbo, C. N. Whang, S. C. Choi, S. B. Kang, S. I. Lee,

M. Y. Lee

Epitaxial Growth of Y2O3 Films on Si(100) by Ionized Cluster Beam

Deposition

D.-J. Huang (黃迪靖) and P. D. Johnson

Resonant Scattering of Quantum Well States in Cu(001) Thin Films

Session VI

S.-L. Lee (李錫隆):Chairman

K. Wandelt

Atomic-Scale Properties on Thin Metal Film and Alloy Surfaces

C. S. Chang (張嘉升)

Initial Stage on Metalization of Noble Metal/Si(100) Systems

Deng-Sung Lin (林登松) and Perng-Horng Wu

Real-Time Scanning-Tunneling-Microscopy Observation of Structural Phase Transitions Si(100)-(2x1)→(2xn)→c(4x4)

M. C. Tringides

Equilibrium vs Non-Equilibrium Surface Diffusion

S. C. Ying

Collective Effects in Surface Diffusion

F. K. Men (門福國) and C. R. Hsu

Surface Stress Anisotropy on the Ge-Covered Si(001) Surface

3/28/97

Session VII

M.-H. Tsai (蔡民雄):Chairman

B. B. Pate

Emission Physics of Negative Electron Affinity Diamond

F. Ren

Enhancement-Mode n- and p-Channel GaAs MOSFETs on Semi-Insulating Substrates

Z. Y. Zhang

Electronic Growth of Metallic Overlayers on Semiconductor Substrates

C.-T. Tseng (曾捲慈), W.-S. Lo, J.-Y. Yuh, R.-Y. Chu and K.-D. Tsuei

Fragmentation and Carbide Formation of C60 on Be(0001) Surface

Session VIII

M.-H. Hon (洪敏雄):Chairman

L. C. Chen (林麗瓊)

Progress in Carbon Nitride Growth

H. C. Shih (施漢章), S. L. Sung, T. G. Tsai and K. P. Huang

Synthesis and Characterization of Carbon Nitride Film on Silicon by Microwave Plasma Enhanced CVD

Chiu-Ping Cheng, Ie-Hong Hong and Tun-Wen Pi (皮敦文)

Core Level Photoemission Study of C60 on Clean Si(001)2x1

Manisha Kundu, Ali Azam Kosravi and S. K. Kulkarni

Band-Gap Tailoring in CdS abd ZnS Nanoparticles

第二屆超晶格物理性質研討會
1997 Symposium on Superlattice Physics

時間：1997年4月25-26日
地點：中央研究院物理研究所

4/25/97

Registration

鄭天佐所長 (中研院物理所)

Welcome and Opening Remarks

Session I

劉鏞 (中研院):Chairman

張慶瑞 (台灣大學)、陳穗斌 (台灣大學)

Influence of Interlayer Coupling in Tunneling Magnetoresistance

洪雪行 (同步輻射中心)

Recent Soft X-Ray Scattering Experiments at SRRC

盧志權 (中研院)

Probing Magnetic Anisotropy of Co Films by means of MOKE & Planar Hall Effect

Session II

陳啓東 (中研院):Chairman

任盛源 (中研院)

鈷鈦磁膜內之磁異向性於成長優選結構

鄭鴻祥 (凝態中心)

Mimiband Structure of 2-6 Semimagnetic Semiconductor

陳恭 (中正大學)

The Interfacial Structure in Oxide Superlattices

傅昭銘 (高雄師範大學)

層狀結構高溫超導氧化物之磁阻與超導電行為

陳立翰 (高雄工學院)

Magnetoresistance in Perovskite Manganite Materials

P. S. Asoka Kumar, Chao-Hong Wang, T. J. Chuang, Ruth Klauser and Chia-Hao Chen

The Interaction of Ga and N on SiC and LiGaO₂ Surfaces Studied by Synchrotron Radiation Photoemission

Chaochin Su (蘇昭瑾), H.-L. Lu, J.-C. Lin, Y. L. Wang, Ker-Jar Song and T. J. Chuang

Desorption of Deuterium from Diamond C(111) and C(100) Surfaces

J. B. Wang (王重博) and Y. L. Wang

Imaging Shallow Ion Implants by Electrostatic Force Microscopy

4/26/97

Session III

姚永德 (中研院): Chairman

楊鴻昌 (台灣大學)

高溫超導超晶格之物理性質研究

劉鏞 (中研院)

鈷/鉻超晶格的磁異向性

張慶安 (工研院)

(100) Magnetic Layers & Superlattices Epitaxially Grown on Silicon

Session IV

楊鴻昌 (台灣大學): Chairman

Ivo Klik (中研院)

Planar Hall Effect in Magnetic Thin Films & Superlattices

劉立基 (彰化師範大學)

由玻璃中析出半導體超微粒之結構分析與光學研究

周麗新 (清華大學)

相變化光碟技術

姚永德 (中研院)

鎳鐵合金單層及多層膜之物理研究

姚永德 (中研院)

Discussion & Closing Remarks

力學與現代科技研討會

Workshops for Mechanics and Modern Sciences & Technologies

時間：1997年4月26-27日

地點：台灣大學

4/26/97

主席：梅強中院士

大會開幕式

中央研究院李院長遠哲致詞

行政院國家科學委員會劉主委兆玄致詞

主席：鮑亦興院士

國內工作小組報告

林見昌教授

基礎力學

戈正銘教授

動力與控制

陳文華教授

固體力學與材料科技

陳朝光教授

流體力學與熱傳

翁政義教授

高科技與航太工程

黃榮鑑教授

地球與環境科學

王唯工教授

生物與醫學科學

分科討論(一)

主席：吳耀祖院士

基礎力學

主席：何志明教授

動力與控制

主席:王劍誠教授

固體力學與材料科技

主席:梅強中院士

流體力學與熱傳

分科討論(二)

主席:沈申甫院士

高科技與航太工程

主席:鄧大暈院士

地球與環境科學

主席:馮元楨院士

生物與醫學科學

主席:梅強中院士、鮑亦興院士、吳耀祖院士

綜合討論與總結

主席:鮑亦興院士

大會閉幕式

The 6th. Academia Sinica Workshop on Statistical Physics and Numerical Simulation: Monte Carlo Method and Computational Biology

27 May 1997, Lecture Room at the First Floor of the Institute of

Physics of Academia Sinica

R. B. Swendsen (Dept. of Physics, Carnegie-Mellon Univ.)

Transition Monte Carlo method

Carmay Lin (Inst. of Biomedical Sci., Academia Sinica)

Three-Dimensional Protein Structure Prediction by Combined Homology Modeling and NMR Restraints

Pik-Yin Lai (Dept. of Phys., National Central Univ.)

Unfolding a collapsed polymer in a poor solvent

Ming-Jing Hwang (Inst. of Biomedical Sci., Academia Sinica)

Restraint-based molecular dynamics simulation annealing for protein structure prediction

R. B. Swendsen (Dept. of Physics, Carnegie-Mellon Univ.)

Protein simulations

Ki-Wing To (Inst. of Phys., Academia Sinica)

Polymer conformation near the critical point of a mixed solvent

應用科學及工程技術新趨勢研討會

Taipei International Symposium on Recent Trends in
Technological Developments

3-5 June 1997, Academia Sinica, Taipei
Lecture Room: Rm201, Institute of Earth Sciences

6/3/97

Registration

Session I

T. T. Tsong (Academia Sinica):Chairman

M. S. Lin (ITRI, Taiwan)

MEMS and Nanotechnological Developments in ITRI

D. T. Shaw (NYSIS SUNY/Bufalo, USA)

Nanoparticle Technology-An Emerging Frontier in Materials Research

J. S. Tsai (NEC, Japan)

The Potential of Aluminum Single Electron Devices in the Light of the Future
Trend in Microelectronics

Session II

H. L. Hwang (NTHU, Taiwan):Chairman

J. P. Pekola (Univ. of Jyväskylä, Finland)

Nanoscale Low Temperature Physics and Techniques

P. Delsing (Chalmers Univ. of Technology, Sweden)

Correlated Transport in Capacitively Coupled Arrays of Small Tunnel
Junctions

S. Han (SUNY/Bufalo, USA)

Quantum Effects in Systems of Small Josephson Tunnel Junctions

C. D. Chen (Academia Sinica)

Andreev Reflection and Josephson Coupling in NSS Transistors

S. Tarucha (NTT, Japan)

Vertical Transport through a Single and a Double Quantum Dot

6/4/97

Session III

Y. Y. Chen (Academia Sinica):Chairman

S. Asai (Hitachi Ltd., Japan)

An Overview of Research at HARL, Hitachi Advanced Research Lab

T. H. Ning (IBM, USA)

Silicon VLSI Technology: Limits and Opportunities

H. L. Hwang (NTHU, Taiwan)

Thin Film Photovoltaics

Session IV

Y. D. Yao (Academia Sinica):Chairman

S. Iijima (NEC, Japan)

Carbon Nanotubes: Production, Characterization and Applications

M. S. Wong (Northwestern Univ., USA)

Science and Technology of Advanced Hard and Superhard Coating Materials

C. H. Chen (Bell Labs., USA)

Charge-Ordering in Doped Manganese Oxides

M. K. Wu (NTHU, Taiwan)

The Observation of Possible p-wave Superconductivity in Ru-based Double
Perovskites

6/5/97

Session III

Y. Liou (Academia Sinica):Chairman

Dr. Yuan T. Lee

Welcome Remarks by President of Academia Sinica

R. D. Shull (NIST, USA)

Properties of Nanostructured Magnetic Materials

J. Moreland (NIST, USA)

Progress Towards Mechanical Detection of Single Spins

C. M. Huang (ITRI, Taiwan)

Electrical and Thermal Modeling of a Gated Field Emission Triode

Seminars

中央研究院物理所八十六年度演講一覽表
(1996年7月~1997年6月)

演講題目	演講者姓名	所屬機構	日期
Wavelet and its Applications	王昆泉	Michigan State University	07/05/96
DNS for flow transition around complex geometry	劉超群	Louisiana University	07/10/96
The CERN CHORUS $\nu_{\mu} \rightarrow \nu_{\tau}$ Neutrino Oscillation	王子敬	CERN	07/12/96
Monte Carlo Programming for Pedestrains	Chien-Peng Yuan	Michigan State University	07/12/96
Electrorheological Properties of Semi-conducting Polymer Particle Suspensions	崔瑩鎮	韓國 Inha University	07/24/96
自由液面流紊流模擬	許文翰、蔣德普、蔡武延	台灣大學	07/26/96
Pattern Formation of Vertically Vibrated Granular Materials	H. K. Pak	Pusan National University	07/30/96
Liquid Thin Films I : Dynamics Scaling of Wetting Layer Growth	H. K. Pak	Pusan National University	08/02/96
Liquid Thin Films II : 2-D Imaging Ellipsometric Microscope			
Anomalous Excitations of the 2D t-J model	李定國	中研院物理所	08/09/96
Bending Energy of Amphiphilic Films at the Nanometer Scale	J. Daillant	CEA-Saclay, France	08/15/96
Introduction to Environmental Magnetism	Masayuki Torii	Lab. of Rock and Paleomagnetism Division of Earth and Planetary Sciences, Graduate School of Science, Kyoto Univ.	08/16/96

演講題目	演講者姓名	所屬機構	日期
Magneto-impedance of Amorphous Ferromagnetic Materials	任盛源	中研院物理所	08/23/96
Design, Construction, and Assembly of Silicon Vertex detector	M. Hrycyk	Fermilab Silicon Laboratory Engineer	09/16/96
Exploration of Electronic Properties of Quantum Dots	C. Y. Fong	University of California, Davis	09/19/96
Universal Power Law in the Noise from a Crumpled Elastic Sheet	梁鈞泰	中研院物理所	09/23/96
The Finite Element Approach to Computational Aerothermodynamics	董秉綱	中國科技大學機械系	09/30/96
Localized Excitations in a Vertically Vibrated Granular Layer	陳志強	中研院物理所	10/07/96
Directional Viscous Fingering	梁乃悅	台灣大學物理系	10/14/96
Extreme Ultraviolet Emission from Active Galactic Nuclei	黃崇源	中研院天文所	10/18/96
Quantum Computation	陳昭安	中研院物理所	10/21/96
He ³ 超流介紹	李定國	中研院物理所	10/22/96
(1) On the Recent Status of Experimental Gravitational Wave Research (2) Post-Newtonian Gravitational Wave Generation From Spinning Particles (3) Primordial Gravitational Wave	(1) 倪維斗 (2) 曹慶堂 (3) 吳建宏	(1) 清華大學物理系 (2) 淡江大學物理系 (3) 中研院物理所	10/28/96
Phases Transitions Generated by the Superposition of Multifractals	曾玄哲	中興大學物理系	10/28/96
Point Contact of Quantized Conductance	張嘉升	中研院物理所	10/29/96
由牛郎織女的情書談到物質的起源及 CP 對稱性的破壞	張達文	清華大學物理系	10/30/96

演講題目	演講者姓名	所屬機構	日期
From the Viewpoint of Operator Product Expansions	蘇旺昌	清華大學物理系	11/01/96
Exclusive Diffractive Processes and the Quark Substructure Mesons	李正雄	Argonne National Laboratory	11/04/96
斷裂現象	曾文哲	中研院物理所	11/04/96
Equilibrium and Non-equilibrium Aspects	李大興	中研院物理所	11/08/96
Experimental Realization of Critical Thermal Fuse Rupture	杜其永	中研院物理所	11/11/96
Distribution of Width-moments in Random Walks and Surfaces	謝景平	Department of Physics, Virginia Tech	11/11/96
Recent Developments in Radiationless Transitions in Photochemistry	林聖賢	中研院原分所	11/13/96
Spin Glass and Derrida Model	David Saakian	Yerevan Institute of Physics, Armenia	11/18/96
Institute of Physics, Organization & New Services	Richard Field	Institute of Physics, England	11/18/96
Couette Taylor Flow in a Dilute Polymer Solution	黎璧賢	中央大學物理系	11/18/96
Status of Glueballs	Keh-Fei Liu	University of Kentucky	11/18/96
Implications of Gravity Couplings on Parameters of the Standard Model	Lay Nam Chang	Physics Department, Virginia Tech	11/19/96
Initial Stage of Oxidation on Si(III)-7 × 7 Surfaces	黃英碩	中研院物理所	11/19/96
Prospects at Japan Hadron Project on 50 GeV Proton Synchrotron	Takao Inagaki	National lab. for High Energy Physics, KEK	11/20/96

演講題目	演講者姓名	所屬機構	日期
Solving the X-ray Phase Problem Using X-ray Multiple Diffraction & Maximum Entropy Method	張石麟	清華大學物理系	11/20/96
The Interaction and Manipulation of C ₆₀ Molecules on Si Surfaces	馬遠榮	Dept. of Physics, Univ. of Nottingham	11/21/96
Self-Dual Yang-Mills Theory and Its Application to the Study of Multigloun Amplitudes	Bill Bardeen	Fermi National Lab.	11/22/96
Armeria: Her History, Culture and Language	David Saakian	Yerevan Institute of Physics, Armenia	11/25/96
Brownian Motion	李大興	中研院物理所	11/25/96
Experiments in Low-Temperature Physics	陳洋元	中研院物理所	11/26/96
弱量度和粒子軌跡 (Weak measurement and Particle trajectories)	王敏生	中央大學物理系	11/27/96
Review and Outlook of Fermilab Top Physics	王明哲	中研院物理所	11/29/96
Nepal: Her History, Culture and Language	Om Praakash Niraula	T. U. Amrit Campus, Nepal	12/02/96
Modeling Transport in Quantum Devices	丁肇西	清華大學物理系	12/02/96
Persistent Current in Mesoscopic Systems	蔡炎熾	中研院物理所	12/02/96
Ladders, Legs and Rungs	姚永德	中研院物理所	12/03/96
Density Matrix Renormalization Group Calculation on Conjugated Polymers	蘇武沛	Dept. of Physics, Univ. of Houston	12/03/96
b → sr Branching Ratio in Type III NFC Model	林志隆	成功大學物理系	12/06/96

演講題目	演講者姓名	所屬機構	日期
The Rheology of Concentrated Suspensions	張景宜	Battelle, Pacific Northwest National Laboratory	02/09/96
Recent Resules on Electron-Positron Production in Heavy Ion Collisions	R. Russell Betts	Physics Division, Argonne National Lab. and Physics Dept., Univ. of Illinois	12/10/96
火星有生命嗎?	李太楓	中研院天文所	12/11/96
High Pt Jets at CDF	張寶棟	中研院物理所	12/12/96
Flavor Symmetry of Parton Distribution in the Proton	彭仁傑	Los Alamos National Lab.	12/13/96
A Modified BFKL Equation	李湘楠	中正大學物理系	12/13/96
Absence of Self-Averaging and universal Fluctuations in Random Systems near Critical Points	林財鈺	中研院物理所	12/16/96
Photoelectron Spectromicroscopy as a Microchemical Probe of high Temperature	胡宇光	中研院物理所	12/16/96
鈷 (鈹, 鎳) 薄膜及超晶格的結構與磁性	劉 鏞	中研院物理所	12/17/96
DNA Sequence Matching, Flux Line Pinning and Localization	Terence T. L. Hwa	U. C. San Diego	12/18/96
Electro-Rheological Fluid	Wing-Yim Tam	香港科技大學	12/18/96
(100) Magnetic Layers Grown by the Technique of Metal-Metal Epitaxy on Silicon	Chin-An Chang	工研院光電研究所	12/18/96
Phase-Shift and Symmetry Breaking Relations Between Strong and Electroweak Interactions	Ling-Lie Chau	U. C. Davis	12/20/96
Optimization on Rugged Landscape	陳企寧	中研院物理所	12/23/96

演講題目	演講者姓名	所屬機構	日期
Some aspects of D-Wave Pairing Symmetry in High Tc Superconductors	丁秦生	University of Houston	12/24/96
Rare Earth Hydrides with Switchable Optical Properties	張富春	Dept. of Physics, Univ. of Cincinnati	12/24/96
Quantum-Dot Glass Materials, Ale on Group Iv Materials, and Composite Films	王威禮	Dept. of Physics and Materials Research Institute, Univ. of Texas	12/24/96
A Field Theory Formulation of Statistical Mechanics of α -Bosons	喬玲麗	U. C. Davis	12/26/96
G ₂ and Dynamical Chiral Symmetry Breaking	張為民	清華大學物理系	12/27/96
An Application of Single Electronics a Single Electron Flash Memory Device	陳啓東	中研院物理所及 NEC	12/31/96
雷射晶體	白鳳周	大陸中科院上海光學精密機械研究所	12/31/96
Supersymmetric Lepton Flavor Violation at Next Linear Collider	鄭信佳	Fermi Laboratory	01/03/97
Magnetotransport Properties in Epitaxial La-Nd-Ca-Mn-O Films	陳立翰	高雄工學院	01/06/97
Motions of Particles Floating on a Turbulent Fluids	張思豪	University of Pittsburgh	01/06/97
Nature of Layer-by-Layer Freezing in Free-Standing 40.8 Films	Chih-Yu Chao	Dept. of Physics State Univ. of New York, Buffalo	01/07/97
Introduction to Halo Nuclei	郭子斯	Suny, Stony Brook	01/10/97
Quantum Computing-Its Power and Limitations	周海峰	香港大學	01/13/97

演講題目	演講者姓名	所屬機構	日期
Some Interesting Aspects of Surface Magnetism	盧志權	中研院物理所	01/14/97
Magnetic Refrigeration- An Emerging Technology for the 21st Century	Karl A. Gschneidner, Jr.	Ames Laboratory, Iowa State University	01/15/97
"Neutrino Oscillation. Is it a Farce or a Factum?"	Songhoon Yang	California Institute of Technology	01/15/97
Shell Model of Soap Froth	司徒國業	香港科技大學	01/16/97
Quantum Magnetotransport	司徒國業	香港科技大學	01/17/97
Recent Research Results on Complex Oxides and Carbon Nanotubes	R. P. H. Chang	Dept. of Materials Science and Engineering, Northwestern University	01/23/97
Crystalline-Amorphous Transition as a Microcosm of Materials Science	M. Meshii	Dept. of Materials Science and Engineering, Northwestern University	01/23/97
Modelling Population Dynamics	Jonathan Dushoff	Princeton Univ.	01/23/97
Super Classical Theory of Quantum Mechanics	Willis Lamb	1995 年諾貝爾獎得主	01/30/97
Absorbate-Induced Broadband Infrared Reflectance Changes on metal Surfaces	Keng Ching lin	physics and Astronomy Dept. univ. of Tennessee, Knoxville	02/04/97
Diffusion and Coarsening of Submonolayer islands in homoepitaxy of Cu(100) and Ag(100): A Direct Visualization	Woei Wu Pai	Solid state Division, Oak Ridge national laboratory	02/04/97
Field Emission from Diamond	林立德	中研院物理所	02/18/97

演講題目	演講者姓名	所屬機構	日期
1. Magneto-transport properties of Magnetic Films 2. AF of Magnetic Film 3. MR of Magnetic Film 4. Hall Effect of Magnetic Film	張慶瑞	台灣大學物理系	02/19/97
Growth of CdTe/Cd Zn Te Strained-Layer Single Quantum Wells by Modified Hot-Well Epitaxy and Their Properties	鄭重鉉	Yonsei University	02/26/97
The Development of two-scale Turbulence Model	趙勝裕	海洋大學	02/28/97
Optical Imaging through Animal Tissues with CW Broadband Interferometry	江海邦	中研院物理所	03/04/97
1. Optical Conductivity in the t-J model 2. Quasiparticles and Superconductivity in the t-t'-J model	N. M. Plakida	Bogoliubov Lab. of Theoretical Physics, JINR	03/06/97
Self-organized criticality in a two-dimensional rotating drum model	陳志強	中研院物理所	03/10/97
Correlation between magnetism, electrical structure, and morphology in fcc-like Fe ultrathin films	M. T. Lin	Max-Planck Institute	03/10/97
t-J model and high temperature superconductors	李定國	中研院物理所	03/11/97
Theory of B Decays	余海禮	中研院物理所	03/14/97
Synthesis and Processing of Nanostructured Materials	G. M. Chow	Naval Research Lab.	03/17/97
General Relativity is a Quantum Effective Field Theory	John F. Donoghue	Massachusetts Univ.	03/21/97

演講題目	演講者姓名	所屬機構	日期
The Determination of the Scaling Equation of State (or Effective Potential) in 3D from Renormalization Group	Jean Zimm-justin	Saclay, France	03/22/97
Invalidity of the Spatiotemporal White Noise Assumption	龐寧寧	台灣大學物理系	03/24/97
高溫超導與玻色-愛因斯坦凝聚	管惟炎	清華大學物理系	03/26/97
Cryogenic Detector and its Applications in Nuclear Spectroscopy	王孫崇	中研院物理所	03/28/97
Large Eddy Simulations of Turbulent Flows	黃美嬌	台灣大學機械系	03/28/97
New Results from HERA for Deep Inelastic e-p Scattering at High Q^2	Jaroslav Antos	Slovak Academy of Sciences	03/31/97
Generalized Simulated annealing algorithms using Ballis Statistics	陳企寧	中研院物理所	03/31/97
Multicannical Annealing for Optimization Problem	陳昭安	中研院物理所	04/07/97
Shear Bands of Complex Fluids	陸駿逸	劍橋大學	04/09/97
Carbon Nanotubes	林明發	交通大學電物理系	04/11/97
Nonleptonic B Decays v.s. PQCD	葉聰文	成功大學	04/11/97
Planar Curve Representation of Many Body Systems and Dynamics	黎璧賢	中央大學物理系	04/14/97
Elements in Electronic Design	朱明禮	中研院物理所	04/14/97
Spontaneous Chiral Symmetry Breaking in Two-Dimensional Aggregation	張振宇	Oak Ridge National Lab.	04/15/97

演講題目	演講者姓名	所屬機構	日期
Quasiparticle Relaxations in Superconductors and Semi-Conductors	齊正中	清華大學物理系	04/16/97
The BPS Domain Walls in Self-dual Chern-Simons Higgs Systems	高賢忠	淡江大學	04/18/97
Nanoparticle Science -- An Emerging Materials Research Frontier	D. T. Shaw	SUNY at Buffalo	04/19/97
推廣統計熱力學以描述穩定態的一個嘗試	曾文哲	中研院物理所	04/21/97
The effects of mass inhomogeneity on determining the cosmological parameters	Ron Kantowski	Univ. of Oklahoma	04/21/97
One-loop Vilkovisky-Dewitt effective potential of the scale invariant gravity	Shih-Yuin Lin	交通大學	04/21/97
etics and Thermodynamics of n-Film Growth	張振宇	Oak Ridge National Lab.	04/23/97
Introduction to Superheated Superconducting Granule System and Transition Radiation	陳晉平	中研院物理所	04/28/97
Discrete Scale Invariance and Complex Critical Exponents	梁鈞泰	中研院物理所	04/28/97
Are We Really Made of Quarks?	Jerome I. Friedman	麻省理工學院物理系	05/01/97
Looking for fish	葉真	中央大學物理系	05/05/97
談渾沌之同步	陳義裕	台灣大學物理系	05/07/97
Simulated Annealing and X-ray Crystallography	陳企寧	中研院物理所	05/08/97

演講題目	演講者姓名	所屬機構	日期
Nonlocal induced Condensates, Charmless B meson Decays, and QCD Sum Rules	楊桂周	中研院物理所	05/09/97
New Method for Top Quark Mass Reconstruction in Dilepton Channel	Jaroslav Antos	Institute of Experimental Physics, SAS	05/12/97
Fabrication and Transport Measurement Techniques for Nanoscale Electronic Devices	陳啓東	中研院物理所	05/13/97
Bounded Higher-order Schemes for Convection-Dominated Transport	B. P. Leonard	Univ. of Akron, 機械系	05/14/97
Quantum Delayed Choice Experiments	Robert B. Griffiths	Carnegie-Mellon University	05/16/97
Modeling the Spread of Human Diseases	Jonathan G. Dushoff	Princeton University	05/19/97
Monolayer thermodynamics of Ge on Si (100)	張振宇	Oak Ridge National Lab.	05/22/97
The Heavy Quark Parton Oxymoron	董無極	Michigan State University	05/23/97
FPGA 的設計與開發	趙棟新	大陸中科院高能物理所	05/26/97
Exotic Atom: Double - Helix Positronium	闕志鴻	中央大學天文系	05/28/97
Mass Measurement of "The Remarkable Top Quark" at CDF	葉平	中研院物理所	06/06/97
Einstein-Langevin Equation and Metric Fluctuations	B. L. Hu	University of Maryland	06/11/97
Cosmological and Black hole Horizon Fluctuations	L. H. Ford	Tufts Institute Cosmology, Tufts University	06/11/97

Visiting Scholars
中央研究院物理所八十六度訪問學人表
(1996年7月~1996年6月)

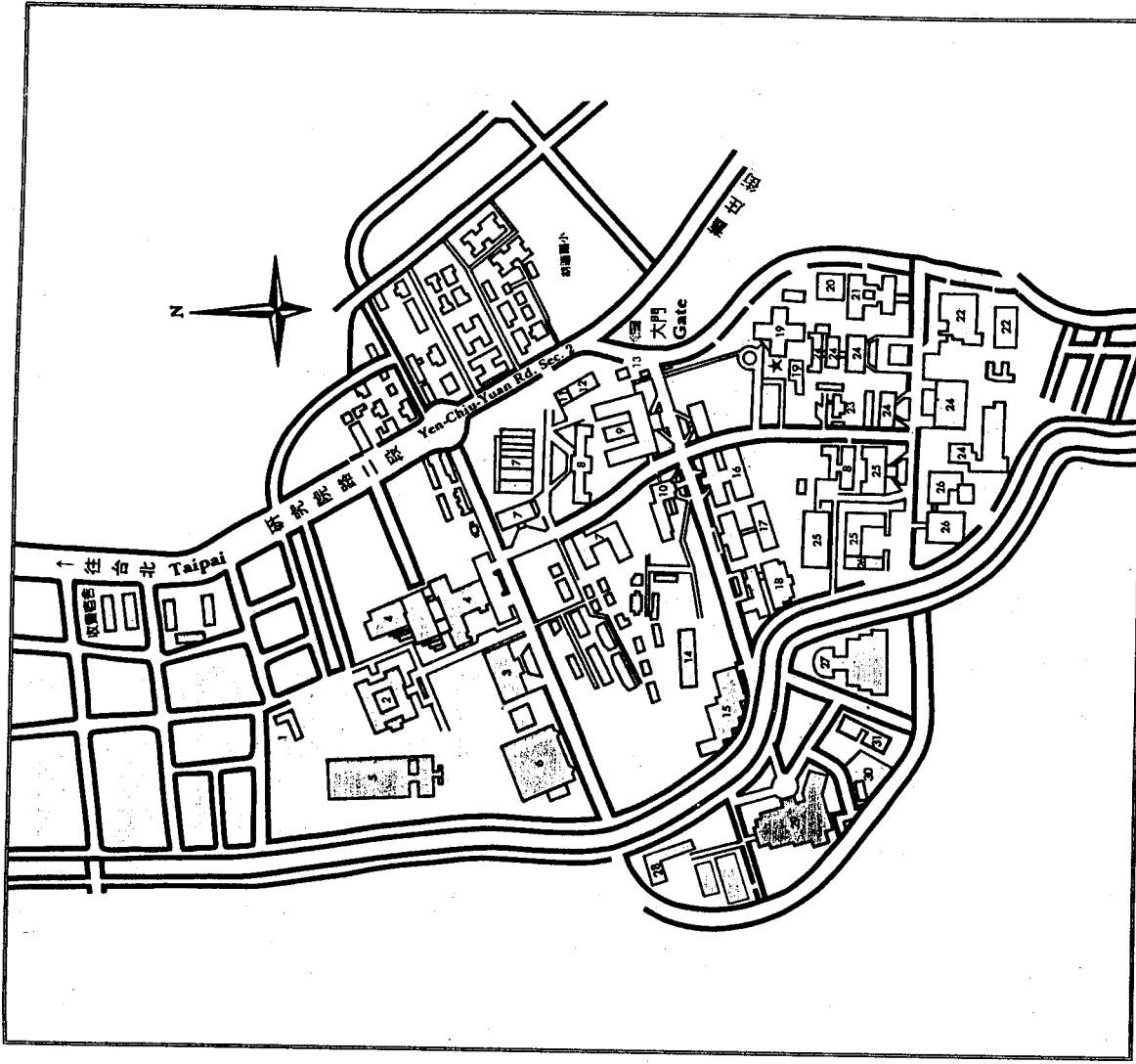
演講題目	演講者姓名	所屬機構	日期
STM and Synchrotron Radiation Studies of Silicon Carbide Surfaces and Interfaces	Patrick Soukiasian	University of PARIS SUD/ORSAAY and CEA, France	06/11/97
QCD Correction to $b \rightarrow s \gamma$ and Its Implications	林貴林	交通大學物理系	06/13/97
Discussion of Aspects Beyond Semiclassical Gravity	B. L. Hu & L. H. Ford	University of Maryland & Tufts University	06/14/97
Some thoughts on small X and high Q^2 Physics	余海禮	中研院物理所	06/16/97
Informal discussions on biophysics	郭鴻	McGill University	06/16/97
Resonances: Foundation of the equipartition principle in dynamics	汪治平	中研院原分所	06/19/97
Statistical Properties of Summands in Random Partition	Hwang Hsien-Kuei	中研院統計所	06/23/97
All Features Large and Small: from the Particle to the Universe	Sheldon Lee Glashow	Physics Department, Harvard University	06/25/97
Dynamics of Random Magnetic System: Implications for Evolution, Neural Networks and Protein Folding	Raymond L. Orbach	Chancellor of Univ. of California at Riverside	06/25/97
Sum Rules for Decays of Mesons Containing Heavy Quarks	Myron Bander	University of California	06/27/97
Physics and the Game of Billiards	Sheldon Lee Glashow	Physics Department, Harvard University	06/27/97
Detecting and Studying Higgs Bosons at Future Colliders	陳泉宏	中研院物理所	06/30/97

訪問人姓名	國籍	訪問期間	備註
梁培德	美國	07/01/96-08/31/96	來所研究
崔瑩鎮	韓國	07/21/96-08/01/96	短期訪問
王煥玉	中國大陸	08/01/96-10/31/96	短期訪問
Om Prakash Niraula	尼泊爾	10/15/96-01/22/97	學術交流
Davit Sahakyan	亞美尼亞	10/20/96-11/19/96	短期訪問
謝景平	美國	11/06/96-12/05/96	學術交流
蘇武沛	美國	12/01/96-12/19/96	短期訪問
喬玲麗	美國	12/16/96-02/01/97	短期訪問
譚永炎	香港	12/18/96-12/21/96	短期訪問
白鳳周	中國大陸	12/28/96-01/17/97	學術交流
郭子斯	美國	12/30/96-01/20/97	短期訪問
Songhoon Yang	韓國	12/30/96-01/20/97	短期訪問
崔瑩鎮	韓國	01/14/97-01/17/97	來所研究
吳守庠	中國大陸	01/23/97-07/20/97	來所研究
蔡旭東	中國大陸	01/23/97-09/30/97	來所研究

訪問人姓名	國籍	訪問期間	備註
Jaroslav Antos	斯洛伐克	03/01/97-05/30/97	來所研究
Nikolai Plakida	俄羅斯	03/06/97-03/13/97	短期訪問
張振宇	中國大陸	03/24/97-05/22/97	短期訪問
陳廷楊	中國大陸	04/07/97-04/22/97	學術交流
Sandor Blasko	匈牙利	04/22/97-05/11/97	短期研究
Jerome I. Friedman	美國	04/29/97-05/01/97	國科會邀請人士
李正雄	美國	05/03/97-05/05/97	合作研究
Robert B. Griffiths	美國	05/13/97-05/16/97	國科會邀請人士
姜偉宜	美國	05/14/97-06/05/97	短期訪問
董無極	美國	05/19/97-05/23/97	短期訪問
Robert H. Swendsen	美國	05/26/97-05/31/97	短期訪問
林敏聰	德國	06/01/97-06/30/97	短期訪問
何健民	美國	06/01/97-06/30/97	短期訪問
Patrick Soukiasian	法國	06/06/97-06/12/97	短期訪問
胡比樂	美國	06/10/97-06/19/97	短期訪問
Raymond L. Orbach	美國	06/21/97-06/27/97	短期訪問
鮑威平	美國	06/23/97-06/30/97	短期訪問

訪問人姓名	國籍	訪問期間	備註
Sheldon L. Glashow	美國	06/24/97-06/27/97	短期訪問

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| 2. 動物研究所 Institute of Zoology | 13. 大門 Gate | 23. 胡適紀念廳 Hu Shi Memorial |
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| 11. 數學研究所 Institute of Mathematics | | 網球場、籃球場 Tennis and Basketball Courts |
| 11. 郵局 Post Office | | |

中央研究院物理研究所年報

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中央研究院

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第二十五卷

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