中央研究院物理研究所年報

ANNUAL REPORT OF THE INSTITUTE OF PHYSICS ACADEMIA SINICA

VOLUME 23 JULY 1995

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OF
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ACADEMIA SINICA

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Members of the Institute

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II

Review of Research Projects

II

Review of Research Projects

A. HYDRODYNAMICS AND ATMOSPHERIC PHYSICS GROUP

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I. Review of Research Activities

The projects conducted by our group members include both basic and applied researches related to the physics of fluid. Our basic researches involve the studies on turbulence, flow instabilities and pattern formation in fluids, phase transition and hydrodynamics of complex fluids and flow in porous medium. On the other hand, our applied research has been conducted in the erea of environmental fluid mechanics, atmospheric physics, computational fluid mechanics and instrumentation in measurement of fluid. Below are summaries of the selected ongoing research proiects carried out by our group members.

1. Basic research in hydrodynamics

a. *Separation flows in two dimension* - In order to understanding the physical mechanism of separation in two dimensional laminar and turbulence flows, we study the flows between eccentric rotating cylinders. The effects of eccentricity and inertial on flow characteristics, instability and transition to turbulence were investigated using a two dimensional Navier-Stokes solver using the isoparametric spectral geometry. The code is performed on SPARC 10 workstation and IBM ES9000 super computer and the flow visualization were employed to analyze the flow properties. It was found that the eddies due to the separation exist for non zero eccentricity and the inertial effects was important in determining the separation/reattachment points. A significant centrifugal component of the pressure is observed when the Reynolds number is large. With suitable modification of the two dimensional solver, we are going to investigate bounded flows with cavitation and unbounded flows with wakes in the future.

b. *Micro-gravity hydrodynamics* - Hydrodynamics on earth is very different from that in space where gravity is negligibly small. Thermal convection, which is a result of the coupling between gravity and density difference will be suppressed in micro gravity condition. We use numerical simulation to study the thermocapillary convection in the half floating zone liquid bridge. The transient behavior is investigated when the gravity is reduced by a factor of 0.0001 in 0.15 second. The result is compared to the experimental data (such as: temperature field, flow pattern and the position of free-boundary) are obtained with the same rate of change of gravity in the drop shaft facility in Japan Micro gravity Center. We hope that this numerical scheme can be extended to three dimensional case which may be useful in the design of experimental equipment for space material processing.

2. Non-equilibrium interfacial phenomena

a. *Depinning dynamics* - Motivated by the interesting phenomenon of nonlinear growth of KPZ-type system and depinning dynamics, an air-water interface is produced in a random medium formed by two pieces of ground glasses. Depinning motions of the interface a produced by changing the pressure difference between the two sides of the interface. ACCD camera is used to capture and record the location of the air-water interface for analysis. We found that the depinning transition of

this system is not characterized by continuous transition as predicted by current theories. A jump in the driving force is needed to drive the interface to move with a uniform velocity starting from rest. We are going to simulate the depinning transition using computer experiment.

b. *Bursting of polymer soap film* - Although the bursting of soap film has been studied for a long time, the knowledge of such highly non-linear process is far from complete. In order to capture the shape of the soap film when it breaks, a very fast but expansive camera is needed. However, we manage to record the detail motion of the film rupturing process using a line scan CCD camera. The rupturing of the film is triggered by an electric spark which synchronize the action of the line scan camera. With this new technique we observed sing of surface wave ahead of the bursting front. When the dynamics of a bursting soap film with and without polymer doping are compared. We found that the addition of polymers (e.g. polyethylene oxide, polyacrylic acid) in the soap film produced by using polymer solutions is usually much thicker than those without polymer. Also the thinning process of the soap film with polymer seems to proceed much slower. In the future, we shall study the thinning process in more detail. On the other hand, we shall try to capture two dimensional picture of the bursting film and to study the generation of surface waves in the bursting film.

3. Physics of complex fluids

Polymer solution of binary solvent - Because the molecular weight of polymer is high, it is not easily dissolved in a given solvent. In most industrial application, mixture of solvent are used. However, the phase equilibrium behavior of polymer in multi-component solvent is not fullyu understood. The simplest case related to the solubility of a polymer in a mixed solvent is when the solvent contains only two components. By direct visual observation and turbidity measurement, the phase diagram of polythylene oxide (PEO) in binary mixture of water and isobutyric acid (IBA) was constructed. At constant PEO concentration, regions of 2 phases and 3 phases coexistence can be obtain by varying the IBA concentration and the scattering techniques and viscometry. The effect of PEO on the critical behavior of the binary mixture will also be investigated.

4. Applied researches in fluid mechanics

a. *Wind-induced mixing in stably stratified fluids* - A steady wind blowing onto a body of liquid may produce waves, drift current (i.e. mean flow), and even turbulence. For a stratified liquid consisting of a light fluid at top and a heavy fluid at the bottom, mixing may occur at the interface between the two stratified layers. Experimental study of this wind-induced mixing is conducted in a water channel equipped with wind-blowing facility. A PIDV method was developed to visualize the cellular circulation patterns and the entrainment characteristics. A relation between the entrainment characteristic and the Richardson number has been found and circulation patterns as well as many thermocline phenomena have been visu-

alized in our experiment. On the other hand, we are developing a two dimensional laminar numerical model for simulating the wind-induced mixing phenomenon. In the future, we plan to use LDA to study the effect of buoyancy on the wind-induced turbulence characteristics in such a stably stratified fluids. In addition, turbulent numerical model will be developed to simulate the experimental situation.

b. *PIV study of turbulence* - In order to understand the turbulence structure in the flow field around a circular cylinder, a PIV system is set up to observe the turbulence flow patterns and to analyze the energy, momentum and vorticity of the flow field. It was found that when the Reynolds number is 1750, values of the turbulent (second order) modeling diffusion and pressure terms become much larger than those without modeling. Furthermore, the order of the Reynolds stresses and the order of turbulent convection terms are comparable to the order of those due to the periodic wakes behind the circular cylinder. In the future, we shall calibrate the modeling parameters and apply the PIV system in cases of high Reynolds number.

c. *Wake flow behind two cylinders* - The wake flow behind two circular cylinders is affected by the turbulence intensity with the same mean flow velocity. In order to clarify the relation between the wake flow and turbulence, different turbulence intensities are generated in a wind tunnel with the same mean velocity through two circular cylinders arranged side by side. For different spacing between the cylinders the turbulent wake flow behind the cylinders is measured. We found that both turbulence intensity and cylinder spacing have strong effect on the wake flow velocity profiles development in the downstream stations. We shall analyze the measured data using bispectral method to study the coherent structure and vortex shedding in the wake flow.

5. Atmospheric Physics

Cloud properties from satellite data - Cloud properties are valuable for atmospheric models and can be derived from the satellite observations of earth. From analysis of the Geostationary Meteorological Satellite (GMS) digital data for East Asia area, we tried to determine the cloud amount and cloud top temperature. We first performed the viewing angle correction and water vapor correction to remove the effect of slant path and atmospheric absorption. Next we used the modified two threshold method to identify the cloud top temperature were calculated. At the same time, a simple cloud classification was also made.

II. Facilities

1. Water channel laboratory

We have a water channel for studying the hydrodynamic phenomena of flow with wind on the free surface. The channel has a cross section of 60cm x 60cm and 8 m long. Flow can be realized by a towing track mounted on the channel or by a wave generato which circulates the fluid using a closed loop type pumping system. Currently, the channel is used to study the effect of surface wind on the stratified

flow in the channel. Important measurement means include hot wire, hot film and salinity gauge. Recently a particle imaging velocimetry system has been develop for qualitative measurement of flow field in the water channel.

2. Optical hydrodynamic laboratory

The equipment and instruments in this laboratory are mainly for the study of basic phenomenon of fluid. A partial list of these research equipment includes a two dimension laser Doppler velocimeter, a goniometer and two digital correlators for dynamic light scattering, a fluorescent microscope, image acquisition and analysis systems. There are also many home made instruments for particular experiments. We have several programmable temperature controlled air baths and water baths for studying phase transition of complex fluid, a laser scanning reflectometer for measuring the shape of liquid interface, an automatic film pulling setup with synchronized electric spark and video capture system for the study of soap film rupturing. Recently we are building a rotating statge for the study of soap film rupturing. recently we are building a rotating stage for the study of physics of fluid in a rotating frame.

3. Computer laboratory

Although our institute runs a computer room for the computation needs of the whole institute, we also maintain a small numbers of workstations and PC for some of our numerical works as well as data acquisitions and control of our experiments. These computers are networded with a SUN SPARC station as the file server and about 10 PCs for numerical works and experimentation.

III. Future Outlook

In the future our group would like to recruit new members to enhance the ongoing researches. At the same time, our members are encouraged to response to stimulus from other research communities to keep up with new developments occurring in other parts of the world. On the other hand, we notice the advantages of interaction with researchers from other disciplines and collaborations among other research personnel within and outside our institute should be supported. We hope that by gathering expertise from different fields and disciplines, we can attack specific problems in different perspectives so that a complete understanding of the problems can be crystallized.

B. NUCLEAR PHYSICS GROUP

I. Experimental Nuclear Physics and Accelerator-Based Physics

1. Nuclear excitation of ^{7}Li-ion bombardment on thick Cu target in the energy range 4.9-11.9 MeV
2. Off-beam gamma-spectroscopy
3. Ligh-ion impact ionization for atoms
4. L x-ray production in La, Nd, Gd, Er, and Lu by 1-5 MeV protons
5. Charged state dependence of M-shell x-ray production in $_{67}$Ho by 2-12 MeV carbon ions
6. Charged-state dependence of K-shell x-ray production in aluminum for 2-12 MeV carbon ion bombardment
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8. Application of PIXE for elemental analysis of ancient Chinese artifacts
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5. Effective lagrangian approach to weak radiative decays of heavy hadrons
6. Light-front heavy quark effective theory and heavy meson bound states
7. Dependence of nuclear shape transformations on the unclear volume
8. Correlated finite temperature mean field approximations
9. Hyperspherical approach in nuclear physics

In the past year, research works in both experimental and theoretical nuclear physics were carried out. The experimental nuclear physics program was focused on the accelerator- based physics and ion beam technology. The main facility of our accelerator laboratory is a 3 MV 9SDH-2 pelletron accelerator installed in mid-1989, it is capable of producing light and heavy ion beams in the MeV range for a variety of research purposes. During the calendar year 1994 a total of ~3000 hours (2600 hours with SNICS source and 400 hours with Alphatross source) of the accelerator beam was delivered for the scheduled researchers. A fraction of the machine time (~20 %) was allocated to users from local universities and institutions such as National Tsinghua University, National Taiwan University, and Industrial Research Institute. Protons, deuterons, ^{3}He-and ^{4}He-ions, and light heavy ions such as ^{12}C and ^{16}O have been accelerated for various experiments.

The efforts of the theoretical nuclear physics research members were devoted to the investigation of medium energy physics and nuclear properties. Some specific topics include nuclear many-body problems, nucleon-nucleon effective interaction, nuclear deformation, quark models, and heavy quark physics.

At present, our group consists of nine staff members (six research fellows, one associate research fellows and two assistant research fellows). Among them, six are experimentalists and three theoreticians. In recent years one of our group members has spent a great deal of time in developing the experimental high-energy physics program for the Institute. The size of the group in 1994-95 is the same as in 1993-94.

The accelerator system is now equipped with six beamlines, including the one set up in 1993-94 in a position 45° from the switching magnet with a scattering chamber and detection system designed for off-beam gamma-spectroscopy and radiative capture experiments. Other facilities of the laboratory include a micro Vax II computer and networks, including a fast electronic system for data acquisition (with fast NIM modules and CAMAC modules). In addition to the micro Vax II computer, our computing facilities for experiments also include two work stations, a VaxStation 3100/76 and a VaxStation 3100/34. These two stations are mainly used for the data relay and off-line analyses. For theoretical calculations, we have access to the SUN4 and IBM/RISC/6000 work stations located in the computer room of the Institute.

The following overview is not intended as a summary of all the work done in the period of 1994-95; instead it describes briefly some selected research projects completed during this time period.

I. Experimental Nuclear Physics and Accelerator-Based Physics

These works were performed at the accelerator laboratory in the Institute, mainly on low energy nuclear reactions, light-and heavy-ion impact ionization, ion-beam technology and application.

1. Nuclear excitation of ^{7}Li-ion bombardment on thick Cu target in the energy range 4.9-11.9 MeV

Gamma-rays emitted from ^{7}Li-ion + Cu (thick target) system have been measured for E(^{7}Li) = 4.9-11.9 MeV with 700 keV energy step. In addition to the gammas from de-excitation of ^{63}Cu and ^{65}Cu nuclei, a broad and prominent gamma-ray peak was observed at E_γ arround 480 keV. The relation between the width of this gamma-ray and the projectile velocity was found to be well consistent with the Doppler broadening relation of the 478 keV gamma-ray from the 478 keV $\rightarrow$ 0 transition in ^{7}Li nucleus, indicating that this gamma-ray originated from ^{7}Li excitation during the collision. The dependence of the normalized intensity of this gamma ray on the projectile energy showed the excitation was via Coulomb excitation mechanism. The results have been published in Nucl. Phys.

2. Off-beam gamma-spectroscopy

The off-beam γ-spectroscopy and rediactivity measurements have been performed in this laboratory. The radioactive samples were prepared by thermal neutron irradiation in the Tsinghua reactor. The singles, coincidence spectra and the γ-γ directional correlation functions for the selected cascades are being measured for studying the nuclear structure parameters, the results are compared with IBA and collective calculations. In order to double check the spin and parity of the measured excited states a linear polarization measurement of the emitted γ-ray is under developed. Results of Monte Carlo calculations for the asymmetric Compton Supression Spectrometer in this series study have recently been published in Nucl. Phys.

3. Ligh-ion impact ionization for atoms

Ligh-ion impact ionizations were investigated for the atomic K-shell on target elements with Z = 27-29 for incident protons, deuterons, ^{3}He- and ^{4}He- ions. X-ray production cross sections σ_x were measured as a function of incident energies 0.7-1.5 MeV/amu in steps of 0.1 MeV/amu. Systematics behavior of excitation functions and cross-section ratios $\sigma_x(1)/\sigma_x(2)$ measured with two types of projectiles of Z = 1-2 ions at same MeV/amu were examined. Two theoretical calculations of the first Born approximation (PWBA + OBKN) and the ECPSSR theories were performed. The results obtained from the experimental data and the theoretical calculations have been published in Chinese J. Physics.

4. L x-ray production in La, Nd, Gd, Er, and Lu by 1-5 MeV protons

Cross sections for production of L-subshell x-rays of the elements La, Nd, Gd, Er and Lu were measured with proton bombardment in the energy range 1-5 MeV. The measurements are compared to the prediction of the first Born and the ECPSSR (energy-loss and Coulomb deflection effects, perturbed stationary state approximation with relativistic correction) theories. In general, the measured cross sections σ_{Lx} and their ratios are found to be in good agreement with the ECPSSR theroy.

The results have been published in J. Phys. B: At. Mol Phys.

5. Charged state dependence of M-shell x-ray production in $_{67}$Ho by 2-12 MeV carbon ions

Charged state dependence of M-shell x-ray production of $_{67}$Ho bombarded by 2-12 MeV carbon ions, with and without K-vacanies, were measured using a windowless Si(Li) x-ray detector with a full width at half maximum resolution of 135 eV at 5.9 keV. Carbon ions of different charge states were produced using a post-acceleration, nitrogen stripping gas cell, and then the carbon ions were magnetically analyzed to select the desired charge state and energy before entering into the target chamber. The total M-shell and M_ζ, $M_{\alpha,\beta}$, M_γ, x-ray cross sections were measured. The electron capture (EC) contributions as well as the direct ionization (DI) contributions can be determined by making a comprehensive study of the projectile charge state dependence of the target x-ray production cross sections for targets in which the single collision realm is maintained. Both EC and DI contributions and the total M-shell x-ray production cross sections are compared to the first Born and ECPSSR theoreis. The results will be published in Phys. Rev.

6. Charged-state dependence of K-shell x-ray production in aluminum for 2-12 MeV carbon ion bombardment

Charged-state dependence of K-shell x-ray production cross sections of $_{13}$Al bombarded by 2-12 MeV carbon ions with charge states from 2+ to 6+ were measured using a Si(Li) detector with 7.6 μm Be window. An Al target of thickness 0.14 μg/cm^2 was used to insure single collision conditions. Contributions of the electron capture as well as direct ionization to the inner-shell ionization were determined by a comprehensive study of the charge state dependence of the target x-ray production. The measurements are compared with the ECPSSR theory using single-hole fluorescence yields. In general, the ECPSSR theory gives close predictions for most of the data for carbon ions without K-vacancies while it overpredilcts the data for carbon ions with K- vacancies. The discrepancy between the data and the ECPSSR theory at low energies is assumed to be produced by the molecular orbit effect. The results are ready for publication.

7. Particle induced x-ray emission (PIXE)

Proton induced x-ray emission is well known to be a powerful tool for multi-element and non-destructive elemental analysis for a variety of samples. We have successfully developed the external-beam PIXE technique and applied it to the determination of the elemental composition of ancient Chinese bronze artifacts. The x-ray emission measurements for the samples bombarded with 3 MeV protons from the 9SDH-2 pelletron accelerator were carried out by using a 30 mm x 5 mm Ge(Li) detector. The data are analyzed with the use of GUPIX software package. Variations of composition for more of 25 samples covering a time period of about three hundred years were examined. The contents of major and minor elements

(Cu, Zn, Pb, Sn, Sb, Fe, Ni and As) were determined. The results have been published in Nucl. Instr. and Meth. in Phys. Res.

8. Application of PIXE for elemental analysis of ancient Chinese artifacts

We made an application of PIXE analysis for a series of ancient Chinese coins from the Tang Dynasty to the Ming Dynasty (AD 618-1679). Ninety-six PIXE spectra were obtained from forty-eight samples of the ancient coins with the use of a Ge(Li) x-ray detector. On each sample two spots at different positions on the flat surface were irradiated per run by 3 MeV protons. The major and minor component elements were determined. Variations in the composition with a time span of about one thousand years for the examined coins were observed. Our data obtained for the Ming coins provide evidence that the change of using ancient Chinese brass coins from the bronze coins appeared in the reign of Jia-jing Emperor (1528-1567). The results have been recently published in Nucl. Instr. and Meth. in Phys. Res.

9. Study of normal and vitrified carnation leaves using proton induced x-ray emission

In this work, we made an application of external-beam PIXE for biological samples and an attempt is made to study the phenomenon of vitrification of carnation plants cultured in vitro. One hundred and twenty PIXE spectra were obtained from forty samples prepared in form of thin film for both normal and vitrious carnation leaves. At each irradiation with 3 MeV protons from 9SDH-2 Pelletron tandem accelerator the beam spot was made to cover the area of the sample. The detailed prerparation of the samples is described. From the detailed analysis on the examined samples, the distribution of elements (P, S, K, Ca, Mn, Fe and Zn) in the samples for the normal and vitrious carnation leaves and their significant difference in element contents were found. The detailed results will be published.

10. Backscattering studies of ^{7}Li, ^{12}C and ^{16}O ions at energies between 3 and 15 MeV

In this work, we made a backscattering analysis of 3-15 MeV ^{7}Li, ^{12}C and ^{16}O ions produced from a 3 MV tandem accelerator. Energy resolution and mass resolution for these ions were measured on a double layered Au/Cu thin film (50 $\AA$ thick) from backscattering spectra using a passivated implanted planar Si (PIPS) detector (Canberra PD 50-11-300). The backscattering data from top Au film (25 $\AA$ thick) and natural Cu layer were used to determine the detector resolution and mass resolution, respectively. The measured spectra show an advantage of using PIPS detector for ^{7}Li-ion in resulting a good energy resolution. The measured value (FWHM) is 21 keV for 5 MeV ^{7}Li-ion as compared to 36 keV obtained previously using a partially depleted Si detector (Nucl. Instr. and Meth. B85 (1994) 51). As for mass resolution for ^{7}Li, ^{12}C and ^{16}O-ions our measured spectra at 6, 9 and 12 MeV show a clear deparation of ^{63}Cu and ^{65}Cu peaks. To examine the accuracy of the stopping power for these heaver ions in different elements predicted by TRIM-95, we measured the backscattering spectra on thin films of Al, Cu and Ag, and

determined the corresponding thickness from a RUMP analysis and a comparison of the backscattering data for the ^{4}He-ion. The detailed results will be published.

11. Collaborative research

a. The $^{1}H(d,\gamma)^{3}$He reaction at 80-keV

This work was performed with collaboration of the National Tsinghua University, the North Caralina State University and the Duke University and TUNL. The $^{1}H(d,\gamma)^{3}$He reaction has been studied using both polarized and unpolarized deuterons with a lab energy of 80 keV. The deuterons were stopped in an ice target and the gamma rays were detected using HpGe detectors with 4 keV resolution at E_γ = 5.5 MeV. Angular distributions of the differential cross section and tensor analyzing power T_{20} have been measured for the first time at these low energies. Our results on the simultaneous T-matrix element analysis of these data together with the cross section and vector analyzing power data for E_p = 40 keV indicate that both E1 trransitions to the S and D states of ^{3}He as well as M1 transitions must be included in order to fit the data. TME fits suggest that M1 s-wave capture contributes strongly to the cross section at these energies. Using asymptotic wavefunctions the asymptotic D/S ratio was determined as well.

b. High-energy physics experiments (in callaboration with Fermi National Accelerator Laboratory, USA)

We have been collaborating with the Fermilab E789 fixed-target experiment since 1989. The project has been supported by the National Science Council. The objective of E789 is to study the production and decay of heavy flavor physics in proton-nucleus collision.

In charm physics, the J/Ψ production has been studied via their decays to $\mu^+\mu^-$ pairs over a wide range of x_F.

The beam dump measurements of J/Ψ production from berllium and coppor targets provides data in the range $0.30 < x_F < 0.95$. The differential cross sections are compared with the predictions of the semilocal duality model for several sets of parton density functions. No evident for a suggested intrinsic charm contribution to the cross section is observed. The ratio of the differential cross sections for Cu and Be targets confirms the suppression of J/Ψ production in heavy nuclei at large x_F.

D-mesons from berllium and gold targets were measured via their decays D$\rightarrow$ Kπ. The measured differential cross section for neutral D-meson production at x_f = 0.031 is 58$\pm$3$\pm$7 μb. The integrated cross section by extrapolating the measured differential cross section to all x_F is 17.7$\pm$0.9$\pm$3.4 μb per nucleon which is consistent with previous measurements. No nuclear dependence is found, with a measured α = 1.02$\pm$0.03$\pm$0.02.

The D$\rightarrow \mu^+\mu^-$ decay is sensitive to flavor-changing neutral-currents (FCNC), which is forbidden at tree level in the Standard Model. The search might shed light

on the new physics beyong the Standard Model. In our measurement, a limit of BR(D$\rightarrow \mu^+\mu^-$)$< 3.1 \times 10^{-5}$ at 90% confident level is set.

Beauty sensitivity is provided in the modes B $\rightarrow J/\Psi + X$ and B$\rightarrow$ dihadrons. The $b \rightarrow J/\Psi \rightarrow \mu^+\mu^-$ decays in 800 GeVc proton-gold interactions were observed. The integrated b-quark production cross section obtained is $\sigma(pN \rightarrow b\bar{b} + X) =$ 5.0$\pm$1.3$\pm$1.2 nb/nucleon.

c. Effect of the irradiation of Au ions on the negative Hall resistivity for YBCO films

This work was performed with collaboration of the Department of Physics, National Taiwan University. Measurements were carried out for a study of the temperature dependence of longitudinal and transversal resistivities (ρ_{xx}(T) and ρ_{xy}(T), respectivity) near the transition region for YBCO films before and after the irradiation of Au ions. Our results show that the peak value of the negative ρ_{xy} increases significantly at 0.5 T but remains nearly the same at 4 T after the irradiation. The power law of [$\rho_{xy} = \rho_{xy}^{\alpha}$] has been extracted for the examined films, with α ranging from 0.9 to 1.6. There is no correlation found between the magnitude of negative ρ_{xy} and the α values. The field dependence of the irradiation effect on ρ_{xy}(T) suggests a complicated interplay between the magnetic field and the defects on the mechanism of the anomalous Hall effect. The results have been published in Physica C.

II. Theoretical Nuclear Physics

1. The effect of the Δ excitation on the nucleon-nucleon effective interactions in the nuclear shell-model

The effect of Δ excitation on the shell-model effective NN interactions is investigated by evaluating the Δ-particle nucleon-hole core polarization diagrams within the folded-diagram formulation. The calculation has been performed using the $NN \leftrightarrow N\Delta$ transition G-matrix generated from a coupled-channel πNN model which is constrained by the NN data up to 1 GeV and is based on a Δ-subtracted Pairs potential. Satisfactory convergence of the calculation is reached by including the Δ excitations up to 20 oscillator shells. The Δ-particle nucleon-hole core-polarization diagrams are found to be small for the sd-shell valence nucleons.

2. The minimum norm method for the determination of the charge density from elastic electron scattering data

Unphysical behavior in the QR algorithm based least squares determination of the expansion coefficients of the charge density obtained from limited information about the charge form factor occurs when the spread of the singular values in the matrix relating these quantities becomes too large. Setting the smallest singular values equal to zero in the singular value decomposition used in the minimum norm method yields a much more reasonable determination of the charge density. Increasing the size of the basis without increasing the range of the prior information

about the charge form factor leads to ambiguities in the determination of the charge density.

3. On a Green's function method with energy-independent vertex functions

In conventional Green's function methods the vertex function Γ is generally energy dependent. However, a model-space Green's function method where the vertex function is manifestly energy independendent can be formulated using energy independent effective interaction theories based on folded diagrams and/or similarity transformations. To illustrate this energy-independent method, we have considered a 1p1h model-space Green's function, and applied it to a solvable Lipkin many-fermion model. The poles of the conventional Green's functions are obtained by solving a self-consistent Dyson's equation and some of the obtained poles appear to be unphysical, based on our model calculations. For the energy-independent Green's funtion method, it seems that only the physical poles of our model problem are reproduced and they are in satisfactory agreement with the exact excitation energies.

4. Corrections to chiral dynamics of heavy hadrons: SU(3) symmetry breaking

In previous publications we have analyzed the strong and electromagnetic decays of heavy mesons and heavy baryons in a formalism which incorporates heavy-quark and chiral symmetries. There are two possible symmetry-breaking effects on the chiral dynamics of heavy hadrons: the finite-mass effects from light quarks and the $1/m_Q$ corrections from heavy quarks. In the present work, chiral-symmetry-breaking effects are studied and applications to various strong and radiative decays of heavy hadrons are illustrated. SU(3) violations induced by chiral loops in the radiative decays of charmed mesons and charmed baryons are compared with those predicted by the constituent quark model. In particular, available date for D^* decays favor values of the parameters in chiral perturbation theory which give predictions for D^* decays close to the quark model results except for the D_s^{*+}.

5. Effective Lagrangian approach to weak radiative decays of heavy hadrons

Motivated by the observation of the decay $\bar{B} \rightarrow \bar{K}^*\gamma$ by the CLEO Collaboration, we have systematically analyzed the two-body weak radiative decays of bottom and charmed hadrons. There exist two types of weak radiative decays: One proceeds through the short-distance $b \rightarrow s\gamma$ transition and the other occurs through W exchange accompanied by a photon emission. Effective Lagrangians are derived for the W-exchange bremsstrahlung processes at the quark level and then applied to various weak electromagnetic decays of heavy hadrons. Predictions for the branching ratios of $\bar{B}^0 \rightarrow D^{*0}\gamma, \Lambda_b^0 \rightarrow \Sigma_c^0\gamma, \Xi_b^0 \rightarrow \Xi_c^0\gamma$, and $\Xi_b^0 \rightarrow \Xi_c^{\prime b}\gamma$ are given. In particular, we find $B(\bar{B}^0 \rightarrow D^{*0}\gamma) \approx 0.9 \times 10^{-6}$. Order of magnitude estimates for the weak raiative decays of charmed hadrons, $D^0 \rightarrow \bar{K}^{*0}\gamma, \Lambda_c^+ \rightarrow \Sigma^+\gamma$, and $\Xi_c^0 \rightarrow \Xi^0\gamma$, are also presented. Within this approach, the decay asymmetry for antitriplet to antitriplet heavy baryon weak radiative transitions is uniquely predicted by heavy quark symmetry. The electromagnetic penguin contribution to $\Lambda_b^0 \rightarrow \Lambda_\gamma$

is estimated by two different methods and its branching ratio is found to be of the order of 1×10^{-5}. We conclude that weak radiative decays of bottom hadrons are dominated by the short-distance $b \to s\gamma$ mechanism.

6. Light-front heavy quark effective theory and heavy meson bound states

The heavy quark effective theory is developed on the light-front. Based on this effective theory, a light-front heavy meson bound state with definite spin and parity is constructed. Within the effective theory, the Isgur-Wise function is derived in terms of the asymptotic light-front bound state amplitudes in the limit $m_Q \to \infty$; the result is a general expression for arbitrary recoil velocities. With the asymptotic form of the BSW amplitudes, the Isgur-Wise function is given by $\xi(v \cdot v') = 1/v \cdot v'$. The slope at the zero-recoil point is $\rho^2 = -\xi'(1) = 1$, in excellent agreement with the recent CLEO result of $\rho^2 = 1.01 \pm 0.15 \pm 0.09$.

7. Dependence of nuclear shape transformations on the nuclear volume

The dependence of nuclear shape transition on changes in the nuclear volume in ^{24}Mg has been studied within the framework of the constrained finite temperature Hartree-Fock approximation. The deformation parameters β and γ are very sensitive to changes in the unclear volume. A first-order shape transition in ^{24}Mg takes place at the temperature of 1 MeV and at the volume of $V_c = 1.025V_0$, where V_0 is the zero temperature unconstrained volume of the system. Previously we have shown that a 2.5% compression of the system yields a downward shift in the critical temperature of 0.7 MeV. Similarly a 2.5% expansion of the system also yields a decrease in the critical temperature of 0.3 MeV. Finally a compression of the system leads to a corresponding reduction in the magnitude of the level density, while an expansion increases its value only slightly.

8. Correlated finite temperature mean field approximations

A correlated finite temperature mean field approximation is compared with the exact canonical, the conventional finite temperature Hartree-Fock and canonical finite temperature Hartree-Fock approximations in ^{20}Ne. The thermal behavior obtained in the correlated approach with a realistic effective interaction differs substantially from that given by mean field caluclations. There are no sharp transitions and the system remains deformed at temperature above the critical temperature of the deformed-to-spherical shape transition observed in the mean field calculations in agreement with the exact canonical results. This suggests rather strongly that using collective deformation parameters obtained from finite temperature mean field calculations as order parameters to describe the universal features of the nuclear shape transition may be misleading.

9. Hyperspherical approach in nuclear physics

The hyperspherical function (K-harmonics) method has been widely used in the theory of light atomic nuclei with some degree of success, especially in the calculations of the binding energies and low-lying excitations of the light nuclei. Within

this frame work, the problems were reduced to solving a system of coupled Sturm-Liouville differential equations for a given effective interaction. These problems are usually solved by converting the second order equation system to a system of coupled first order equations. A technique of solving the system of these coupled equations has been develoned. After solving these Schrödinger type equation systems, certain nuclear properties can be obtained, *viz.* binding energies, rms radii, excited states of normal and amomalous parity, compressibilities of the nuclei *etc.* A unified calculation of neutron-rich isotopes in lithium has been performed in a hyperspherical basis in which the underlying symmetry of each isotope exhibits a simple structure. The variation in the binding energy as a function of mass number is qualitatively reproduced, and the radial distribution of each isotope decreases exponentially asymptotically.

C. SOLID STATE AND BIOPHYSICS GROUP

I. Solid State Physics

1. Surface physics
2. Superconductivity
3. Raman and infrared spectra physics
4. Magnetism
5. Thermodynamic physics
6. Physical property of nanocrystalline particles

II. Biophysics

The main areas of our research activities are surface physics, superconductivity, Raman and infrared spectra physics, magnetism, thermodynamic and biophysics etc. During the last few years, a significant progress has been made. Current research projects focus on some of the fundamental problems of surface physics, solid state physics, as well as materials science. The following summary is not intended to cover all the work done in this group; instead, it describes briefly only some of our recent researches in these areas.

I. Solid State Physics

1. Surface physics:

Our research efforts focus on basic physics of solid surfaces and thin films. The surface physics laboratory is currently equipped with general surface science analytical instruments having the following spectroscopic techniques: ESCA, UPS, LEED, AES, HREELS etc., and microscopic techniques: STM, AFM, FIM and Atom-Probe FIM. The thin film laboratory has a microwave plasma chemical vapor deposition system and a mini MBE system. In addition, we have an active theoretical program in surface physics. Recent works accomplished and research projects in progress are summarized below.

a. Atomic exchange phenomena on Ir(100) surface:

The temperature dependent behaviors of Ni, Fe and Co adatoms on the (1x1) and (5x1) Ir(100) surfaces have been studied using low energy Helium ion scattering. Ni, Fe and Co atoms were deposited on well cleaned and treated surfaces kept at 110 K. For the (1x1) surface, the ion bombardment induces a continuous exchange of adatoms with substrate atoms. In addition, rapid rises in the Ir signal intensities are found when the surface temperature is gradually raised. The onset of thermally induced atomic exchange between the adatoms and substrate atoms is at 200 K for Ni and 180 K for both Fe and Co. No such exchanges are found on the (5x1) surface. These results are published in Phys. Rev. Lett.

b. Ascending motion of step atoms of Ir(111) surface:

The behavior of diffusing adatoms and edge atoms at the lattice steps plays an important role in the growth mode of crystals and epitaxial thin films from the vapor phase, crystal shape change and the morphology of crystal surfaces at high temperatures. From a field ion microscopic study, we have discovered that step edge atoms of the Ir(111) can ascend to the upper terrace as likely as dissociate to the lower terrace. We have also measured the activation energy for the ascending motion. This surprising result is submitted to Phys. Rev. Lett.

c. Basic principles of atomic manipulation:

With the application of voltage pulses, mounds of 20 nm in diameter and 2 nm in height on the average can be created on a gold surface with very high efficiency in nonconducting liquid from a gold tip. The created mounds are similar to those

produced in air. Tungsten and PtIr tips are also used in this study and the dominant shapes of created structures are craters and volcano-like mounds, respectively. Our data show that these nanometer structures are created by a mechanical contact between the tip and the sample. These results will appear in Appl. Phys. Lett.

Two methods for the controllable creation of nanometer scale holes at the Pt surface in air and silicone fluid with scanning tunneling microscope are found. Holes with sizes down to 2 nm can be created with a proper choice of the pulse voltage and duration when the gap between the tip and the sample is within 10 to 40 Å in both media. When the gap is less than 10 Å, a different process dominates, which results in different generated features. These results are published in J. of Appl. Phys.

An invited review article of this subject will appear in the June issue of Jpn. J. Appl. Phys.

d. Boundary-confined new two dimensional periodic structures at reconstructed Pt(100) surface:

New 2-D periodic structures are observed in the regions of the reconstructed Pt(100) surface which are confined by domain boundaries or lattice steps. These structures can be seen only in a narrow energy window near the Fermi level, and they are strongly correlated to the original atomic arrangement of the surface. We explain these structures to arise from a quantum confinement effect of the electrons of Fermi energy, and their distribution is screened by the ion cores of the surface in a periodic manner. This coupling is invoked to minimize the surface free energy of a confined region. These results will appear in Surf. Sci. Lett. and Jpn. J. Appl. Phys.

e. Kikuchi electron holography: New technique for surface crystallography:

Direct inversion of the diffraction patterns of Kikuchi electrons, using integral-energy phase-summing method, is found to yield three-dimensional Patterson function of the near-surface structure. The results on the systems such as metal, semiconductor, and metal/semicoductor are obtained. High-fidelity, artifact-free three-dimensional images of nearby atoms measured from the emitters are obtained with a high-resolution ($\sim 1\mathring{A}$) in all direction. Special attention is paid to the correct role of background subtraction in removing artifacts. The work has demonstrated the surface sensitivity of Kikuchi electron holography and led to direct surface structural determination by inverting measured Kikuchi patterns.

f. Growth mechanism of this films:

(1) Diamond thin films:

Epitaxial textured diamond films grown on different substrates has been studied by microwave and hot-wired plasma enhanced chemical vapor deposition techniques. Substrate orientatios, carbon concentrations in the gas mixtures and substrate temperatures are the crucial factors for the highly oriented textured diamond growth.

The increase of the nucleation density of the diamond crystals by substrate biasing enhances the textured diamond growth.

(2) Single crystal metal thin films and superlattices:

Single crystal metal films and superlattices are grown by molecular beam epitaxy technique. Different high purity metal sources, such as Co, Fe, Cr, Mo are evaporated by electron beam evaporation method. The structure of epitaxial films and superlattices are characterized by in-situ reflection high energy electron diffraction (RHEED) and X-ray diffraction. The magnetic properties, such as magnetization and magnetoresistance, are studied by using a superconducting quantum interference device (SQUID) system. Anomalous anistropic magnetoresistances for Co films and Co/Cr superlattices grown on different substrates are found to be related to the crystal symmetry between the Co layer and underlayer structures.

2. Superconductivity:

A number of significant researches concerning high temperature superconductivity in various systems have been reported during recent years. We have obtain a lot of experience in the fabrication and the physical properties of various high Tc oxides. It is evidently that the high Tc superconductors have much better potential for the future applications. Therefore, it is worthwhile for us to study the details and to find the mechanism and to improve the quality of high Tc superconductors.

3. Raman and infrared spectra physics:

a. Enhanced Raman scattering studies:

In this study, we have found that the enhancement of sulfite ions adsorbed on an Ag island film could reach as high as $10^{10} - 10^{12}$ times, far more exceeding the well-known 10^6 value. The aim of this research, is to investigate the enhancement more accruately by use of the XPS measurement of sulfur content on the Ag thin film. In addition, in order to understand the underlying physics and therefore to determine appropriate model for the enhancement mechanism, we propose to measure the relation among the enhancement factor and the energy of incident photons as well as the thickness of thin Ag film.

b. Raman and infrared spectra study:

Applying the laser Raman and infrared spectroscopic techniques, we can obtain the complete temperature dependent Raman and infrared spectra of the crystal from 10K to 400K. A detailed study of the spectra of the mode frequency, line width, line shape and intensity versus temperatures, together with the group correlation table, give us accurate information of the crystal structures of different phases and also the identification of the vibration modes. These assignments propose a useful optical data in lattice dynamics calculations.

c. Excitation spectra study:

Recently, the Institute of Physics of Academia Sinica has 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. Besides, 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.

The purpose of the present research is mainly to study 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.

d. 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 meterials 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 meterial 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 um 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.

4. Magnetism:

a. Magneto-impedance of amorphous materials:

We are interested in studying the magneto-impedance effect in the amorphous materials. This subject has caught people's attentions, due to its potential use as a sensor. Magneto-impedance means the change of impedance (including the resistance and reactance), if an external magnetic field is applied on the sample. The effect is almost isotropic and in a negative sense. We have fabricated a series of amorphous ferromagnetic materials. Some samples have been field-annealed below the Curie points. The bias field could be below 50 Oe. So far, the highest magneto-impedance ratio achieved is 150% and the sensitivity is over 10% Oe.

b. Magnetic, optical and electric properties of magnetic alloy films:

The main goal in this is to study the magnetic, optical and the electric properties of magnetic alloy films. Especially, we shall pay attentions to those physical properties at various temperatures. As the 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.

c. Magneto-Kerr effect:

First, we shall set up a Magneto-Kerr effect apparatus, which works only at room temperature. This apparatus employs the longitudinal Kerr effect. For a given material, we try to study the Kerr rotation and Kerr ellipticity as a function of photon energy. The incident light can be either s-wave or p-wave. The angle of incidence is fixed and smaller than 90°. At present, our lab. has equipped with the following optical items: those include mercruy arc lamp, monochromator, Glan-Thompson prism, and etc. The samples will be made from our thin film coater. In order to build up the complete MOKE device, we need (a) an electromagnet, which can provide field strong enough to saturate the sample, (b) a high precision rotator, which is resolvable to a one minute range (usually, the Kerr rotation of ferromagnetic materials is in the range 1-10 min.) and (c) a gaussmeter, which is used to read the field strength. Our preliminary objective is to make a reliable MOKE device. The data obtained will also be analyzed. Here, because of the complications from the surface effect, which can only be distinguished from a in-situ measurement, we deliberately make our film much thicker (thicker than 2000 $A°$) so that the measured properties are close to the bulk value.

5. Thermodynamic physics:

a. Two dimensional thermodynamic and magnetic properties in nanocrystalline materials:

Due to the megligible amount of surface mass in bulk materials, it is almost not feasible to directly measure the surface macroscopic properties such as specific

heat and magnetic susceptibility. Whereas if materials are fabricated in the form of ultra fine particles with the size in the order of a few tens of angstroms to a couple of hundreds of angstroms, their surfaces can be considerably increased and their physical properties can be seen. In this work we performed the measurements of low temperature specific heat and magnetic susceptibility of TiO_2 and Ni nanorystals with particle size around 200 Å, it is found that the specific heat and magnetic susceptibility of TiO_2 and Ni nanocrystals exhibit the characteristics of two dimensional conduction electrons and lattice phonons which are associated with the surface area, electron density of states and probably with the defects, disorders and inter-grain boundaries in TiO_2 and Ni nanocrystals.

b. Magnetic susceptibility and low temperature specific heats of palladium nanocrystals:

In this work we performed the measurements of low temperature specific heat for $T = 0.3K - 20K$ and magnetic susceptibility for $T = 1.8K - 300K$ of Pd nanocrystals with particle size around 75 Å. It is found that the specific heat of Pd nanocrystals can be fitted into formula $C(T) = \gamma T + \delta T^2 + \beta T^3$, in which γT is the specific heat of the conduction electrons and βT^3 is the specific heat of bulk lattice phonons. The δT^2 term which is not seen in bulk Pd is attributed to the contribution of two-dimensional surface phonons by the proof of a simple algebraic calculation. In Pd nanocrystals the temperature coefficient of specific heat $\gamma = \sim 7.8 + 0.3$ mJ/mol K^2 and Debye temperature as derived $\Theta_D = 240 + 5K$, both are smaller than those of bulk Pd, 9.42 mJ/mol K^2 and 274 K respectively. It is found that in the measurements of magnetic susceptibility, the magnitude of magnetic suceptibility of Pd nanocrystals is also smaller than that of bulk Pd for $1.8 < T < 300K$ and the maximum seen in Pd bulk at $\sim$ 80K no longer exists. It is concluded that the density of state D (ε_F)and elastic constant of Pd are decreased as it is fabricated in the form of nanocrystals.

c. Magnetic ordering and coherence in heavy fermion compound $(Ce, La)_3Al$:

We have studied the temperature dependent resistivity, magnetic susceptibility and specific heat in $(Ce_{1-x}La_x)_3Al$ for $0 \leq x \leq 1$. It was found that to increase amount of La substitution x will decrease the structural phase transition temperature T_{Ph} and anti-ferromagnetic ordering temperature $T_N, T_{Ph} = 150K$ and $T_N = 1.9K$ for $Ce_3Al(X = 0)$. Although the effect also occurred on the coherence onset temperature T_{Max} in $\rho(T)$, but it shows different behavior for $x > 0.3$, for instance no anti-ferromagnetic ordering can be seen by the peak at T_N in $\chi(T)$ as $x \geq 0.3$ whereas the onset of coherence still exist for x up to 0.7 evidenced by the low temperature resistivity drop is $\rho(T)$, its quadratic temperature coefficient A and the peak temperature in $C(T)$. The distinction also seen in the drastic change in low temperature Curie constant C, Curie-Weiss temperature Θ and temperature coefficient γ in $C(T)$. Different x dependent of magnetic ordering and coherence in $\chi(T), C(T)$ and $\rho(T)$ were reported. It is concluded that below a critical amount

of La alloying magnetic ordering and coherence develop might be dependent on same parameter and have close relation whereas for highter La concentration above a critical amount coherence still exists and moves to higher temperature as anti-ferromagnetic ordering disappears already. To understand this interrelation further study is needed.

d. Thermoelectric effect:

This is a low-temperature measurement. Temperature variations are from 2 to 10K. At present, our lab. has the following equipments:(a)two calibrated semiconductor type diode sensors, and (b)a He-4 insertable cryostat. We plan to attach a heater to one end of the sample so that there is a temperature gradient dT/dx along the sample length. Because it is essential to keep dT/dx as steady as possible, we need a constant current source, which has a low ripple, to control the heater power. Finally, the analyzing work will be put in two perspectives:(a)Two-current model for thermoelectricity, and (b)Thermoelectric power $S = dln\sigma/dE$, where σ is the electrical conductivity and E is the electronic energy.

6. Physical property of nanocrystalline particles:

For the researches of nanocrystalline particles, many investigations of the properties and the industrial applications such as new materials for catalysts sensors, and magnets etc. have been reported, in addition to the study of the growth technique. During the past several years, we have studied the physical properties of Fe, Cu, Pd etc. nanocrystalline particles. Recently we are interested to study the electrical, magnetic, and thermal properties of nanocrystalline particles. From our experimental data, we will get new results for both academia and industrical contributions.

II. 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 studies the cadiac artery disease.

D. THEORETICAL PHYSICS GROUP AND HIGH ENERGY PHYSICS PROJECT

I. Theory

1. Study of some fundamental issues in electroweak standard model and scale invariant theories
2. Light-front field theory and light-front QCD
3. Nonlinear dynamics, quantum chaos and open systems
4. Quantum nucleation of vortex string loops
5. The Chern-Simons coefficient in supersymmetric Yang-Mills Chern-Simons theories
6. Generalization of the Coleman-Hill theorem

II. Particle Phenomenology

1. 1/M corrections to baryonic form factors in the quark model
2. Form factors for $B \to \pi$ and $D \to \pi$ transitions
3. Extraction of a_1 and a_2 from $B \to \psi K(K^*)$, $D(D^*)\pi(\rho)$ decays
4. Vector dominance effects in weak radiative decays of the B mesons
5. Hadronic weak decays of heavy mesons and nonfactorization

III. Gravitation and Cosmology

1. Temperature and polarization correlation for the cosmic microwave background
2. Primordial gravitational waves

IV. Equilibrium Statistical Physics

1. Cell-to-cell renormalization group transformation and order parameter calculation
2. Boundary conditions, lattice shapes and scaling functions
3. Universal scaling function in critical phenomena
4. Zeros for potts model
5. Lattice animals and potts model

V. Nonequilibrium Statistical Physics

1. Self-organized criticality: earthquake models
2. Non-equilibrium phase transitions

VI. Computational Physics

1. Importance-sampling histogram Monte Carlo Method and its applications
2. Comparison of different schemes to calculate critical points
3. Subtleties in data analysis for critical phenomena

VII. High-Energy Experimental Physics Porject

I. Theory

1. Study of some fundamental issues in electroweak standard model and scale invariant theories

In recent years, there are a few issues within the standard model that are bothering people. One of them is that the Higgs particle has not yet been seen and the mass of its lower bound keeps increasing. Another thing worth studying is that there are several theoretical groups giving arguments that the physical quantities calculated by people are actually gauge dependent. With all these in mind, we here want to investigate the issues of gauge invariance and renormalizability of scale invariant and electroweak standard model when one actually computes physical quantities and uses them to compare with experimental result.

2. Light-front field theory and light-front QCD

We developed an approach to determine the low-energy bound states in nonperturbative QCD as a weak-coupling problem. The key to eliminating necessarily nonperturbative effects is the use of the bare QCD Hamiltonian in which quarks and gluons have nonzero constituent masses rather than the zero masses of the current picture. The weak-coupling approach potentially reconciles the simplicity of the Constituent Quark Model with the complexities of Quantum Chromodynamics. The penalty for achieving this weak-coupling picture is the necessity of formulating the problem in light-front coordinates and of dealing with the complexities of renormalization which such a formulation entails, then set up a precise similarity renormalization scheme and exhibit calculations to second order. The further investigations remains to be carried out: There is an initial nonperturbative calculation of the hadronic masses, with binding energies required to be fourth order in coupling constant. Next there is a calculation of the leading radiative corrections to these masses within the renormalization scheme. The real struggle of finding the right extensions to weak-coupling approach to study the strong-coupling behavior of bound states can then begin.

Currently, the significant achievement in hadronic physics is the heavy hadron dynamics. The discovery of heavy quark symmetry and the development of heavy quark effective theory has largely simplified our understanding to heavy hadrons. But all the nontrivial properties of heavy hadrons associated with the nonperturbative QCD have not been solved. To provide a possible understanding of nonperturbative QCD in heavy hadron dynamics, we developed the light-front heavy quark effective theory from QCD. This new formalism permits a straightforward canonical quantization to all orders in $1/m_Q$, and manifests naturally the heavy quark symmetry in heavy mass limit. It can serve as an useful framework for the study of non-perturbative QCD dynamics of heavy hadron bound states. We have constructed the consistent light-front heavy meson bound state within the framework of LFHQET and calculated the Isgur-Wise function for arbitrary recoil velocities. Further applications to the exclusive and inclusive heavy meson decays and the

$1/m_Q$ corrections are in progress.

In order to study the nonperturbative dynamics of heavy hadrons in QCD, we derived the quark-antiqaurk confining interaction from QCD on the light-front for heavy quark system. By using the similarity renormalization group scheme and the light-front heavy quark effective theory we developed, we constructed an effective light-front QCD Hamiltonian in $Q\overline{Q}$ sector at the hadronic scale, which manifests the coexistence of a confining potential and a Coulomb potential. The light-front quark confinement mechanism is discussed and the light-front heavy quark bound states (BS-type equation) within this confinement mechanism is being explored based on our weak-coupling approach of light-front field theory.

Light-front field theory also makes the manifestation of chiral symmetry and its breaking through the helicity dependent quark interactions on the light-front. Combining with PCAC, it allows us to construct the effective interactions which are the effect of spontaneous chiral symmetry breaking. We expect that this will give us an alternative approach to explore the second nontrivial property of QCD, the chiral dynamics. Further investigation is in plan.

3. Nonlinear dynamics, quantum chaos and open systems

The basic concept to study chaos in nonlinear dynamical systems is *integrability*. To study quantum chaos, we developed the concept of quantum nonintegrability, as viewed from geometry and dynamical symmetry breaking. Quantum nonintegrability is defined from the mathematical structures of quantum mechanics. We have shown that there is a natural geometrical description for a quantum system, which provides a suitable stage to investigate the time-honored question of quantum to classical transition, as well as the underlying problem of nonintegrability in quantum mechanics. The implication of dynamical symmetry breaking to quantum nonintegrability and chaos is revealed. A practical approach to study quantum chaos, which we named it the "semiquantal description" has also been developed. We further explored the global controlling of occurrence of quantum chaos from the intrinsic geometrical properties of quantum system. Many examples have been examined to determine such a dependence.

The most significant progress in the study of quantum chaos is the discovery of quantum suppression of chaos in the kicked rotor model. Later on it has been found in many other systems. Therefore such a phenomenon has been considered as a universal property of quantum manifestation of chaos. However, a clear picture to the origin of quantum suppression has yet to be provided. We use the semiquantal dynamics to study chaotic behavior in the kicked rotor model. A quantal mapping which contains the classical standard mapping as a limit is derived. The quantum suppression of chaos is manifested explicitly in the effective control parameter from which a simple picture of the origin of quantum suppression of chaos emerges.

For a deep understanding of quantum to classical transition, we further study open systems which results in dissipative systems in certain conditions. We studied

the wavepacket spreading for a special dissipative system with various nonlinear external potentials. We show that the position uncertainty of a Gaussian wavepacket is dictated by quantum correlation and the behaviors of its evolution can be vividly displayed. The spreading of the wavepacket is inevitably suppressed by the dissipation. This could provide us some insights on the fundamental problems of quantum to classical transition. We are also developing a new description of quantum mechanics from the classical Langevin equation in which the stochastic motion is determined from the interaction between the system and its environment. The Schrodinger equation may be derived from the classical equations of motion without quantization, and the stochastic classical trajectories can determine the evolution of quantum systems. In this framework, chaos could be the crucial concept to allow us to describe quantum dynamics in terms of classical mechanics.

4. Quantum nucleation of vortex string loops

We investigate quantum nucleation of vortex string loops in the relativistic quantum field theory of a complex scalar field by using the Euclidean path integral. In particular, we focus in the case that the initial metastable homogeneous field configurations carry a spacelike current. It turns out that the path integral is dominated by the $O(3)$ symmetric bounce solution. When the current is much smaller that certain critical value and the self-interaction is weak, we find the nucleation rate and the critical vortex loop size. Because of the effect of quantum nucleation, initial current will gradually decays to zero, since the induced current inside vortex loops is opposite to the initial current. We also discuss a similar process in Maxwell-Higgs systems, and possible relevance to systems exhibiting superfluidity.

5. The Chern-Simons coefficient in supersymmetric Yang-Mills Chern-Simons theories

We study one-loop corrections to the Chern-Simons coefficient in $N = 1, 2, 3$ supersymmetric Yang-Mills Chern-Simons systems. It is known that in the pure bosonic case, one-loop correction modifies the Chern-Simons coefficient k to $k + c_v$, where c_v is the quadratic Casimir of the gauge group. In the $N = 1$ case, the fermionic contribution cancels the bosonic contribution by half and the shift is $k \to k + c_v/2$, making the theory anomalous if c_v is an odd integer. In the $N = 2, 3$ cases, the fermionic contribution cancels the bosonic contribution completely and there is no correction. We also calculate the mass corrections, showing the supersymmetry is preserved. As the matter fields decouple from the gauge multiplet in the pure Chern-Simons limit, this work sheds some light on the regularization dependence of the correction in the pure Chern-Simons systems. We also discuss the implication of our result to the case when the gauge symmetry is spontaneously broken due to additional matter fields.

6. Generalization of the Coleman-Hill theorem

In terms of the effective action, we show to one-loop order the Coleman-Hill theorem can be generalized to systems with spontaneous symmetry breaking. Although

the correction to the parity-odd part of the vacuum polarization looks complicated in the Higgs phase, it turns out that the correction to the Chern-Simons term is identical to that in the symmetric phase, with the difference coming only from the contribution of the would be Chern-Simons term. We also discuss the implication of our result to nonabelian systems.

II. Particle Phenomenology

1. 1/M corrections to baryonic form factors in the quark model

In the heavy quark effective theory (HQET), there are two different types of $1/m_Q$ corrections to the hadronic form factors: one from the $1/m_Q$ correction to the current operators, and the other from the presence of higher dimensional operators in the effective Lagrangian. The latter amounts to the hadronic wave-function modifications. In general, the predictive power of HQET for $1/m_Q$ effects is very limited by the fact that we do not know how to carry out first-principles calculations for the hadronic matrix elements in which higher dimensional kinetic and chromo-magnetic operators O_1 and O_2 are inserted. Consequently, several new unknown functions are necessarily introduced besides the leading Isgur-Wise functions. For example, to order $\Lambda_{\rm QCD}/m_c$, there are four new subleading Isgur-Wise functions $\eta(\omega)$, $\chi_1(\omega)$, $\chi_2(\omega)$ and $\chi_3(\omega)$ for $B \to D$ transition, whose normalizations are not determined except that χ_1 and χ_3 vanish at the zero-recoil point $\omega \equiv v \cdot v' = 1$. Since the Isgur-Wise functions are not calculable from perturbative QCD or HQET, a calculation of them should be resorted to some models. It is known that the Isgur-Wise functions have some simple expressions in the quark model. Denoting the heavy meson wave function by $\psi = \psi_0 + \psi_{\rm kin} + \psi_{\rm mag} + \cdots$, where ψ_0 is the wave function in the heavy quark limit, $\psi_{\rm kin}$ and $\psi_{\rm mag}$ are the $1/m_Q$ corrections to the wave function due to the operators O_1 and O_2 respectively, the Isgur-Wise function $\xi(v \cdot v')$ simply measures the degree of overlap between the wave functions $\psi_0(v)$ and $\psi_0(v')$, while χ_1 (χ_3) can be expressed as the overlap integral of $\psi_{\rm kin}$ ($\psi_{\rm mag}$) and ψ_0.

Weak current-induced baryonic form factors at zero recoil are evaluated in the rest frame of the heavy parent baryon using the nonrelativistic quark model. Contrary to previous similar work in the literature, our quark model results do satisfy the constraints imposed by heavy quark symmetry for heavy-heavy baryon transitions at the symmetric point $v \cdot v' = 1$ and are in agreement with the predictions of the heavy quark effective theory for antitriplet-antitriplet heavy baryon form factors at zero recoil evaluated to order $1/m_Q$. Furthermore, the quark model approach has the merit that it is applicable to any heavy-heavy and heavy-light baryonic transitions at maximum q^2. Assuming a dipole q^2 behavior, we have applied the quark model form factors to nonleptonic, semileptonic and weak radiative decays of the heavy baryons. It is emphasized that the flavor suppression factor occurring in many heavy-light baryonic transitions, which is unfortunately overlooked in most literature, is very crucial towards an agreement between theory and experiment for the semileptonic decay $\Lambda_c \to \Lambda e^+ \nu_e$. Predictions for the decay modes $\Lambda_b \to J/\psi\Lambda$, $\Lambda_c \to p\phi$, $\Lambda_b \to \Lambda\gamma$, $\Xi_b \to \Xi\gamma$, and for the semileptonic decays of Λ_b, $\Xi_{b,c}$ and Ω_b are presented.

2. Form factors for $B \to \pi$ and $D \to \pi$ transitions

A reliable determination of the quark mixing matrix element V_{ub} from the semileptonic decay mode $\bar{B} \to \pi\ell\bar{\nu}$ ($\ell = e,\ \mu$) requires a knowledge of the $\bar{B} \to \pi$ transition form factor $f_+^{B\pi}$ at $q^2 = 0$. In the past, this form factor has been calculated using the nonrelativistic quark model, QCD sum rules, and heavy quark symmetry in synthesis with chiral symmetry. A systematic analysis of the $1/m_b$ correction to the weak form factors $f_\pm^{B\pi}$ was recently studied in the framework of the heavy quark effective theory. In the method of heavy quark symmetry, form factors $f_\pm^{B\pi}$ can be related in a model-independent way to the form factors $f_\pm^{D\pi}$ in the kinematic region close to zero recoil. In order to extract $f_+^{B\pi}(0)$ from the available experimental information of $f_+^{D\pi}(0)$, an extrapolation of the form factors from zero recoil to maximum recoil (i.e. $q^2 = 0$) has to be assumed. However, unlike the well measured form factor $f_+^{DK}(0)$, the present experimental data on $f_+^{D\pi}(0)$ are still plagued with large statistic and systematic errors. Fortunately, this situation was changed recently, Two new measured SU(3)-breaking effects in charm decays to be discussed later are very sensitive to the relative magnitude of the form factors $f_+^{D\pi}(0)$ and $f_+^{DK}(0)$. By fitting to the data, we found a best fit of $f_+^{D\pi}(0)/f_+^{DK}(0)$, and hence $f_+^{D\pi}(0)$. In this paper, heavy quark symmetry is applied so that $f_+^{B\pi}(q^2)$ is related to $f_+^{D\pi}(q^2)$ near zero recoil. In the second stage, the requirement of heavy quark symmetry is relaxed, namely it applies only to soft pion emissions from the heavy meson.

Armed with the information on the form factor $f_+^{D\pi}(0)$ inferred from recent CLEO measurements of SU(3)-breaking effects in charmed meson decays, we have studied the form factor $f_+^{B\pi}$. In the heavy quark limit, $f_+^{B\pi}(q^2)$ is related to $f_+^{D\pi}(q^2)$ in the kinematic region close to zero recoil. Assuming pole dominance for its q^2 dependence, $f_+^{B\pi}(0)$ is estimated to be ≈ 0.39. If the requirement of heavy quark symmetry is relaxed so that it applies only to soft pion emissions from the heavy meson, we find that $f_+^{B\pi}(0)$ is more likely of order $0.55 \sim 0.60$.

3. Extraction of a_1 and a_2 from $B \to \psi K(K^*)$, $D(D^*)\pi(\rho)$ decays

The fact that the D^+ meson has a longer lifetime than the D^0 is already manifest at the exclusive two-body decay level: The number of two-body D^+ decay modes is about two times less than that of the D^0 and there exists a large destructive interference in the Cabibbo-allowed decays $D^+ \to \bar{K}^0\pi^+$, $\bar{K}^0\rho^+$, $\bar{K}^{*0}\pi^+$, which is also known as the Pauli interference at the inclusive level. The recent CLEO data on $B \to D\pi$, $D\rho$, $D^*\pi$, $D^*\rho$ decays exhibit a rather unexpected result: The interference between the two different amplitudes contributing to exclusive two-body B^- decays are evidently constructive, contrary to the charmed meson

case. This feature is quite stunning since the rule of retaining only the leading terms in the $1/N_c$ expansion (N_c being the number of color degrees of freedom), which is empirically operative in charm decays, fails in $B \to D^{(*)}\pi(\rho)$ decays. Quantitatively, the ratio of the parameters a_1 and a_2 corresponding to the external and internal W-emission amplitudes is found to be positive with the magnitude $a_2/a_1 = 0.23 \pm 0.04 \pm 0.04 \pm 0.10$.

Based on the factorization approach, we show that the CLEO data for the ratio $\Gamma(B \to \psi K^*)/\Gamma(B \to \psi K)$ and the CDF measurement of the fraction of longitudinal polarization in $B \to \psi K^*$ can be accounted for by the heavy-flavor-symmetry approach for heavy-light form factors provided that the form factor F_0 behaves as a constant, while the q^2 dependence is of the monopole form for F_1, A_0, A_1, and of the dipole behavior for A_2 and V. This q^2 extrapolation for form factors is further supported by $B \to K^*\gamma$ data and by a recent QCD-sum-rule analysis. We then apply this method to $B \to D(D^*)\pi(\rho)$ decays to extract the parameters a_1 and a_2. It is found that $a_1(B \to D^{(*)}\pi(\rho)) = 1.01 \pm 0.06$ and $a_2(B \to D^{(*)}\pi(\rho)) = 0.23 \pm 0.06$. Our result $a_2/a_1 = 0.22 \pm 0.06$ thus significantly improves the previous analysis that leads to $a_2/a_1 = 0.23 \pm 0.11$. We argue that, contrary to what anticipated from the leading $1/N_c$ expansion, the sign of $a_2(B \to \psi K^{(*)})$ should be positive and $a_2(B \to \psi K^{(*)}) \gtrsim a_2(B \to D^{(*)}\pi(\rho))$.

4. Vector dominance effects in weak radiative decays of the B mesons

Recently the weak radiative decays of B mesons and bottom baryons have been systematically studied. At the quark level, there are two essential mechanisms responsible for weak radiative decays: electromagnetic penguin mechanism and W-exchange (or W-annihilation) bremsstrahlung. The long distance vector-meson-dominance (VMD) effects on the weak radiative decays $B \to \rho\gamma$ and $B^0 \to D^{*0}\gamma$ are studied. For $B \to \rho\gamma$ decays, the VMD contribution is $(10-20)\%$ of the short-distance penguin amplitude. The pole effect is as important as the VMD one in the decay $B^- \to \rho^-\gamma$, but it is suppressed in $B^0 \to \rho^0\gamma$. The branching ratio of $B \to \rho\gamma$, estimated to be of order 10^{-6}, strongly depends on the sign of the Wolfenstein parameter ρ. A measurement of any deviation of the ratio $R = \Gamma(B^- \to \rho^-\gamma)/\Gamma(B^0 \to \rho^0\gamma)$ away from the isospin value 2 will provide a probe on the long-range contribution and possibly indicate the sign of ρ: $R > 2$ for $\rho < 0$ and $R \sim 2$ for $\rho > 0$. The decay $B^0 \to D^{*0}\gamma$ does not receive short-distance contributions, and its branching ratio, predicted to be 0.9×10^{-6}, is dominated by W-exchange accompanied by a photon emission.

5. Hadronic weak decays of heavy mesons and nonfactorization

It is customary to assume that two-body nonleptonic weak decays of heavy mesons are dominated by factorizable contributions. Under this assumption, the spectator meson decay amplitude is the product of the universal parameter a_1 (for external W-emission) or a_2 (for internal W-emission), which is channel independent in D or B decays, and hadronic matrix elements which can be factorized as the product of two independent hadronic currents. The universal parameters a_1 and a_2 are related to the Wilson coefficient functions c_1 and c_2 by $a_1 = c_1 + \frac{1}{N_c}c_2$, $a_2 = c_2 + \frac{1}{N_c}c_1$, with N_c being the number of colors. It is known that the bulk of exclusive nonleptonic charm decay data cannot be explained by this factorization approach. For example, the predicted ratio of the color-suppressed mode $D^0 \to \bar{K}^0\pi^0$ and color-favored decay $D^0 \to K^-\pi^+$ is in violent disagreement with experiment. This signals the importance of the nonfactorizable effects.

The parameters $\chi_{1,2}$, which measure nonfactorizable soft gluon contributions to hadronic weak decays of mesons, are updated by extracting them from the data of D, $B \to PP$, VP decays (P: pseudoscalar meson, V: vector meson). It is found that χ_2 ranges from -0.36 to -0.60 in the decays from $D \to \bar{K}\pi$ to $D^+ \to \phi\pi^+$, $D \to \bar{K}^*\pi$, while it is of order 10% with a positive sign in $B \to \psi K$, $D\pi$, $D^*\pi$, $D\rho$ decays. Therefore, the effective parameter a_2 is process dependent in charm decay, whereas it stays fairly stable in B decay. This is in accordance with the picture that nonfactorizable soft gluon effects become stronger when the relative momentum of the decay particles becomes smaller. As for D, $B \to VV$ decays, the presence of nonfactorizable terms in general prevents a possible definition of effective a_1 and a_2. This is reinforced by the observation of a large longitudinal polarization fraction in $B \to \psi K^*$ decay, implying nonfactorizable effects contributing differently to S-, P- and D-wave amplitudes. We found that $A_1^{nf}/A_1 > 0 > A_2^{nf}/A_2$, V^{nf}/V (nf standing for nonfactorization) for $B \to \psi K^*$ decay and $0 > A_1^{nf}/A_1 > A_2^{nf}/A_2$, V^{nf}/V for $D \to \bar{K}^*\rho$ decay. A measurement of longitudinally and transversely polarized decay rates Γ_L and Γ_T in color-suppressed decay modes $\bar{B}^0 \to D^{*0}\rho^0$, $D^{*0}\omega$ and $D^+ \to \phi\rho^+$ is urged.

III. Gravitation and Cosmology

1. Temperature and polarization correlation for cosmic microwave background

The Cosmic Background Explorer's (COBE) detection of cosmic microwave background radiation (CMBR) temperature anisotropies opens a window to our understanding of physics associated with the initial conditions of the early Universe. The temperature anisotropy of CMBR are induced by the density perturbations (scalar mode), the primordial gravitational waves (tensor mode) or both.

Our earlier calculations indicated that the degree of polarization of the CMBR is somewhat different for the scalar and tensor modes, and it can be used as a potential method to distinguish these two modes of fluctuation. We extend the previous work to study the polarization-temperature and polarization-polarization correlations on the cosmic microwave sky induced by an initial spectrum (both scale invariant and non-scale invariant) of scalar and tensor fluctuations. They serve as a further test of this approach. This consideration has some advantages for experiments in which noise in the polarization is limiting, for it averages to zero.

We are setting up a numerical code to solve the radiative transfer equation,

and calculate the anisotropy and polarization correlation functions. A system of about a thousand coupled first order differential equations is solved numerically by using the fourth-order Runge-Kutta method. The Gaussian quadratures method is employed to compute all the multi-dimension integrals. Vectorization of the code is performed on the CONVEX C3840 and C3400 computers at National Center for High-Performance Computing and Academia Sinica respectively. Parallel computation is an approach that can provide faster computing speed. Among different algorithm of parallel computation, we will employ the Parallel Virtual Machine (PVM) software in tackling our numerical work.

2. Primordial gravitational waves

The evolution of scale-invariant gravity waves from the early universe is analyzed using an equation of state which smoothly interpolates between the radiation dominated era and the present matter dominated era. We find that for large wavenumbers the standard scale-invarant wavefunction for the gravity wave severely underestimates the actual amplitude of the gravity wave. Moreover, there is a definite shift in the *temporal phase* of the gravity wave as it crosses the radiation-matter phase transition. The tensor-induced anisotropy of the cosmic microwave background and the present spectral energy density of the gravity wave is then calculated, and compared with previous work. It is found that the phase shift has significant effect on the power spectrum of the CMB.

The phases of primordial gravity waves is analysed in detail within a quantum mechanical context following the formalism developed by Grishchuk and Sidorov. It is found that for physically relevant wavelengths both the phase of each individual mode and the phase *difference* between modes are randomly distributed. The phase *sum* between modes with oppositely directed wave-vectors, however, is not random and takes on a definite value with no rms fluctuation. The conventional point of view that primordial gravity waves appear after inflation as a classical, random stochastic background is also addressed.

IV. Equilibrium Statistical Physics

1. Cell-to-cell renormalization group transformation and order parameter calculation

We point out that in the large cell-to-cell renormalization group transformations to obtain the thermodynamic free energy and order parameter of a phase transition system we need only iterate the transformations until the correlation length of the system is smaller than the linear dimensions of the cells. We apply this idea to obtain very accurate order parameter for the site random percolation model, which may be used to represent dilute magnets at low temperatures.

2. Boundary conditions, lattice shapes and scaling functions

We use a histogram Monte Carlo simulation method to calculate the scaling functions of the existence probability E_p and the percolation probability P of the

site and bond percolation models on planar lattices with free and periodic boundary conditions and with different lattice shapes. We find that different boundary conditions and lattice shapes give quite different scaling functions near the critical region. However, they give the consistent critical point, critical exponents, and the thermodynamic order parameter from renormalization group calculations.

3. Universal scaling function in critical phenomena

A histogram Monte Carlo method is used to evaluate the existence probability E_p and the percolation probability P of bond and site percolations on finite square, plane triangular, and honeycomb lattices. We find that, by choosing a very small number of nonuniversal metric factors, all scaled data of E_p and P may fall on the same universal scaling functions. We also find that free and periodic boundary conditions share the same nonuniversal metric factors. This study may be extended to many critical systems.

4. Zeros for potts model

We have evaluated numerically the zeroes of the partition function of the q-state Potts model on the square lattice with reduced interactions K. On the basis of our numerical results, we conjecture that, for both finite self-dual lattices and for lattices with free or periodic boundary conditions in the thermodynamic limit, the zeroes in the $Re(x) > 0$ region of the complex $x = (e^K - 1)/\sqrt{q}$ plane are located on the unit circle $|x| = 1$ for positive integer values of q.

5. Lattice animals and potts model

The Potts model is mapped into a directed compact lattice animal problem which is in turn related to the enumeration of restricted partitions occurring in number theory. The exact solution of the Potts model is then obtained from the known solutions of the enumeration problem. The phase transition in the Potts model is found to be of first order with a jump discontinuity in the internal energy. Our analysis also solves the directed compact lattice animal problem and establishes a recent conjecture on the location of the zeroes of the Potts partition function.

V. Nonequilibrium Statistical Physics

1. Self-organized criticality: earthquake models

Self-organized criticality (SOC) is an important concept which explains the evolution of spatially extended systems towards scale-invariant states. It was argued that scale invariance found in a wide variety of physical processes can be understood within such a framework. Earthquake provides one of the earliest example of power-law scaling (e.g. the Omori law for aftershocks, Gutenberg-Richter law for frequency and magnitude). A spring-block model of earthquakes was introduced. It incorporates realistic force-displacement relations with stick-slip action as the mechanism of strain release in earthquakes. The model may be mapped onto a cellular automaton, and it generalizes previous well-known models. This is the first

investigation of the effects of internal stresses, vectorial forces and nonlinearities (in displacements).

2. Non-equilibrium phase transitions

A three-state lattice gas model has been introduced to investigate nonequilibrium phase transitions. In this model, two kinds of particles are driven along orthogonal directions. Novel jamming and de-jamming transitions were found. A highly successful field-theoretic description was also developed, predictions of which agree excellently with simulations.

VI. Computational Physics

1. Importance-sampling histogram Monte Carlo method and its applications

Based on Hu's histogram Monte Carlo method and Swendsen-Wang algorithm, we calculate the geometrical factor of the q-state bond-correlated percolation model corresponding to the q-state Potts model (QPM). The free energy f, the internal energy U, and the specific heat C_h of the Ising model, i.e. the QPM with $q = 2$, calculated from such geometrical factor agree very well with exact results. This histogram important sampling Monte Carlo method is very simple and is used to calculate the thermodynamic properties of the QPM on a simple cubic lattice.

2. Comparison of different schemes to calculate critical points

We study site percolation on the square lattice and show that, when augmented with histogram Monte Carlo simulations for large lattices, the cell-to-cell renormalization group approach can be used to determine the critical probability accurately. Unlike the cell-to-site method and an alternate renormalization group approach proposed recently by Sahimi and Rassamdana, both of which rely on *ab initio* numerical inputs, the cell-to-cell scheme is free of prior knowledge and thus can be applied more widely.

3. Subtleties in data analysis for critical phenomena

We found that certain widely-used methods used in the literature to extract critical exponents are unreliable and they rely on unjustified assumptions. The central issue here is the size of the critical region.

VII. High Energy Physics Project

1994 is an important year for the High Energy Physics Group of Academia Sinica. CDF announced "evidence of top quark"in March, which attracted a lot of media attention locally and around the world. The proposal to search for CP violation in hyperon decays (P871), which we joined from beginning, was officially approved by Fermilab and became E871. Under the direction of our visitor Z.Q. Yu from IHEP (Beijing), we started the R&D project on microstrip gas chamber (MSGC) and microgap gas chamber (MGC). We formally took the responsibility to produce the "Dense Optical Interface Module" (DOIM) for CDF and signed R&D contract with the Telecommunication Laboratory (TL), a research institute

under the Ministry of Transportation. With the help of another visitor C.S. Yu, we started to design the front end module (FEM) and the corresponding interface module (FEMI) for use in E871. These hardware projects helped us focus our efforts in setting up our laboratory, temporarily at Room 405 of the Institute.

CDF was taking data during most part of 1994. Simultaneously, there was an intense effort in analyzing the data for top candidate events. Our group members M.J. Wang and H.Y. Chao worked very hard in trying to understand the discrepancy between Monte Carlo and data for SVX' . In particular, H.Y. Chao discovered a correlation between cluster charge and cluster length. Their efforts resulted in an improved SVX' simulation program. C.H. Wang played a major role in SVX' software alignment job. He was responsible for producing the alignment constants of SVX'. He also developed the wedge-to-wedge alignment code. The success of alignment job was esssential for SVX' to achieve a better than 10 μm resolution. C.N. Chiou was responsible for upgrading the SVX' display package. His efforts made interactive track fitting possible which helped the development of better b-tagging algorithms.

On the SVX II upgrade project, thanks to the efforts of J. Antos, H.Y. Chao and Paul Chang, who joined later of the year we were able to take sole responsibility for SVX II simulation. Our group produced the whole SVX II simulation package and our simulation results influenced the decision on several details of the SVX II upgrade project.

M.T. Cheng, M.L. Chu and P.K. Teng worked hard on the DOIM project. The first prototypes of laser-diode and photo-diode arrays had been produced. Radiation-hardness test was tried at TRIUMF with the help of R.S. Guo. We had been collaborating with the analog IC laboratorv of Chiao-Tung University and the Chip Implementation Center (CIC) to design the driver and receiver IC. M.L. Chu also needed to design circuit boards for the DOIM test before the relevant IC's become available.

R.S. Guo had been playing an increasingly important role in the mechanical subgroup of the SVX II group. He helped the calculation of the radiation length budget of the baseline design, studied the noise issue due to epoxy and was the main organizer of the TRIUMF beam test. Paoti Chang had also worked with the mechanical group since he joined near the end of the year.

P. Yeh had played an important role in the data production. He is solely responsible for the IBM farm and contributed greatly to the operation of SGI farm also. Paoti Chang had been helping him since he joined. The efforts of the Taiwan group were well recognized by the SVX II and the CDF group. The participation of Taiwan was explicitly mentioned in the press conference presenting the "evidence of the top quark". J. Antos, M.T. Cheng, M.J. Wang and P. Yeh appeared in the author list of the "evidence of the top quark" paper. P.K. Teng, C.H. Wang, C.N. Chiou and H.Y. Chao were allowed on the author list by the end of the year.

P.K. Teng, Y.C. Chen, C. Ho, C.S. Yu and K.C. Cheng were the main participants of our group in E871. C. Ho had visited LBL since September and had helped on the design of the wire chamber. A11 group members were actively involved in the design of the DAQ for E871.

The two visitors Z.Q. Yu and C.S. Yu from IHEP (Beijing) had been very helpful to our group. Z.Q. Yu had given a series of lectures on "Introduction to Experimental Particle Physics". Both of them participated in Taiwan's first detector school. C.S. Yu had undertaken the job of designing the various modules for DAQ of E871 while Z.Q. Yu, with help from P.K. Teng and M.L. Chu, led students H.J. Wai and S.S. Wang in developing the high rate chambers MSGC and MGC.

Research assistant K.S. Lu had done a great job in keeping our computing system functioning and our CDF and other HEP related software updated. He is also responsible for establishing and maintaining "Taiwan High Engergy Physics Network" (twhepnet) as well as similar networks for other fields.

In the coming year, we expect more intense efforts will be focused on data analysis for interesting physics at CDF. The R&D mode for optical readout system for SVX II is fast approaching the concluding phase. We need to work; harder on the chip design for DOIM. E871 is expected to start taking data in April 1996. We need to enter production mode for wire chambers and DAQ in mid-1995. The R&D on MSGC and MGC is expected to lead to definite conclusion by the summer of 1995. We are looking forward to another busy and fruitful year.

III

List of Ongoing Research Projects

中央研究院物理所八十四年度計畫清單一覽表

(1994年7月~1995年6月)

主持人	計畫名稱	執行期間	計畫編號
杜其永	二元混合液在多孔體內之相變及相分離研究	08/01/94-07/31/95	NSC 84-2112-M-001-021
黃榮鑑	海岸空間利用-海岸污染(2)一子1：電廠熱排水之混合擴散及模擬研究	08/01/94-07/31/95	NSC 84-2611-E-001-001
黃榮鑑	以雙層模式預測流過長方柱流場	08/01/94-07/31/95	NSC 84-2211-E-001-001
陳志強	二元混合液中薄膜液面現象之研究	08/01/94-07/31/95	NSC 84-2112-M-001-010
曾忠一	衛星遙測頻道之大氣訂正(II)	07/01/94-06/30/95	84 遙測-04-3
曾忠一	輻射傳遞模式在大氣輻射遙測問題上的應用(I)	08/01/94-07/31/95	NSC 84-2112-M-001-019
簡來成	建立「固體火箭裙燄分析作業程式(2)」	07/01/94-06/30/95	CS 84-0210-D-001-001
簡來成	極超音速鈍頭飛行體氣熱與阻力之探討	08/01/94-07/31/95	NSC 84-2212-E-001-001
王建萬	以鋰七誘發庫倫激發探討原子核低激發能態	08/01/94-07/31/95	NSC 84-2112-M-001-008
江紀成	在E_P=1.5MeV時^2D (p, γ)^3 He 反應研究	08/01/94-07/31/95	NSC 84-2112-M-001-009
余岳仲	氦離子束誘發稀土元素之L層游離之研究	08/01/94-07/31/95	NSC 84-2112-M-001-004-Y
林爾康	離子射束分析及高速輕離子激發原子電離	08/01/94-07/31/95	NSC 84-2112-M-001-017
曾詣涵	暗物質與夸克及原子核(II)	08/01/94-07/31/95	NSC 84-2112-M-001-007
鄧炳坤	重夸克及強作用物理之研究(子二)：CDF及E866實驗相關之粒子偵器研製	08/01/94-07/31/95	NSC 84-2112-M-001-029 -PE
顏迪佑	核子結構與強作用反應	08/01/94-07/31/95	NSC 84-2112-M-001-025
王唯工	針刺足三里及太谿對心跳速率及脈波頻譜之影響	07/01/94-06/30/95	NRICM-84107

主持人	計畫名稱	執行期間	計畫編號
王唯工	以脈分析原理研究四逆湯之作用	07/01/94-06/30/95	DOH 84-CM-054
王唯工	血液波前進方程式之建立及其在偵測心臟血管疾病之可能應用	08/01/94-07/31/95	NSC 84-2213-E-001-014
任盛源	磁性合金之物性(卡爾與熱電效應)研究	08/01/94-07/31/95	NSC 84-2112-M-001-011
何侗民	以矽中之鈹雜質進行價帶自旋與軌道裂距之研究	08/01/94-07/31/95	NSC 84-2112-M-001-019
胡宇光	顯像式光電子能譜顯微術	08/01/94-07/31/95	NSC 84-2613-M-001-002
姚永德	鈷及過渡金屬多層膜之電磁特性暨超微粒之物性研究	08/01/94-07/31/95	NSC 84-2112-M-001-042
陳洋元	重費米子材料之磁性與相關性研究	08/01/94-07/31/95	NSC 84-2112-M-001-033
梁乃崇	鐵/鉻/鐵薄膜的磁性結耦	08/01/94-07/31/95	NSC 84-2112-M-001-012
張嘉升	原子操縱術應用在金屬表面上之基本機制研究	08/01/94-07/31/95	NSC 84-2112-M-001-020
黃英碩	掃描穿隧顯微儀對磊晶成長及結構變化的研究	08/01/94-07/31/95	NSC 84-2732-M-001-005
黃英碩	掃描穿隧顯微儀對磊晶成長及結構變化的研究(1/2)	08/01/94-07/31/95	NSC 84-2112-M-001-037
鄭天佐	表面原子動態之研究	09/01/94-08/31/95	NSC 84-2112-M-001-018
劉鏞	高度方向性紋理的鑽石薄膜生長研究及其應用	08/01/94-07/31/95	NSC 84-2216-E-001-002
劉鏞	金屬鈷,鈷鉻合金等單晶薄膜,多層膜及超晶格之磊晶,結構改變因素及其對磁性之影響	08/01/94-07/31/95	NSC 84-2112-M-001-039
謝雲生	鈮酸鋰晶體之拉曼光譜與長晶研究	08/01/94-07/31/95	NSC 84-2112-M-001-030
魏金明	科學計算和數據分析中數學圖形顯示之改善	02/01/95-07/31/95	NSC 84-2112-M-001-049

主持人	計畫名稱	執行期間	計畫編號
魏金明	利用分子動力學模擬方法研究金屬表面原子的擴散及移動行為	08/01/94-07/31/95	NSC 84-2112-M-001-006
王明哲	重夸克及強作用物理之研究(子三):CDF及E866實驗之物理模擬與數據分析	08/01/94-07/31/95	NSC 84-2112-M-001-028-PE
余海禮	規範場論、強作用及相關物理之研究(子二):小X與重強子物理	08/01/94-07/31/95	NSC 84-2112-M-001-034
吳建宏	宇宙微波背景輻射之各向不同性及偏極性	08/01/94-07/31/95	NSC 84-2112-M-001-024
李世昌	沙堆模型及其它非線性系統之研究	08/01/94-07/31/95	NSC 84-2112-M-001-022
李世昌	重夸克及強作用物理之研究(子一):頂夸克搜尋及強作用之非微擾現象及相關物理之研究	08/01/94-07/31/95	NSC 84-2112-M-001-001-PE
李世炳	規範場論、強作用及相關物理之研究(子五):尺度不變與標準模型中一些基本問題的探討	08/01/94-07/31/95	NSC 84-2112-M-001-035
胡進錕	臨界現象新算法及其應用(II)	08/01/94-07/31/95	NSC 84-2112-M-001-013-Y
胡進錕	統計物理與凝體理論(1/2)	02/01/95-07/31/95	NSC 84-2112-M-001-048
張志義	規範場論、強作用及相關物理之研究(子四):重夸克對稱與手徵動力學	08/01/94-07/31/95	NSC 84-2112-M-001-036
林誠謙	蒙地卡羅模擬及最佳化問題	08/01/94-07/31/95	NSC 84-2112-M-001-005
梁鈞泰	非線性系統之相變	08/01/94-07/31/95	NSC 84-2112-M-001-023
鄭海揚	物理理論研究發展及推動小組	07/01/94-12/31/94	NSC 84-2112-M-001-003
鄭海揚	粒子現象學之研究(II)	08/01/94-07/31/95	NSC 84-2112-M-001-014

IV

Publication List of 1994/1995

Chan, Chi-Keung（陳志強）

1. K.W. To and C.K. Chan, "Morphology and Dynamics of a Separating Binary Mixture under Gravity," *Physica* **A205**, 320 (1994).
2. C.K. Chan, "Anisotropic Phase Separation of a Non-Equilibrium Liquid-Liquid Interface," *Phys. Rev. Lett.* **72**, 2915 (1994).
3. C.K. Chan and N.Y. Liang, "Convection Pattern on the Liquid-Liquid Interface of a Phase Separated Binary Mixture," (preprint).
4. N.Y. Liang and C.K. Chan, "Slip-Stick Dynamics of an Air-Water Interface Moving in a Random Medium," (preprint), (1995).
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6. C.S. Chang, W.B. Su and T.T. Tsong, "New Charge Density Modulations in the Confined Regions of the Reconstructed Pt(100) Surface," *Jpn. J. Appl. Phys.*, (accepted).
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8. T.C. Chang, C.S. Chang, H.N. Lin and T.T. Tsong, "Generation of Nanostructures on Gold Surfaces in Nonconducting Liquid," *Appl. Phys. Lett.*, (accepted).

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V

Supporting Facilities

Computer Room
電腦室工作概況

一、電腦室目前共有兩位工作人員，負責執行由資訊設備委員會議決議的各項事務；電腦室所有工作及支援行政室自動化系統之建立。主要工作項目為：

1. 管理及維護電腦室所有設備及資源之使用及使用者諮詢服務。
2. 提供研究人員大量資料處理及數值分析運算所需之軟、硬體設備。
3. 網路通訊服務。由於本所網路屬TANET上的一節點，因此可由本所網路直接對Internet上各節點進行通訊連結，傳遞訊息，檔案及分享資源等。
4. 行政室自動化方面，目前可透過專屬的NetWare網路進行資源共享及micom連接院內行政系統。
5. 為公共資料保存，製作備份，對全所共用系統上的所有資料及軟體等作維護及保存。
6. 提供技術支援。對所內各組別或個人提供技術、採購及網路連線之諮詢或支援服務。

二、以目前本所擁有之軟、硬體設備及使用狀況而言：

1. 網路現況：

目前所內的網路採乙太網路(Ethernet)型態，二、三樓部份網路線是連接至一hub上，而行政室網路線亦是透過hub連接上所內網路主幹線(backbone)。各樓層的實驗室及研究室亦透過bridge連接至主幹線上。整體網路的邏輯架構請參考附圖。

對外網路共可分3個部份，分別為本院院區光纖網路，院內micom系統及本所提供的兩組modem電話號碼。

本院院區光纖網路自八十二年五月啓用，提供院內傳輸速率達10 MB/S。而本所與院內光纖網路之連接，乃透過計算中心之光纖中繼站所設的路由器(router)與所內網路主幹線相連。藉由光纖網路的連繫，不但在所內即可分享本院計算中心所提供的各項線上服務及各種資源，並可連上教育的TANET, 進而與國際學術網路(BITNET)及網際網路(Internet)等大型網路相連。

而micom乃是經由多工器以9600 baud速度專線和院內計算中心的Terminal Server相連，提供專線的網路系統服務。

modem系統，為二台14400baud的高速modem, 並具有傳輸即時壓縮之功能，加快透過modem進入操作的user速度上的服務。現正朝slip或ppp的方式設置中，提供更方便的使用途徑。

2. 計算機系統及其它週邊設備：

電腦室目前所有計算設備包括四部IBM RISC/6000工作站，十四部SUN Sparc工作站，一部VAX 3100工作站，七部PC及三部麥金塔電腦。並且連接多種週邊設備以期多方面充分利用資源。八十四年度所採購的工作站共計四部，其型號及規格分別如下：

(1) DTK SUN Sparc 5/70工作站四部，含32MB RAM, 525MB H.D, Sun OS 4.1.3。其主機名為phys12, phys13, phys14, phys15。

(2) Pentium 100 PC 一部含16MB RAM 525MB H.D 17" Color monitor MS Dos 6.2。

而針對各類型計算機目前使用狀況分別如下：

IBM RISC/6000工作站，主機名稱分別為hal, hall, ha12及ha13, 為專供本所研究人員數值運算，資料分析處理使用。採用IBM AIX V3.2 OS, 並安裝fortran及C compiler及一套

ESSL工程科學程式軟體。這四部工作站皆已連上所內網路，以一部model 550 工作站為專用檔案伺服器，並可和SUN工作站群共用二部網路雷射印表機。磁帶機及光碟機等週邊。目前皆放置於420室。

SUN工作站群屬於全所共用的計算機系統，提供計算；網路；資料儲存；備份等多方面服務功能。凡本所人員或以學術，非商業用途為目的者皆可申請使用。其主機名稱別為physerv ; physms; phys3~phys15等。而其分置於420室及317室及其它研究室及實驗室。所有SUN工作站亦連上網路，有一部專用檔案伺服器，二部印表伺服器(置於420室及317室)及一部共用的電子郵遞(e-mail)及譯名服務(domain name)伺服器。其餘週邊設備有一部 2.3GB 8mm磁帶機，二部150MB 1/4"磁帶機，一部容量涵蓋600MB至1GB可讀寫光碟機及一部唯讀光碟機。

SUN工作站群除了有多種週邊設備外，軟體部份採用SUN OS 4.1x OS, 其提供Open Windows 及Sun View兩種視軟體，e-mail、ftp、telnet等網路服務及C compiler。此外，另有一套SUN F77 V2.01 compiler,mathematica V2.0; V2.2,公共軟體如TeX、WWW、Xmosaic等等 ·

透過網路的使用，user可利用SUN工作站之軟碟機、磁帶機及光碟機來備份自己的資料。而電腦室除了定期製作資料備份於磁帶及光碟片上，並於網路上提供一線上的getmir程式幫助user取回前一天所有的資料，以防止user資料意外的流失。

在個人電腦方面，共提供七部PC, 三部麥金塔電腦。另有四部PC供訪問學人借用。在PC使用上提供中英文MS-Window及DOS、倚天中文。文書軟體有PE2、3,中英文Tex, OA-mate, MS-office, C, C++, Clipper等。系統軟體有OS/2,

Net Ware, Linux等。另外，也有其它諸如mathematica等數學軟體及影像處理軟體等多項應用軟體。

參金塔上提供System 7英文OS及System 7中文，其有MS-Word文書軟體等。並有週邊：CD-ROM及抽取式硬碟機。

在PC及參金塔輸出方面，有一HP PJ/XL 300彩色噴墨印表機和HP LJ4m 600dpi雷射印表機與之搭配。

3. 影像處理系統，目前連接至SUN工作站，可透網路來使用。其提供類比和數位訊號隻重接收功能，並附有影像格式轉碼程式，可使PC或Mac上的一般影像檔透過此程式轉為SUN工作站上的影像格式檔輸出至此設備，藉由其照相機拍於軟片上。加強了電腦室現有的彩色輸出。

三、其它服務支援：

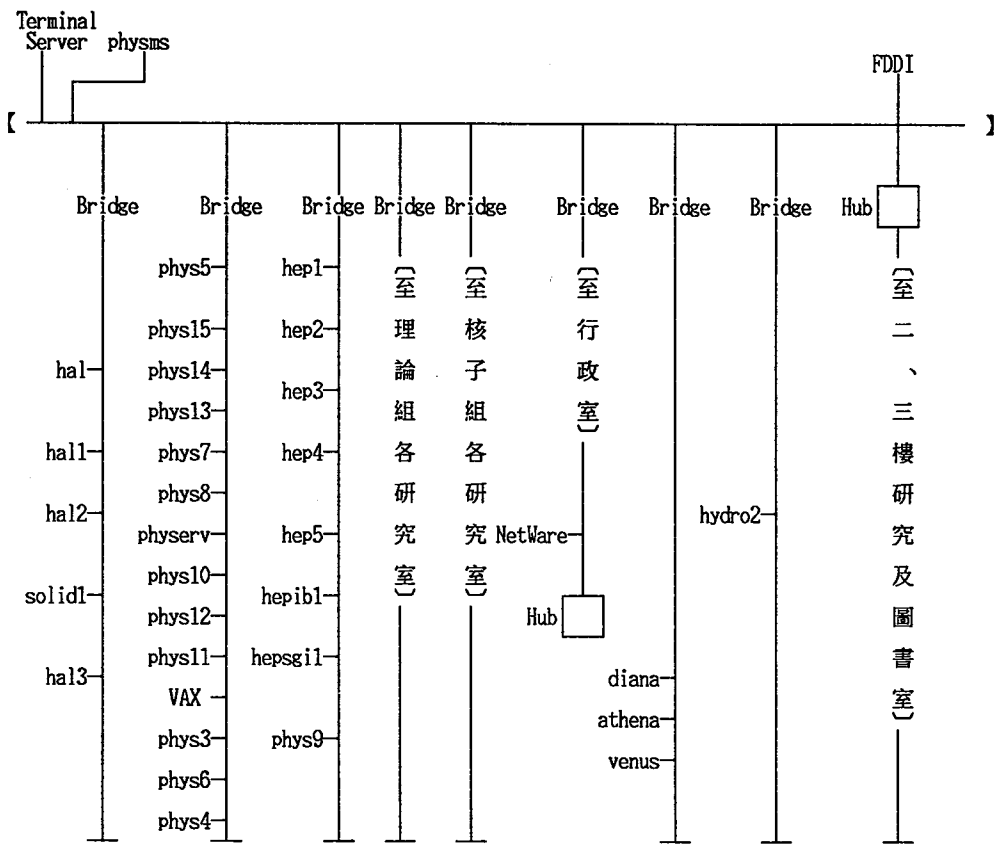
在行政室自動化於八十四年度添購一部HP 4M plus 600dpi的雷射印表機準備提供網路列印服務。另外，亦有新翰藝排版系統及莎士比亞等文書排版軟體。

此外電腦室不但負責全所共用的電腦、網路及行政室自動化，並支援圖書室及各實驗、研究人員對網路連接、技術、採購等諮詢服務。而如本所新大樓之網路佈線及電腦室部份，亦提供管線、空間規劃等設計參考。

四、結論：

電腦室除維護現有設備，擴充及加強更新的設備外，也不斷加強技術及對使用者的服務。

物理所電腦網路邏輯圖



Library
圖書室概況

壹、沿 革：

中央研究院物理研究所圖書室成立於民國51年（1962），為一學術性專門圖書館。成立的目的，在為本所研究人員，國內物理學界人士提供完善的物理學研究的環境。

貳、組 織：

隸屬於中央研究院物理研究所，所長為負責人，設有圖書委員會。委員由所內研究人員組成，協助所長掌理館藏規劃及圖書政策之審議，並設有專業館員一名，助理一名處理圖書資料的採訪、編目、典藏、閱覽、流通與參考服務等工作。

參、面 積：

位於物理所大樓三樓，有170坪，內設圖書、期刊閱覽室，研究人員著作陳列室，及閱讀座位21席。

肆、經 費：

近三年來(82-84)，每年購書經費約台幣650萬，其中85%訂購期刊，15%購買圖書。

伍、館 藏：

一、印刷品資料

中、西文圖書26,000餘冊（含期刊合訂本10,000餘冊）期刊近300種（包括國際重要物理期刊如Physical Review, Review of Modern Physics, Physical Review Letters等)。類別涵蓋物理、數學、及應用科學，大陸出版的科技期刊亦收藏有18種。每年購進的圖書約700種，裝訂成冊的期刊約

1500冊。目前持續訂閱的期刊約200餘種。

二、非印刷品資料

（一）縮影資料（32種期刊的Back Issues）

（二）光碟系統4套

1. SCI (Science Citation Index)
2. INSPEC (Physics Abstract 的光碟版)
3. PDF-2 Database (查材料屬性的資料庫)
4. OCLC (OCLC Online Computer Library Center, 查西文書目的資料庫)

這些館藏除提供本所同仁使用外，開放外界物理研究者使用。

陸、圖書館作業內容：

圖書館作業內容分下列三點說明：

一、技術服務

僅針對資料徵集及資料處理兩方面而言。

(一)資料徵集：

1. 由研究人員推薦，圖書委員會議審議後，提報所長視經費情況採購。
2. 資訊的掌握，為研究工作者的重要課題，本館針對此，時時注意及加強相關資料的收集，收集的途徑如下：

(1)有學術價值的集叢，例如 Lecture notes in physics 等30餘種，委託國外書商以standing order的方式訂購，以加速資料到館的時效。

(2)單本圖書，委託國內外書商，以一般訂購方式購買，自81年度起，為改善到館時效，改以空運方式寄送。

(3)研究人員的興趣主題，凡能索贈者，即以贈與

方式徵集，例如HTc Update等資料。

(4)有計劃的補購具有研究參考價值的期刊的Back issues。

(5)陳列出版商的出版資料，做為新書介購的參考。

(6)CD-ROM在資訊檢索上較印刷資料快速，除可節省時間外，還可得到較完整的檢索，對資料的收集，助益頗大，本館為支援研究工作，購有CD-ROM產品（參考上列光碟系統），以提高服務品質。

(二)資料的處理：

徵集到館的書刊資料，為了方便管理和使用，將它作系統化的組織是必要的，本館資料處理方式如下：

1.編目：

中文採用中國編目規則(CCR)，西文採用英美編目規則(AACR II)著錄該資料的題名、作者、出版資料等項目。方便館員或讀者就已知的作者、書名或主題查到所需要的資料。

2.分類：

中、西文資料分別採用中國書分類法、美國國會圖書館分類法分類。經過分類的處理，可讓館員及讀者了解整個館藏資料的類別與性質，各類別資料間的比重及將來館藏發展的方向。資料的組織與整理是一項思考性與判斷性的工作，同時也是一項〝勞力密集〞的工作。所幸近年來電腦發展快速，利用電腦協助圖書館作業自動化可解決部份勞力的工作。

二、參考服務項目

服務項目分下列六項說明：

(一) 閱覽服務：

1.本館資料採開架陳列，本院同仁可憑借書證借閱，院外人士以館內閱覽為原則。

2.每月有二次新書展示，在展示期間接受預約借閱。

(二) 參考諮詢服務

讀者可利用面洽、電話、傳眞或書信向本館查詢資料。

(三) 館際合作服務：

本館是〝中華民國科技館際合作協會〞的會員，除協助本所同仁蒐訪其他圖書館收藏之科技資料外，並供應各合作單位及對物理研究有興趣者所需之資料。最近二年來，每年處理外界向本館申請的館際合作約500件，本館向外館申請的約250件。

(四) 資料複印服務：

1.備有影印機二部，閱讀影印機(Reader/ Printer) 一部，以方便讀者在不侵害著作權益之原則下，影印本館資料。

2.備有傳眞機一部，提供資訊傳眞服務，縮短資料傳送的時間。

(五) 其 他：

1.購有PC, CD-ROM Driver及Laser Printer一套，放在圖書室供研究人員檢索資料用。

2.CD-ROM網路系統的建立，是將來服務的項目，目前限於經費，尚未進行。

3.設立讀者意見箱，廣徵各方意見，做為圖書館館務推行的參考。

三、圖書館自動化

為有效處理本院館藏資料及發揮資訊交流的功能，中央研究院於民國80年引進INNOPAC圖書館自動化作業系統。本館為連線圖書館之一，並於80年9月展開自動化作業。目前進行的工作有：

（一）書目與館藏資料的建檔：

為自動化作業第一階段的重點工作。為節省人力及加速建檔工作，利用書目光碟片做為館藏資料回溯的依據及新書編目的參考。目前已完成21,000餘筆館藏資料的建檔。

（二）期刊線上處理：

自81年底起，到館的期刊改由線上及人工雙向處理。期刊的登錄、催缺、裝訂清單的列印均可在線上作業，使用者也可經由INNOPAC系統得知期刊到館的狀況。

（三）圖書流通：

已建有讀者檔100餘筆，借書記錄均已建入系統，陸續要完成的工作是將借書，借閱可直接在線上查看自己的借書記錄。

柒、總結：

提供完善的資訊服務，協助研究工作的進行是本館經營的目標也是本館的任務。為了發揮此項功能，圖書館需要大家的督導，也需要大家的鼓勵。

捌、附錄：

一、新服務：

1. 84年7月以後，Physical Review Letter的線上版問世(physical Review Letter on-line version)，圖書室已向American Physical Society申請帳號，屆時研究人員可以在線上獲取即時性的資料。

2. 將新到館期刊清單以e-mail發送給研究人員。

3. 裝設www（全球資訊系統）的瀏覽軟體，讓查尋的資料更多元化。

4. 協助研究人員以DDS (Document Delivery Service)方式，經由Internet的傳送，在短時間內即可取得論文資料。

二、新設備：

1. 增購486個人電腦一部，17"彩色螢幕一個及四倍速光碟機二部。以提高資料檢索的速度及清晰的影像傳送。

2. 更換微縮影印機的驅動器，讓使用微縮資料時更方便。

三、館際合作：

協助三十多位同仁向國內外資料單位索取論文資料二百二十多篇，同時亦提供二百六十多篇論文資料給四十幾個向本所索取資料的研究單位及大專院校。

四、資訊系統及光碟資料庫：

1. 資訊系統

(a) LAS (Library Automation System)

查本所及全院的館藏資料，透過此系統還可以查國外的圖書館資訊系統。

(b) PINET(The Physics Information Network of the American Institute of Physics)

由American Institute of Physics發展的。提供物理界新知及論文發表動態等消息。

(c) ITIS產業分析資訊系統

由工研院開發，提供國內廠商名錄及市場動態等消息。（目前免費使用）

2. CD-ROM資料庫

(a) Thomas Register

提供美加地區廠商名錄。此資料庫可以和ITIS系統參照使用,做為查尋國內外廠商資料的參考。

(b) SCI (Science Citation Index) with Abstracts

收錄三千多種科學期刊,是查尋科學文獻,文獻被引用與否及評鑑期刊水準的參考資料。

(c) INSPEC (Physics)

收錄三、四千種物理、電子、電機等方面的期刊、會議論文、專利、研究報告等的文獻,是電子版的Physics Abstracts。

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

查材料屬性的資料庫。

Technical Group
技術組工作概況

本所技術組成立已屆三年,成立的構想在集中本所目前的技術資源,作全所性的技術支援工作。其中包括:(1)電子儀器之維修與製作;(2)儀器配件之製作與組裝;(3)各種試料之裝備;(4)眞空技術之支援;(5)研究實驗用各種氣體、液體之供應與管理;(6)大型複雜性儀器設備之操作與保養;(7)放射性物料管理及輻射安全等;(8)各種電力供應通訊設施以及其它技術性之支援等等。目前技術組大約分為:一、電子工作室,二、機械工作室,三、眞空服務部,四、一般性支援等四方面,茲將工作分述如下:

一、電子工作室

電子工作室對全所電子儀器設備提供服務,由於全所電子設備包羅萬象,精密儀器種類繁多,因此在維修時,常因資料不全,稀少性零件不易覓得,在維護上造成困擾及耗費不少時間,我們已在加強:

1. 蒐集儀器資料:包括儀器的操作,維修手冊,以及廠商的資料等等,去年增加的資料手冊有intel ICS DATABOOK。
2. 加強電子零件的庫存:去年我們已開始建立一個完備而常用的電子庫存房,對於一般性的耗材能迅速提供各研究實驗室。希望能減少因耗材的久缺而浪費時間,今年已增加BNC訊號接頭RG隔離信號線、眞空用電子線料件庫存,亦提供各類訊號線之組裝。
3. 精密測試儀器:目前電子工作室的測試檢查儀器仍尚未完備,我們將在近期內增購類比示波器,低電阻測試儀等。電子工作室去年所提供的服務如附表一。

二、機械工作室

機械室成立迄今已三年餘，除了原有之設備外，又陸續添購了氬焊機、空氣離子切割機及自行修復一部木鋸床。另外在八十二年度國科會補助下，添購一部瑞士 SCHAUBLIN 精密車床。此部車床除了可車削外，亦可作銑削及研磨；功能齊全，且精密度高，精密工件加工可不求外人。這部車床已於本年六月中旬加入運作。機械室目前正積極的建立各類耗材的庫存，以供全所同仁使用。已建立耗材庫存有：鋁材、銅材、不銹鋼材、壓克力、螺絲及Swagelok管接頭等，並且依各實驗之發展及需求，再陸續添購各類耗材。

三年多以來，機械室的技術及工作經驗正逐步提升，將嚐試與其他較先進之機械工廠作技術交流，盼能藉此提高機械室之技術水準，以符合各實驗室之要求。機械室目前現有之設備如表二。機械室本年度自製的成品項目及數量如表三。

三、眞空服務部：

眞空服務部除了繼續維持原有對原子核組加速器及固態組X光繞射各型眞空設備之操作與維修外，推廣並加強對各實驗室作眞空技術服務；另外並積極建立各項眞空零組件與耗材的庫存，以方便同仁使用。目前已建立之庫存眞空零組件如表四。

希望在來年能有一套自己的維修專用眞空泵，及一測漏儀便於維修與測試眞空設備，另一方面加強與各眞空泵製造商聯繫，能迅速取得最新的眞空泵、各類眞空系統的附件等技術資訊。

四、一般性支援

除了經常性維護本所研究大樓一般水電、消防、空調、通訊設備（包括電話、FAX、超短波、無線電等）聲光、影設備外，同時協助實驗改善電力品質及接地裝置，同時進行全所照明設備評估，改善目前以長條型日光燈為主的照明設備以節省燈管更換的人力及節省能源。已規劃完成液態氮供應系統工程，並於八十三年一月份試車啓用，此一系統完成後不但使各實驗室取得液態氮更為便利，在費用上，更較原先購買散裝之費用節省，預估可節省公帑25萬元。為了節省資源，更積極計劃將大樓各實驗室的冷卻以回收循環再利用，此計劃亦即將陸續完工。

負責全所輻射偵防，管理輻射廢料及人員輻射劑量佩章也是技術組工作之一，技術支援本所多項研討會錄音、錄影等工作；此外積極參與本所研究大樓擴建計劃，協助多項技術性及行政作業，在大樓工程進行時，將會同建築師事物所協助監工業務。

綜上所述技術組的工作繁多，除了一般性的技術支援外，也涉及到高科技的層面，怎樣使技術組茁壯成長，使之眞正能發展配合尖端性的研究工作則還有大段路要走。而人力不足，人才難覓以及現階段的人事法令下發展出一強力技術支援群則有賴於大家的努力。好在目前各院方正積極進行〝改善技術人力方案〞，設法提升技術人員待遇及建立技術人員晉升管道。我們自己也在推動培訓人才的工作，設法送技術人員赴國外有名實驗室以汲取經驗，希望藉此以提昇其技術能力。

表一：電子工作室設計製作及修護項目

設計及製作方面：

工　　作　　項　　目	使用人
地線配置	王建萬
信號線更換	王建萬
PCB製作	鄧炳坤
High speed SW	張嘉升
低衰減信號線	江紀成
前置放大器控制線	余岳仲
眞空用導線	張嘉升
SMTPCB製作	朱明禮
雙層隔離線接頭	林鶴南

修護方面：

工　　作　　項　　目	使用人
Digital Temperature Controller	鄭天佐
The Cooling Fan of Power Supply	陳志強
超音波洗淨機	鄭天佐
大型超音波洗淨機	王建萬
加速器用前置放大器	王建萬

表二：機械工作室現有設備

設　備　名　稱	數量	設　備　名　稱	數量
車床(楊鐵)	一部	手提砂輪研磨機	二部
鋸床(臥式)	一部	手提電鑽	一部
線鋸床(立式)	一部	手提電鋸	一部
鑽床(桌上型)	一部	花岡岩石精密平台	一部
鑽、銑兩用複合機(中型)	一部	精密高度規	一部
電焊機	一部	精密比測台	一部
砂輪機	一部	486電腦	一部
砂輪切斷機	一部	2#精密銑床(大型)	一部
氬焊機	一部	高速電鑽(小型)	一部
空氣離子切割機	一部	木鋸床(中型)	一部
瑞士精密車床(中型) (SCHAUBLIN 102N-VM)	一部	立式鑽床(小型)	一部
精密磨床(中型)	一部		

表三：機械工作室自製成品項目

成　品　名　稱	數　量	申請者
Mini Flange焊接...等	45	鄭天佐
拋光儀防塵罩...等	48	謝雲生
鐵弗龍靶...等	31	原子核組
低溫比熱架...等	12	姚永德
試管架...等	20	杜其永
不鏽鋼板鉆孔...等	41	陳悅來
無氧銅靶架...等	40	黃英碩
壓克力桶槽...等	73	高能組
鉬製靶架...等	8	劉　鏞
鐵弗龍...等	24	陳志強
合金鋁及無氧銅...等	21	張嘉升
鋁架...等	12	任盛源
儀器架...等	9	曾怡仁
靶架...等	9	梁乃崇
鐵心製作...等	4	盧志權

表四：眞空服務部之庫存

Gasket	Blank		Bellow	O-ring	Vent Valve	Four way Tube	Three way Tube	90 ELBOW
16CF	NW16	16CF	NW25	U.S.A	NW16	NW50	35CF	NW25
35CF	NW25	35CF	NW50	Parker	NW40	35CF	NW25	
63CF	NW40	63CF		Viton				
100CF	NW50	100CF		系列				
160CF		160CF						

VI

Academic Activities

Attendances in International Conferences

中研院物理所八十四年度出席國際會議表

(1994年7月~1995年6月)

會議名稱	會期	舉辦地點	出席人員	經費來源
第四屆國際高溫超導研討會	07/02/94-07/11/94	法國格勒諾勃	姚永德	國科會
澳洲國家物理學會及亞太物理學會聯合會議	07/03/94-07/06/94	澳洲布里斯本	鄭天佐	物理所
伯克萊Lab.參與B-粒子物理實驗組會議	07/06/94-07/10/94	美國舊金山	朱明禮	物理所
日本KEK美工廠會(B-factory)	07/06/94-07/11/94	日　本	王正祥	自　理
第二屆生物力學大會	07/09/94-07/15/94	荷蘭阿姆斯特丹	王唯工	中研院
第四十一屆國際表面物理研討會	07/11/94-07/15/94	法國魯昂	鄭天佐	物理所
第廿七屆國際高能物理會議並於7.12-19及7.28-8.17訪問費米及LBL Lab.	07/12/94-08/17/94	英國格拉斯哥	李世昌	物理所
第三屆國際生物流體力學大會	07/16/94-07/21/94	德國慕尼黑	王唯工	中研院
第六屆國際輻射物理研討會	07/16/94-07/24/94	法國摩洛哥,拉巴特	江紀成	國科會
第四屆國際新鑽石科學技術會議	07/17/94-07/22/94	日本神户	劉　鏞	國科會
第十一屆國際物理數學會議及訪問美加各大學郭登固態有序無序會議	07/18/94-08/27/94	法國巴黎、美國新漢普夏州	胡進錕	中研院
第廿七屆國際高能物理會議	07/20/94-07/27/94	蘇格蘭Glasgow大學	鄭海揚	中研院
赴麻省理工學院短期訪問	08/01/94-09/06/94	美國麻省	李世炳	物理所

會議名稱	會期	舉辦地點	出席人員	經費來源
參與矽微條偵測器SVXII工作者會議,會後訪問勞倫斯伯克萊實驗室	08/03/94-08/28/94	美國芝加哥	安徒斯	中研院
閩港台沿海環境科技與管理研討會	08/07/94-08/12/94	中國廈門	黃榮鑑	物理所
閩港台沿海環境科技與管理研討會	08/07/94-08/12/94	中國廈門	蕭葆義	物理所
第六屆國際半導體內淺能階中心會議	08/10/94-08/12/94	美國加州	何侗民	國科會
第十四屆國際拉曼光譜學會議及衛星會議和籌備會議	08/10/94-08/31/94	香港	謝雲生	國科會、物理所
第四屆國際光錐量子化及非微擾動力學研討會:重子理論及光界量子色動力學	08/15/94-08/25/94	波蘭華沙	張爲民	中研院
一九九四年國際磁學會議	08/18/94-08/27/94	波蘭華沙	任盛源	中研院
一九九四年國際磁學會議	08/20/94-08/28/94	波蘭華沙	姚永德	物理所
國際拉曼光譜於薄膜及超薄膜會議	08/28/94-08/31/94	中國廣州中山大學	劉鏞	物理所
第四屆KINR原子核物理國際會議	08/29/94-09/07/94	烏克蘭基輔市	顏迪佑	國科會
Babar實驗組九月份合作會議	09/07/94-09/10/94	美國舊金山史丹佛	李世昌	物理所
赴俄莫斯科大學訪問	09/08/94-09/15/94	俄羅斯莫斯科	顏迪佑	物理所
第四屆量子不可積專題討論會	09/08/94-09/11/94	美國費城	張爲民	物理所
相對論的物理解釋會議	09/09/94-09/12/94	英國倫敦	李世炳	國科會
一九九四年強子結構會議及短期訪問	09/17/94-09/30/94	斯洛伐克科西嘉	安徒斯	中研院、自理

會議名稱	會期	舉辦地點	出席人員	經費來源
美國航空太空學會技術委會	09/26/94-09/28/94	美國阿拉巴馬	簡來成	物理所
第二屆國際超微結構物質特性研討會	10/03/94-10/07/94	德國司徒加	姚永德	物理所
第四十五屆國際太空聯盟年會	10/08/94-10/22/94	以色列耶路撒冷	簡來成	中研院
美國眞空學會會議	10/23/94-10/28/94	美國丹福市	鄭天佐	物理所
美國眞空學會年會	10/24/94-10/28/94	美國丹佛市	張嘉升	國科會
第十三屆國際加速器在研究及工業應用會議	11/05/94-11/10/94	美國德州丹頓市	余岳仲	國科會
第十三屆加速器研究及應用國際會議並順道訪問紐約石溪大學	11/07/94-11/10/94	美國北德州大學	林爾康	中研院、物理所
第十三屆國際加速器在研究及工業應用會議	11/07/94-11/10/94	美國德州丹頓市	王建萬	國科會
第四十七屆美國物理學會流體動力學年會	11/20/94-12/24/94	美國喬治亞州亞特蘭大市	杜其永	國科會、物理所
一九九四材料研究學會秋季會議	11/28/94-12/02/94	美國麻州波士頓市	黃英碩	國科會
第二屆海內外華人航天科技研討會	12/01/94-12/04/94	中國大陸北京	簡來成	物理所、自理
第二屆國際 STM 演講會	12/07/94-12/10/94	日本金澤	鄭天佐	物理所
第三十三屆航空太空會議	01/09/95-01/12/95	美國內華達州雷諾市	簡來成	國科會
第九屆世界風工程研討會	01/09/95-01/13/95	印度新德里	蕭葆義	物理所
面向二十一世紀原子、分子與固體物理國際學術研討會	02/20/95-02/23/95	中國上海復旦大學	鄭天佐	物理所

會議名稱	會期	舉辦地點	出席人員	經費來源
參與矽微條偵測器SVXII工作者會議,會後訪問勞倫斯伯克萊實驗室	08/03/94-08/28/94	美國芝加哥	安徒斯	中研院
閩港台沿海環境科技與管理研討會	08/07/94-08/12/94	中國廈門	黃榮鑑	物理所
閩港台沿海環境科技與管理研討會	08/07/94-08/12/94	中國廈門	蕭葆義	物理所
第六屆國際半導體內淺能階中心會議	08/10/94-08/12/94	美國加州	何侗民	國科會
第十四屆國際拉曼光譜學會議及衛星會議和籌備會議	08/10/94-08/31/94	香港	謝雲生	國科會、物理所
第四屆國際光錐量子化及非微擾動力學研討會:重子理論及光界量子色動力學	08/15/94-08/25/94	波蘭華沙	張爲民	中研院
一九九四年國際磁學會議	08/18/94-08/27/94	波蘭華沙	任盛源	中研院
一九九四年國際磁學會議	08/20/94-08/28/94	波蘭華沙	姚永德	物理所
國際拉曼光譜於薄膜及超薄膜會議	08/28/94-08/31/94	中國廣州中山大學	劉鏞	物理所
第四屆KINR原子核物理國際會議	08/29/94-09/07/94	烏克蘭基輔市	顏迪佑	國科會
Babar實驗組九月份合作會議	09/07/94-09/10/94	美國舊金山史丹佛	李世昌	物理所
赴俄莫斯科大學訪問	09/08/94-09/15/94	俄羅斯莫斯科	顏迪佑	物理所
第四屆量子不可積專題討論會	09/08/94-09/11/94	美國費城	張爲民	物理所
相對論的物理解釋會議	09/09/94-09/12/94	英國倫敦	李世炳	國科會
一九九四年強子結構會議及短期訪問	09/17/94-09/30/94	斯洛伐克科西嘉	安徒斯	中研院、自理

會議名稱	會期	舉辦地點	出席人員	經費來源
美國航空太空學會技術委會	09/26/94-09/28/94	美國阿拉巴馬	簡來成	物理所
第二屆國際超微結構物質特性研討會	10/03/94-10/07/94	德國司徒加	姚永德	物理所
第四十五屆國際太空聯盟年會	10/08/94-10/22/94	以色列耶路撒冷	簡來成	中研院
美國眞空學會會議	10/23/94-10/28/94	美國丹福市	鄭天佐	物理所
美國眞空學會年會	10/24/94-10/28/94	美國丹佛市	張嘉升	國科會
第十三屆國際加速器在研究及工業應用會議	11/05/94-11/10/94	美國德州丹頓市	余岳仲	國科會
第十三屆加速器研究及應用國際會議並順道訪問紐約石溪大學	11/07/94-11/10/94	美國北德州大學	林爾康	中研院、物理所
第十三屆國際加速器在研究及工業應用會議	11/07/94-11/10/94	美國德州丹頓市	王建萬	國科會
第四十七屆美國物理學會流體動力學年會	11/20/94-12/24/94	美國喬治亞州亞特蘭大市	杜其永	國科會、物理所
一九九四材料研究學會秋季會議	11/28/94-12/02/94	美國麻州波士頓市	黃英碩	國科會
第二屆海內外華人航天科技研討會	12/01/94-12/04/94	中國大陸北京	簡來成	物理所、自理
第二屆國際 STM 演講會	12/07/94-12/10/94	日本金澤	鄭天佐	物理所
第三十三屆航空太空會議	01/09/95-01/12/95	美國內華達州雷諾市	簡來成	國科會
第九屆世界風工程研討會	01/09/95-01/13/95	印度新德里	蕭葆義	物理所
面向二十一世紀原子、分子與固體物理國際學術研討會	02/20/95-02/23/95	中國上海復旦大學	鄭天佐	物理所

會議名稱	會期	舉辦地點	出席人員	經費來源
美國物理學會春季會	03/20/95-03/24/95	美國加州聖荷西市	何侗民	物理所、自理
美國物理學會三月年會	03/20/95-03/24/95	美國加州聖荷西市	鄭天佐	主題計畫
一九九五美國物理協會三月年會	03/20/95-03/24/95	美國加州聖荷西市	黃英碩	物理所、自理
一九九五年美國物理學會三月會議	03/20/95-03/24/95	美國加州聖荷西市	魏金明	物理所、自理
生命物質之物理:起伏.自我組成及演化	03/27/95-04/06/95	挪威 Geilo	胡進錕	國科會
一九九五國際磁學研討會	04/18/95-04/21/95	美國德州	姚永德	自　理
國際磁學會議 (INTERMAG '95)	04/18/95-04/21/95	美國德州	劉　鏞	物理所、自理
掃描式顯微術國際會議	05/06/95-05/13/95	美國休士頓	張嘉升	物理所、自理
國際粒子理論與現象會議	05/22/95-05/24/95	美國愛荷華州 Ames	鄭海揚	國科會
第二屆微重力科學學術會議	05/23/95-05/28/95	中國重慶	簡來成	自　理
第七屆PIXE及其分析應用國際會議	05/26/95-05/30/95	意大利威尼斯	余岳仲	物理所
夏威夷中國學人協會	05/26/95-05/27/95	美國夏威夷	王唯工	物理所
「反粒子質譜儀」國際合作實驗組會議	06/03/95-06/12/95	美國太空總署	李世昌	國科會、物理所
第十八屆太平洋科學協會年會	06/05/95-06/12/95	中國大陸北京	簡來成	中研院
香港表面科學講習會	06/19/95-06/23/95	香　港	魏金明	自　理

會議名稱	會期	舉辦地點	出席人員	經費來源
國際表面科學會議	06/19/95-06/23/95	香　港	鄭天佐	主辦單位
中俄中高能物理學研討會	06/24/95-07/06/95	俄羅斯	曾詣涵	國科會
國際表面科學研討會	06/25/95-06/27/95	韓國 Postech	鄭天佐	主題計畫
中俄中高能物理學研討會	06/26/95-06/28/95	俄國莫斯科	張志義	中研院
中俄中高能物理學研討會	06/26/95-06/28/95	俄國莫斯科	鄧炳坤	中研院
中俄中高能物理學研討會	06/26/95-06/28/95	俄國莫斯科	王明哲	國科會
中俄中高能物理學研討會	06/26/95-06/28/95	俄國Dubna	鄭海揚	國科會

Institute Sponsor Meetings

1994 Workshop on Statistical Physics—Monte Carlo Simulation
1994統計物理研討會：蒙地卡羅模擬法
June 11～14, 1994, Taipei, Taiwan

6/11/94 (Monday)

09:00 - 09:50 註冊
09:50 - 10:00 開幕
10:00 - 10:50 趙挺偉
Introduction to Monte Carlo Simulation (I)
< Coffee Break >
11:10 - 12:00 趙挺偉
Random Number Generators (I)
12:00 - 13:00 午 餐
13:30 - 14:20 趙挺偉
Random Number Generators (II)
< Coffee Break >
14:30 - 15:20 胡進錕
Monte Carlo Simulation of Percolation Problems (I)
< Coffee Break >
15:40 - 16:30 趙挺偉
Introduction to Monte Carlo Simulation (II)
16:40 - 17:30 趙挺偉
Introduction to Monte Carlo Simulation (III)
17:30 - 晚 餐

6/12/94 (Tuesday)

09:00 - 09:50 胡進錕
Monte Carlo Simulation of Percolation Problems (II)
< Coffee Break >
10:00 - 10:50 胡進錕
Finite Size Scaling
< Coffee Break >
11:10 - 12:00 胡進錕
Percolation and Finite Size Scaling：Demo
12:00 - 13:00 午 餐
13:30 - 14:20 陳昭安
Cluster Algorithm (I) Swendsen-Wang Algorithm
< Coffee Break >
14:30 - 15:10 陳企寧

Cluster Algorithm (II) Wolff Algorithm
< Coffee Break >
15:30 - 16:20 黃景祥
Application of Monte Carlo Methods to Statistics
< Coffee Break >
16:30 - 17:20 黎璧賢
Monte Carlo Simulation of Random Walks and Polymers (I)
17:30 - 晚 餐

6/13/94 (Wednesday)

09:00 - 09:50 林誠謙
Introduction to Simulated Annealing (I)
< Coffee Break >
10:00 - 10:50 林誠謙
Introduction to Simulated Annealing (II)
< Coffee Break >
11:10 - 12:00 林誠謙
Introduction to Simulated Annealing (III)
12:00 - 14:00 午 餐
14:00 - 14:50 黎璧賢
Monte Carlo Simulation of Random Walks and Polymers (II)
< Coffee Break >
15:00 - 15:50 黎璧賢
Monte Carlo Simulation of Random Walks and Polymers (III)
< Coffee Break >
16:10 - 17:00 黎璧賢
Monte Carlo Simulation of Random Walks and Polymers：Demo
17:00 - 晚 餐

6/14/94 (Thursday)

09:00 - 09:50 陳永忠
Quantum Monte Carlo Simulations (I)
< Coffee Break >
10:00 - 10:50 陳永忠
Quantum Monte Carlo Simulations (II)
< Coffee Break >
11:10 - 12:00 陳永忠

Quantum Monte Carlo Simulations (III)

12:00 - 14:00 午　餐

14:00 - 14:50 林海青

Quantum Monte Carlo Approach to the Strongly Correlated Systems (I)

< Coffee Break >

15:00 - 15:50 林海青

Quantum Monte Carlo Approach to the Strongly Correlated Systems (II)

< Coffee Break >

16:10 - 17:00 林海青

Quantum Monte Carlo Approach to the Strongly Correlated Systems (III)

17:00 - 晚　餐

中央研究院統計物理與數值模擬第一次研討會

August 30, 1994, Taipei, Taiwan

08:50 - 09:10 報到

09:10 - 09:30 開幕式

09:30 - 10:00 胡進錕

Some Recent Developments of Monte Carlo Simulations

10:00 - 10:30 梁鈞泰

Self-organized Criticality and Its Applications

10:30 - 11:00 休　息

11:00 - 11:30 姜祖恕

Exponential Perturbed Markov Chains

11:30 - 12:00 許順吉、謝　仲

Some Mathematical Aspects of Simulated Annealing

12:00 - 12:30 王錦華

Scaling Laws of Earthquake and Their Modeling

12:30 - 14:00 午　餐

14:00 - 14:30 黃景祥

Application of Monte Carlo Methods to Statistics

14:30 - 15:00 林誠謙

A New Methodology of Simulated Annealing for the Optimisation Problems

15:00 - 15:30 袁小玲

Three-Dimensional Structure of Protein Determined by X-Ray Diffraction Method

15:30 - 16:00 休　息

16:00 -16:30 黃太煌

Determination of Macromolecular Structures by NMR Method

16:30 - 17:00 楊堯文

Molecular Evolution Based on DNA Sequences

17:00 - 17:30 湯志眞

Universal Grammer in Natural Languages

18:00 - 晚　餐

中央研究院統計物理與數值模擬第二次研討會：*DNA*和生物演化

September 24, 1994, Taipei, Taiwan

09:00 - 09:45　楊堯文

Some Traditional Models of Bilolgical Evolutions

09:45 - 10:30　陳企寧

Long Range Correlation in DNA Sequences

10:30 - 10:50　休　息

10:50 - 11:30　趙淑妙

從18S RNA序列估計單子葉和雙子葉植物的分離時間

11:35 - 12:20　胡進錕

Models of Self-Organized Biological Evolution

Taipei "International Symposium on Surfaces and Thin Films"

March 27～30, 1995, Taipei, Taiwan

3/27/95 (Monday)

09:20 - 09:35　Welcome and Openning Remarks by Organizers
About Institute of Atomic and Molecular Sciences
by Director, Professor S.H.Lin (林聖賢)

Session 1　**Synchrotron Radiation, Spectroscopy and Microscopy**
Chairman : Professor T.T.Tsong (鄭天佐)

09:35 - 10:20　Yuen-Chung Liu (劉遠中) (Invited)
The Construction and Application of the TLS at SRRC

10:20 - 11:05　G. Schmahl, D. Rudolph, B. Niemann. G. Schneider, P. Guttmann, T. Thieme, T. Wilhein, B. Kaulich, T.Schliebe, J.Lehr (Invited)
X-ray Optics and X-Ray Microscopy

11:05 - 11:25　**Tea/Coffee Break**

11:25 - 12:10　Brian P.Tonner (Invited)
The SpectroMicroscopy Facility at Advanced Light Source

12:10 - 13:30　**Lunch**

Session 2　**Surface Photoeffects, Dynamics and Microscopy**
Chairman: Professor T.J.Chuang (莊東榮)

13:30 - 14:15　John C.Polanyi (Invited)
Photochemistry at the Adsorbate-Substrate Interface

14:15 - 15:00　Richard M.Osgood, Jr. (Invited)
Electron Transfer Reactions on Corrugated Semiconductor Surfaces

15:00 - 15:20　L.A.Smoliar and Y.T.Lee
Atom Beam-Surface Scattering Studies of:
1.HF and DF Produced in the Reaction: H(D)+LiF(100)
and
2.Ethylene-d4, Acetylene-d2, and Teradeuteromethane Produced in the Reaction of D-Atoms with Graphite

15:20 - 15:40　**Tea/Coffee Break**

Chairman: Professor G.J.Jan (詹國禎)

15:40 - 16:25 Yoshiyasu Matsumoto (Invited)
Photochemical Activation of Methane on Metal Surface

16:25 - 17:10 Cheng-Hao Ko (柯正浩), Janos Kirz, Harald Ade, Erik Johnson, Steve Hulbert and Erik Anderson (Invited)
Material Surface Imaging with the X1A Scanning Photoemission Spectromicroscope

17:10 - 17:55 Ping-chin Cheng (鄭炳今) (Invited)
Modern Biological Microscopy

3/28/95 (Tuesday)

Session 3 **Nanostructure Fabrication and Properties**
Chairman: Professor Y.F.Chen (陳永芳)

09:20 - 10:05 W.Eberhardt (Invited)
The Electronic Structure of Quantum Confined Systems: Porous Si, Magnetic Multilayers and Clusters

10:05 - 10:50 Sumio Hosaka (Invited)
Fabrication of Nanometer-sized structures on Insulators and in Magnetic Materials Using a Scanning Probe Microscope

10:50 - 11:10 **Tea/Coffee Break**

Chairman: Professor G.C.Chi (紀國鐘)

11:10 - 11:55 M.Oshima, M.Sugiyama, F.Maeda, Y.Watanabe and S.Maeyama (Invited)
Synchrotron Radiation Analysis of Atomically-Controlled GaAs Surfaces and its Application to Forming Novel Nano-Crystals for Quantum Dots

11:55 - 12:15 Ker-Jar Song (宋克嘉),J.C.Lin,M.Y.Lai and Y.L.Wang
Faceting Phase Transitions of Mo(111) Induced by Pd,Au and Oxygen Overlayers

12:15 - 12:30 Group Photo

Session 4 **Poster papers and Buffet Lunch**

Chairmen: Drs.J.C.Lin (林景泉)and K.J.Song (宋克嘉)

12:30 - 14:30 **Presentation of poster papers**

Session 5 **Atomic Scale Processes and Reactions**
Chairman: Dr.R.Klauser (柯陸詩)

14:30 - 15:15 Ken-ichi Tanaka (Invited)
Activation of Bimetallic Surfaces by Chemical Reconstruction

15:15 - 15:35 Ing-Shoug Hwang (黃英碩),Robert E.Martinez, Chien Liu, and Jene A.Golovchenko
A Soft Incommensurate Reconstruction on Pb/Si(111)

15:35 - 15:55 Pei-Kuen Wei (魏培坤)and Wunshain Fann
Near-field Optical Microscopy

15:55 - 16:20 **Tea/Coffee Break**

Chairman: Professor C.S.Shern (沈青嵩)

16:20 - 17:05 Milton W.Cole (invited)
New Kinds of Wetting Phenomena

17:05 - 17:50 Chonglin Chen,Tien.T.Tsong (Invited)
Surface Diffusion on Iridium Surfaces

3/29/95 (Wesnesday)

Session 6 **Surface Effects and Thin Films**
Chairman: Professor H.L.Huang (黃惠良)

09:20 - 10:05 Ming L. Yu and T.H.Philip Chang (Invited)
Field Emission from Ultra-Sharp Emitters and the STM Aligned Electron Beam Microcolumn Project

10:05 - 10:50 C.S.Chang (張嘉升) (Invited)
Boundary Confinement Induced Periodic Structures on the Reconstructed Pt(100) Surface

10:50 - 11:10 **Tea/Coffee Break**

Chairman: Professor C.C.Chang (張晢政)

11:10 - 11:55 Shigemi Yugo (Invited)
Nucleation Mechanisms of Diamond in Plasma Chemical Vapor Deposition

11:55 - 12:15 B.R.Wu (吳璧如), C.Cheng and S.-L.Li
Dissociative Chemisorption of Hydrogen Molecules on

the Si(111)(1×1) Surface: First-Principles Calculations

12:15 - 13:00 **Lunch**

Session 7 **Surface/Thin Film Structure and Spectroscopies**
Chairman: Professor P.K.Tseng (鄭伯昆)

13:30 - 14:15 R.J.MacDonald (Invited)
Low Energy Ion Scattering Studies of the Surface Structure and Composition of Binary Alloys

14:15 - 15:00 T.-M.Lu (Invited)
The Growth of Rough Interface: A far-from equilibrium Phenomenon

15:00 - 15:20 Der-Ruenn Su (蘇德潤)
Surface Potential Singularities of a Film

15:20 - 15:40 **Tea/Coffee Break**

Chairman: Professor C.-R.Wen (溫清榕)

15:40 - 16:25 Y.C.Chou (周亞謙),I.H.Hong and C.M.Wei(Invited)
Kikuchi Electron Holography: A New Direct Method for Surface Structure Determination

16:25 - 17:10 J.M.Chen (陳錦明),R.Klauser,S.I.Cheng,S.C.Yang, Y.J.Hsu, and C.-R.Wen (Invited)
The Electronic Structure,Electronic Decay and Desorption Processes of Molecular Film Following Core-level Excitation Using Synchrotron Radiation

17:10 - 17:30 J.Yu,M.Hayashi,A.A.Villaeys and S.H.Lin (林聖賢)
Theorectical Studies of IR-UV Sum-frequency Generation

17:30 - 17:50 M.-H.Tsai(蔡明雄), S.H.Lin, and C.C.Jiang
Ab Initio Molecular Dynamics Study of the Clean and Hydrogen Covered Diamond(111) Surfaces

18:45 - Conference Banquet at Asia World Plaza Hotel

3/30/95 (Thursday)

Session 8 **Novel Materials and Processing**
Chairman: Professor C.N.Chang (張秋男)

10:00 - 10:20 H.-N.Lin (林鶴南),C.S.Chang,and Tien T. Tsong
Genetation of Nanometer Holes at Pt Surfaces in Air and a Nonconducting Liquid with the Scanning Tunneling

Microscope

10:20 - 11:05 M.K.Wu (吳茂昆),May-Yen Li,H.L.Kao,C.L.Lin and C.C.Chi (Invited)
Control and Growth of Superconducting Bi-epitaxial Grain Boundary Junctions

11:05 - 11:25 H.Chang(張華),Q.Xiong,Y.Y.Xue,and C.W.Chu
Surface Chemical Decomposition of $HgBa_2CuO_{4+\delta}$ by High Powered Laser Radiation

11:25 - 11:45 C.C.Chin
The Surface of the(001)$SrTiO_{3-\delta}$ Substrate at High Temperature

11:45 - 11:50 **Concluding Remarks**

12:00 - 13:30 **Lunch**

13:30 - 17:00 **Tour to Palace Museum, Institute of Physics or Institute of Atomic and Molecular Science(IAMS)**

3/31/95 (Friday)

08:30 - 03:00 **Tour to Synchrotron Radiation Research Center**

The 6th Spring School on Nuclear Physics

May 10 ~ 13, 1995

5/10/95 (Wednesday)

18:00 - 19:30	Welcome Dinner
19:30 - 20:20	A.Arima *Electromagnetic Properties of Nuclei(I)*
20:20 - 21:10	A.Arima *Electromagnetic Properties of Nuclei(II)*

5/11/95 (Thursday)

08:30 - 09:20	E.Oset *Meson Creation and Absorption and Related Few and Many Body Problems(I)*
09:20 - 10:10	E.Oset *Meson Creation and Absorption and Related Few and Many Body Problems(II)*
10:40 - 11:30	B.K.Jennings *Hypernucleus(I)*
11:30 - 12:20	B.K.Jennings *Hypernucleus(II)*
12:30 -	**Lunch**
18:00 -	**Dinner**
19:30 - 20-20	K.Kubodera *Current Topics in Nuclear Astrophysics(I)*
20:20 - 21:10	R.Brockmann *Relativistic Nuclear Physics(I)*

5/12/95 (Friday)

08:30 - 09:20	K.Kubodera *Current Topics in Nuclear Astrophysics(II)*
09:20 - 10:10	B.K.Jennings *Hypernucleus(III)*
10:40 - 11:30	R.Brockmann *Relativistic Nuclear Physics(II)*
11:30 - 12:20	R.Brockmann *Relativistic Nuclear Physics(III)*
12:20 -	**Lunch**
18:00 -	**Dinner**
19:30 - 20:20	B.K.Jennings *Hypernucleus(IV)*
20:20 - 21:10	E.Oset *Meson Creation and Absorption and Related Few and Many Body Problems(III)*

5/13/95 (Saturday)

08:30 - 09:20	K.Kubodera *Current Topics in Nuclear Astrophysics(III)*
09:20 - 10:10	K.Kubodera *Current Topics in Nuclear Astrophysics(IV)*
10:40 - 11:30	R.Brockmann *Relativistic Nuclear Physics(IV)*
11:30 - 12:20	E.Oset *Meson Creation and Absorption and Related Few and Many Body Problems(IV)*

Seminars

中央研究院物理所八十四年度演講一覽表

(1994年7月~1995年6月)

演講題目	演講者姓名	所屬機構	日期
State. Phys. and Numerical Simulation : Introduction to Context Free Grammar in Discrete Mathematics	陳昭安	中研院物理所	07/01/94
Superfluidity of Nuclear Matter and Nuclei	T. T. S. Kuo	美國紐約大學石溪分校	07/01/94
Calculation of Electronic and Magnetic Structures of Metal Superlattices	張亞中	Univ. of Illinois-Urban-Champaign	07/01/94
The classical-and-statistical-thermodynamic, as well as quantum mechanical foundation of low temperature heat capacity of solids	何健民	清華大學物理系	07/01/94
Soft Condensed Matter Journal Club: Behavior of a Ball on the Surface of a Rotating Disk	謝定國	中研院物理所	07/07/94
Different contribution to the total heat capacity	何健民	清華大學物理系	07/08/94
Schottky anomalies	何健民	清華大學物理系	07/15/94
Recent Advances in Scanning X-ray Spectromicroscopy	Franco Cerrina	Univ. of Wisconsin-Madison	07/15/94
Soft Condensed Matter Journal Club：Statics of Self-Organized Percolation Model	陳企寧	中研院物理所	07/21/94
Electron Spin Resonance(ESR) Microscopy & Its Application	池谷元伺	Osaka University	07/21/94
Heat Capacity of Superconductors	何健民	清華大學物理系	07/22/94
A New Direct Surface Structural Probe By Inverting Measured Kikuchi Electron Patterns	魏金明	中研院物理所	07/27/94

演講題目	演講者姓名	所屬機構	日期
核技術在生物學上之應用	姚惠英	復旦大學物理系	07/29/94
Magnetic Properties of Spin-1 Heisenberg Ferromagnet with an Arbitrary Crystal-field Potential	潘國貴	長庚醫學院	08/02/94
Light Scattering Studies of Turbulent Rayleigh-Benard Convection	童彭爾	Oklahoma State Univ., U.S.A.	08/04/94
Soft Condensed Matter Journal Club: Nonequilibrium /Fluctuation-Induced Transport	梁鈞泰	中研院物理所	08/04/94
Colloids in Polymer Solutions：Depletion and Adsorption	童彭爾	Oklahoma State Univ., U.S.A.	08/05/94
Multiplicity Distribution in Q.C.D.(I)	I. M. Dremin	Lebedev Physics Institute, Moscow	08/26/94
Multiplicity Distribution in Q.C.D.(II)	I. M. Dremin	Lebedev Physics Institute, Moscow	09/02/94
Characterization of Drag Reducing Polymer in Rotating Disk Apparatus	崔瑩鎮	Inha Univ., Inchon, Korea	09/02/94
Gravitons from Inflation and Squeezed States	吳建宏	中研院物理所	09/09/94
In Situ UHV Reflection Electron Microscopy of Silicon Surface Dynamic Processes	薛亞夫	Russian Academy of Sciences	09/09/94
近場掃描光學顯微鏡	蔡定平	中正大學物理系	09/13/94
細胞通訊的語言	周成功	陽明醫學院	09/14/94
Particulate Generated by Pulsed Laser Ablation	林麗瓊	台灣大學凝態中心	09/15/94
Soft Condensed Matter Journal Club：Rotationally Induced Segregation of Granular Materials	陳志強	中研院物理所	09/15/94

演　講　題　目	演講者姓名	所　屬　機　構	日 期
Inclusive Neutral Meson, Direct Photon, and Massive Di-π Production from π^- Interactions with Cu and Be Targets	張　寶　棣	中研院物理所	09/16/94
高壓相變	劉　玲　根	中研院地球所	09/17/94
心靈的複雜度	張　　復	中研院資訊所	09/21/94
Soft Condensed Matter Journal Club：Line Dispersion in Homogeneous Turbulence：Stretching, Fractal Dimensions, and Micromixing	杜　其　永	中研院物理所	09/22/94
Search for CP Violation in Hyperon Systems	陳　彥　竹	中研院物理所	09/23/94
A Soft Incommensurate Reconstruction on Pb/Si(111)--Stress Modulation, and Structural Transformations	黃　英　碩	中研院物理所	09/23/94
Finite-size Effects in non-equilibrium phase transition	梁　鈞　泰	中研院物理所	09/26/94
Biological Applications of Synchrotron Photoelectron Spectromicroscopies	Gelsomina De Stasio	Instituto di Struttura della Materia CNR	09/27/94
Soft Condensed Matter Journal Club：Behavior of a Falling Paper	梁　乃　悅	台大物理系	09/29/94
消息、認知、與意識的產生	黃　榮　村	台大心理系	10/05/94
Parallel Computation and DNS of Turbulence	黃　美　嬌	中研院物理所	10/05/94
Soft Condensed Matter Journal Club：Go easy with those spilling breakers	陳　義　裕	台大物理系	10/06/94
Limitations of Stochastic Approach in Two-Phase Turbulent Flow Calculation	張　克　勤	成大航太系	10/12/94
An STM observation of strong-coupling charge density waves on the strained Pt(100) surface	張　嘉　升	中研院物理所	10/12/94

演　講　題　目	演講者姓名	所　屬　機　構	日 期
Soft Condensed Matter Journal Club：Scaling Behavior in Daily Air Humidity Fluctuations	張　書　元	中研院物理所	10/13/94
Doing Weak and Strong Coupling Expansions Simultaneously	Baruch Rosenstein	中研院物理所	10/14/94
Power-law Decay of Turbulence and Similarity of Velocity Autocorrelations	黃　美　嬌	中研院物理所	10/19/94
複雜系統的心靈	林　誠　謙	中研院計算中心	10/19/94
Soft Condensed Matter Journal Club：One-Dimensional Patterns and Wavelength Selection in Magnetic Fluids	張　英　傑	師大物理所	10/20/94
Massless Fermions and the Goldstone Theorem	Vladimir A. Kouchnir	中研院物理所	10/21/94
Non-equilibrium Dissociating Flow over Spheres	溫　志　勇	大葉機械	10/26/94
Lx-ray production in La, Nd, Gd, Er and Lu by 1-5 MeV protons	余　岳　仲	中研院物理所	10/26/94
Soft Condensed Matter Journal Club：Unwiding of DNA Molecules under Forces Flows	黎　璧　賢	中央大學物理所	10/27/94
Quantum Mechanics, Linearized Gravitational Waves and Gravitational Wave Detectors	施　靄　克	中研院物理所	10/28/94
Quantum Chaos	張　爲　民	中研院物理所	10/28/94
複雜系中產生的秩序－生物的信息、構造及演化	徐　明　達	中研院生醫所	11/02/94
Soft Condensed Matter Journal Club：Obstructions to Shadowing when a Lyapunov Exponent Fluctuates about Zero	陳　昭　安	中研院物理所	11/03/94
New surprises to the factorization approach for meson decays	鄭　海　揚	中研院物理所	11/03/94

演　講　題　目	演講者姓名	所　屬　機　構	日 期
On the Complementarity of Optical and Quark Models for Elementary Particle Scattering	J. C. Sens	中央大學物理系	11/04/94
Mixing in Separated—Reattached Flow Behind a Backstep	楊　鏡　堂	清華大學動機所	11/09/94
Soft Condensed Matter Seminar：Nonlinear Optical Spectroscopies of Amorphous Materials	黃　中　垚	交通大學光電所	11/10/94
加速器驅動反應獲得乾淨核能的新思路	郁　忠　強	中研院物理所	11/15/94
從物理學看生物斑紋的形成	陳　義　裕	台大物理系	11/16/94
Soft Condensed Matter Journal Club：Slow Relaxation with Many Conservation Laws：Trimers on a Line	梁　鈞　泰	中研院物理所	11/17/94
Λ_b -> Λ_c Decay form Factors in HQET	郭　新　恆	北京中科院高能物理所	11/18/94
氧化物超導體的離子尺寸效應	管　惟　炎	清華大學	11/22/94
加速器與現代社會	翁　武　忠	同步輻射研究中心	11/23/94
二元水溶液固化之流力實驗研究	陳　發　林	台大應研	11/23/94
交大高溫超導研究概況	郭　義　雄	交通大學電物系	11/23/94
Soft Condensed Matter Journal Club：Bubbling in Vertically Vibrated Garnular Materials	陳　志　強	中研院物理所	11/24/94
New surprises to the factorization approach for meson decays(II)	鄭　海　揚	中研院物理所	11/25/94
Nonlocal Conductivity in Type II Superconductors	牟　中　瑜	Virginia Univ.	11/30/94
生命科學系列演講總結	王　唯　工	中研院物理所	11/30/94

演　講　題　目	演講者姓名	所　屬　機　構	日 期
Soft Condensed Matter Journal Club：Interfacial Phenomena in Boltzmann Cellular Automata	梁　乃　悅	台大物理所	12/01/94
A Scheme for Radiative CP Violation	張　達　文	清華大學物理系	12/02/94
Gd and Dy Films on Si：Growth and Characterization	徐　力　行	彰師物理系	12/05/94
旋轉座標上之管流問題	李　　雨	台大應研所	12/07/94
Soft Condensed Matter Journal Club：Symmetry, Beauty and Evolution	修　宇　鋒	中研院物理所	12/08/94
Double Patron Scattering of Hadron-Hadron Interaction	劉　鴻　祥	中研院物理所	12/09/94
Limitations of Stochastic Approach in Two-Phase Turbulent Flow Calculation	張　克　勤	成大航太系	12/14/94
Recent Modification in Belle Detector	松　武　田	KEK, Japan	12/14/94
高溫超導物質中不尋常的霍爾效應	籃　明　德	中興大學物理系	12/14/95
Soft Condensed Matter Journal Club：An Approximate Closed Form for the Entropy of Spin Glass	林　光　爵	中研院計算中心	12/15/94
Flavor and Spin Contents of the Nucleon in the Quark Model	Ta-Pei Cheng	Univ. of Missouri	12/19/94
Ultra-High Resolution Electron Microscope Study of Clusters on Material Surface	K. Takayanagi	東京工業大學	12/21/94
Soft Condensed Matter Journal Club：Preferential Concentration of Heavy Particles in a Turbulent Channel Flow	黃　美　嬌	中研院物理所	12/22/94
Topcolor and Effective Field Theory	Chia-Hung Chang	Harvard Univ.	12/23/94
Electron Scattering in Metal/Semiconductor Systems Measured by Ballistic Electron Emission Microscopy	Leo J. Schowalter	Dept. of Physics, Rensselaer Polytechnic Institute	12/23/94

演　講　題　目	演講者姓名	所　屬　機　構	日 期
中紅外線光檢測器及雷射之研製	蘇　炎　坤	成功大學電機所	12/28/94
Soft Condensed Matter Journal Club：Generalized Circle Theorem on Zero of Partition Function at Asymmetric First-Order Transitions	陳　企　寧	中研院物理所	12/29/94
Introduction to Fermionic String Models	Wei Chung	Fermilab	12/30/94
粗糙表面流動(池)沸騰現象之研究	謝　曉　星	中山機械	01/04/95
Hadron Matter and Quark Gluon Plasma：Theoretical Models and A＋A Experiments	Mark Gorenstein	Ukrainian Academy of Sciences	01/05/95
Perspective on Quark Mass and Mixing Relations	王　國　光	台大物理系	01/06/95
Active Walks：Pattern Formation, Self-Organization, and Complex Systems	L. Lam	San Jose State Univ.	01/11/95
液晶分子指向場排列及其光學應用	王　淑　霞	交大光電所	01/11/95
理論物理組專題演講(I)	G. 't Hooft	Univ. of Utrecht	01/13/95
理論物理組專題演講(II)	G. 't Hooft	Univ. of Utrecht	01/14/95
Calorimetric and Magnetic Properties of Zinc Ferrite Nanoparticles	何　建　民	Wichita State Univ.	01/16/95
Introduction to Electroweak Baryogenesis	楊　炳　麟	Iowa State Univ.	01/16/95
Infromation Theory and Inverse Problems	H. G. Miller	Univ. of Pretoria	01/17/95
Physical Phenomena of Flow over a Biconic Body	謝　祖　蔭	美國海軍地面武器中心	01/25/95
Characterization and Transport Properties of $YBa_2Cu_3O_Y/PrBa_2Cu_3O_Y$ Superlattices in Magnetic Fields	楊　鴻　昌	台大物理系	01/25/95
Some Recent Results on Vertex Models in Statistical Mechanics	伍　法　岳	東北大學物理系	02/08/95

演　講　題　目	演講者姓名	所　屬　機　構	日 期
K-M Matrix and CP Violation	謝　瑞　平	馬來西亞大學	02/10/95
高溫超導的最近發展及未來展望	吳　茂　昆	清華大學材料中心	02/21/95
2D Interacting Boson System and Fractional Quantum Hall Effect	孟　心　飛	交通大學物理所	02/24/95
Solution Structure Determination of Snake Venom Proteins	余　　靖	清華大學化學系	02/24/95
Soft Condensed Matter Journal Club：Sonoluminescence：Sound into Light	陳　志　強	中研院物理所	02/27/95
Discrete Gauge States in 2d Gravity	鍾　子　丹	交通大學物理所	03/03/95
禪與物理	梁　乃　崇	中研院物理所	03/06/95
Soft Condensed Matter and Statistical Physics Journal Club：Generation and Prediction of Time Series by a Neural Network	陳　昭　安	中研院物理所	03/06/95
粒子流	蕭　述　三	中央機械	03/08/95
頂夸克的發現說明會	李　世　昌	中研院物理所	03/10/95
Soft Condensed Matter and Statistical Physics Journal Club：Shape Fluctuations of Interacting	張　英　傑	師大物理所	03/13/95
建立雙向(two phases)熱流模式所遭遇的問題	許　翼　雲	原委會	03/15/95
Spin-Polarized Proton Experiment	儲　中　明	中央大學物理系	03/15/95
Renormalization Group and Field Theory at Finite Temperature	廖　先　彬	Duke Univ.	03/17/95
IBA(離子束分析)與表面及界面原子結構研究	承　煥　生	復旦大學物理二系	03/17/95

演　講　題　目	演講者姓名	所　屬　機　構	日 期
Multiple Scattering in QCD and Nuclear Dependence at High Energy	邱　建　偉	Iowa State Univ.	03/21/95
Studies of Switching Anisotropy of Ultra Thin Iron Films on Si(111) by Means of Surface Magneto-Optical Kerr Effect (SMOKE)	盧　志　權	Univ. of Sussex, United Kingdom	03/21/95
Electroweak Mass Generation and Anomalous Dipole Moment	W. Marciano	Brookhaven National Lab.	03/21/95
Unsteady Boundary Layer Separation and Infraction	伍　次　寅	台大電機系	03/22/95
Turbulence Model Development and its Applications in Solving Flow Problems	黃　榮　鑑	中研院物理所	03/22/95
Nonlinear Temperature Dependence of Magnetic Viscosity in Nanoscale Ferromagnetic Particles	Ivo Klik	台大物理系	03/24/95
Silicon Carbide Clean and Metal Covered Surfaces and Interfaces	Patrick Soukiassian	Univ. of Paris-Sud/Orsay	03/24/95
在宇宙中尋找新的長壽命重粒子的實驗設想	郁　忠　強	中研院物理所	03/31/95
Defects and Braiding of Chiral Polymer Crystals	David Nelson	Harvard Univ.	04/01/95
納米材料擴散特性之研究	承　煥　生	復旦大學物理二系	04/10/95
Universality of Normal and Exotic States	馮　達　旋	Drexel Univ.	04/12/95
超硬材料的過去與未來	宋　健　民	工研院材料所	04/12/95
Semi-Leptonic B Decay	余　海　禮	中研院物理所	04/14/95
Entropy, Information, and Complexity	Murray Gell-Mann	Santa Fe Institute	04/17/95
Reaction Channels of $^{51}_{23}V+^{7}_{3}Li$ System Below Coulomb Barrier	王　建　萬	中研院物理所	04/19/95

演　講　題　目	演講者姓名	所　屬　機　構	日 期
介面活性物質與自由液面紊流	蔡　武　廷	海洋大學海洋科學系	04/19/95
The Sonoluminescence Phenomenon	袁　　斾	中研院天文所	04/21/95
混沌之用	陳　志　隆	中山大學物理系	04/24/95
任意維度的易形模型	林　達　觀	中興大學	04/28/95
Computation of Dendritic Growth at Large Supercoolings by Using Phase Field Model	王　順　蓮	Carnegic-Mellon Univ.	04/28/95
Heavy Baryons in the Skyrme Model	吳　勇　錫	台大物理系	04/28/95
Soft Condensed Matter and Statistical Physics Journal Club：Spontaneous Symmetry Breaking in a one-dimensional Driven Diffusive System	陳　企　寧	中研院物理所	05/01/95
Long-time Effect of Relaxation for Hyperbolic Conservation Law	陳　宜　良	台大數學系	05/03/95
立足'95．放眼 2000	羅　海　槎	惠普科技	05/03/95
繪圖軟體Halo(說明與Demo)	黃　英　碩	中研院物理所	05/04/95
Collective Interaction Between Neutrinos and Electron Gas	闕　志　鴻	Institute of Astronomy, National Central Univ.	05/05/95
Determination of W Mass in LEP	黃　達　年	清華大學物理系	05/05/95
Soft Condensed Matter and Statistical Physics Journal Club：Topological Effects of Knots in Polymers	黎　璧　賢	中央大學物理系	05/08/95
Additional Physics in E871 Experiment	彭　仁　傑	中研院物理所	05/09/95
Quark Confinement in QCD	張　爲　民	中研院物理所	05/12/95
Top Quark Observation by CDF and D0	J. Antos	中研院物理所	05/12/95
Universal Scaling Functions in Critical Phenomena	胡　進　錕	中研院物理所	05/15/95

演　講　題　目	演講者姓名	所　屬　機　構	日 期
Experimental Studies on Mixing and Buoyancy in Turbulent Stratified Flows	施　聖　洋	中央機械	05/17/95
SVX(II) simulation and svx' simulation	趙　效　瀛	中研院物理所	05/17/95
Colossal Magnetoresistance in La-Ca-Mo-O Films	陳　立　翰	高雄工學院	05/19/95
The Application of Accelerators in Research and Industry	Jerome L. Duggan	Univ. of North Texas	05/22/95
Soft Condensed Matter Journal Club：Solvent Induced Phase Separation	杜　其　永	中研院物理所	05/22/95
Photoelectron Spectromicroscopy and other Synchrotron Radiation Applications	胡　宇　光	中研院物理所	05/24/95
Introduction to Seiberg-Witten Theory(I)	朱　重　遠	中國科學院理論物理所	05/26/95
Introduction to Seiberg-Witten Theory(II)	朱　重　遠	中國科學院理論物理所	05/27/95
Soft Condensed Matter and Statistical Physics Journal Club：Noise Induce Transition	梁　鎧　廣	中央大學物理系	05/29/95
Soft Condensed Matter Journal Club：Geometric Phase Effects for Wavepack Revivals	高　賢　忠	中研院物理所	06/05/95
Depinning Dynamics of an Air-Water Interface Moving in a Random Medium	陳　志　強	中研院物理所	06/07/95
Molecular Dynamics Studies of Quenched Fluid System	馬　文　忠	中央大學物理系	06/12/95
Cosmics Microwave Background as a Probe for Cosmology	吳　建　宏	中研院物理所	06/14/95
Quantum Fluctation in Semi-Classical Theory	郭　忠　一	東吳大學物理系	06/16/95
1/M Corrections to Baryonic Form Factors in the Quark Model	曾　　龍	中研院物理所	06/16/95

演　講　題　目	演講者姓名	所　屬　機　構	日 期
Dynamical Behavior of Coubomb Crystal and Liquid in Strongly Coupled Dusty Plasma	伊　　林	中央大學物理系	06/20/95
Critical Behavior of Magnetic Films and Heterostructures—Classical and Quantum Theory	林　多　樑	SUNY at Baffalo	06/28/95
Generalization of the Coleman-Hill Theorem	高　賢　忠	中研院物理所	06/30/95

Visiting Scholars

中央研究院物理所八十四度訪問學人表

(1994年7月~1995年6月)

訪問人姓名	國　籍	訪問期間	備　註
Jaroslav Antos	捷　克	07/01/94-06/30/95	教授級學者
張亞中	美　國	07/01/94-07/02/94	短期訪問
顏東茂	美　國	07/03/94-07/16/94	短期訪問
李正雄	美　國	07/08/94-07/11/94	參加諮詢委員會議
唐叔賢	美　國	07/08/94-07/11/94	參加諮詢委員會議
胡斑比	美　國	07/18/94-09/01/94	短期講學
V. A. Kouchnir	烏克蘭	08/01/94-07/31/95	博士後研究
施靄克	美　國	08/01/94-07/31/95	博士後研究
童彭爾	中國大陸	08/04/94-08/06/94	短期訪問
Dremine Igor	俄　國	08/04/94-09/03/94	短期講學
崔瑩鎮	韓　國	08/28/94-09/03/94	短期訪問
Baruch Rosenstein	以色列	09/06/94-07/31/95	特案副研究員
Carlo Rubia	意大利	10/30/94-11/07/94	短期講學
郭新恆	中國大陸	11/01/94-02/01/95	短期講學
Hank. G. Miller	美　國	11/01/94-02/01/95	短期訪問

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Georges Charpak	法　國	11/04/94	參觀訪問
John Peoples	美　國	11/12/94-11/16/94	參觀訪問
Peter W.H. Geltenbort	德　國	12/03/94-12/06/94	短期訪問
Arthur L. Schawlow	美　國	12/05/94-12/06/94	短期訪問
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承煥生	中國大陸	02/14/95-04/24/95	短期研究
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