



Molecular Science and Technology Program (MST)

Research Topics

The following research fields constitute the spectrum of the Molecular Science and Technology (MST) graduate program:

- (1) Chemical dynamics and molecular spectroscopy:** This topic currently focuses on studies of structures and dynamics of molecules, ions, radicals, and transient species, and covers mechanisms involved in photodissociation, reactive scattering, energy transfer, and elementary reactions in atmospheric and combustion chemistry using cutting edge tools such as laser spectroscopy, mass spectrometry, and molecular cross-beam techniques. Research subjects also cover reaction and solvation dynamics, relaxation, diffusion, and phase transformation in liquids, solids, surfaces, and interfaces using FT-IR, Raman, fluorescence, UV-VIS, NMR, and single-molecule spectroscopic approaches.
- (2) Advanced Functional materials:** This subject focuses on syntheses and characterization of novel functional materials, such as microporous zeolites and mesoporous aluminosilicates, porous carbons, carbon nanotubes, organic optoelectronic materials, inorganic membranes and films, organic-inorganic hybrid materials, metal-incorporated materials, and colloidal crystals. Interdisciplinary efforts in utilizing these novel materials for nano-scaled sensing, adsorptive, catalytic, and energy-related (e.g., solar and fuel cells, and fuel storage) applications have promise prominent prospect.
- (3) Biomolecular structures and dynamics:** This subject presently covers (1) spectroscopic and spectrometric characterization of biomolecules, clusters, and biopolymers, biological energy conversion; (2) biolabeling and biosynthesis assisted by nano-structured materials; (3) development of novel analytical biotechnologies for facilitating the study of molecular structures of DNA, proteins, and nucleic acids etc.; (4) dynamics of protein folding and ligand binding in hemoglobin and myoglobin, and of electron transfer in metalloproteins and photosynthetic systems; and (5) refolding dynamics of virus envelope proteins by fluorescent and spin labeling, and molecular recognition of cellular receptor by viral fusion protein.
- (4) Ultrafast laser technology and high-field physics:** This area currently focuses on the development and application of high-intensity ultrafast laser technology, such as 100-terawatt-class femtosecond lasers, waveform synthesis, laser wakefield electron accelerators, soft x-ray lasers, plasma nonlinear optics, transient plasma photonic devices, high-harmonic generation, proton acceleration, keV coherent x-ray sources, and femtosecond gamma-ray sources.
- (5) Light-matter interactions and optical controlling:** This area focuses on comb laser applications, laser cooling of atom, Bose-Einstein condensation, molecule cooling and trapping, quantum control of atomic states and molecular dynamics, frequency-stabilized lasers, laser spectroscopy of atoms, nonlinear optics, quantum optics and high precision optical measurements.
- (6) Molecular electronics:** This area focuses on designing and fabrication of electronic/optoelectronic and electroluminescent/photovoltaic devices, and field effect transistors based on thin films, spintronics, monolayers, and single molecules. In addition, novel lithographic techniques have been developed to create electronic and/or molecular devices based on semiconductors, magnetic superlattices, and heterostructural materials, etc. The optical, electrical, and magnetic properties of these exotic materials are also explored.
- (7) Theoretical and computational chemistry:** This area focuses on development and application of theoretical methods, such as ab initio calculation of electronic and molecular structures, quantum dynamical calculations of atomic scattering and chemical reactions, and molecular dynamics simulations of biological systems in gas/liquid phase, protein folding, etc.



Faculty

Institute of Atomic and Molecular Sciences (IAMS), Academia Sinica

Website: <http://www.iams.sinica.edu.tw/en/>

Huan-Cheng Chang

Ph. D. in Chemistry, Indiana University, U.S.A.

Biophysical chemistry and bioanalytics

Ming-Shien Chang

Ph. D. in Physics, Georgia Tech, U.S.A.

Experimental ultracold atomic physics, quantum gas, quantum information

Ta-Chau Chang

Ph. D. in Chemistry, Iowa State University, U.S.A.

Biological applications of laser spectroscopy

Kuei-Hsien Chen

Ph. D. in Applied Science, Harvard University, U.S.A.

Optoelectronic materials and nanosciences

Szu-Yuan Chen

Ph. D. in Electrical Engineering, University of Michigan, U.S.A.

laser-plasma-based light source / material growth and characterization by light pulse / application in energy, quantum computing, and medicine

Ying-Cheng Chen

Ph. D. in Physics, National Tsing Hua University, Taiwan

Laser cooling of atom, ultra-cold atom and molecule sciences, quantum optics

Mei-Yin Chou

Ph. D. in Physics, University of California, Berkeley, U.S.A.

Computational Materials Physics, Theoretical Condensed Matter Physics, Electronic and Structural Properties of Solids, Surfaces, Interfaces, and Clusters

Chau-Chung Han

Ph. D. in Chemistry, Stanford University, U.S.A.

Biological mass spectrometry and chromatography

Chia-Lung Hsieh

Ph. D. in Electrical Engineering, California Institute of Technology, U.S.A.

Nanoscale diffusion in biological membranes, Bio-imaging with linear scattering and nonlinear scattering nano-materials, High-speed single-particle tracking, Single-molecule fluorescence microscopy

Yen-Chu Hsu

Ph. D. in Chemistry, University of Pennsylvania, U.S.A.

Molecular spectroscopy and laser spectroscopy

Jer-Lai Kuo

Ph. D. in Chemical Physics, Ohio State University, U.S.A.

Computational Physics/Chemistry, Multi-scale Simulation

Yuan-Tseh Lee

Ph. D. in Chemistry, University of California at Berkeley, U.S.A.

Reaction dynamics

Jung-Chi Liao

Ph. D. in Mechanical Engineering, Massachusetts Institute of Technology, U.S.A.

Biophysics, Advanced Microscopy, Drug Development

Jim Jr-Min Lin

Ph. D. in Chemistry, National Taiwan University, Taiwan

Reaction dynamics and photochemistry

Kopin Liu

Ph. D. in Chemistry, Ohio State University, U.S.A.

Chemical dynamics

Shang-Bin Liu

Ph. D. in Physics, College of William and Mary, U.S.A.

Nuclear magnetic resonance spectroscopy, porous materials, and catalysis

Chi-Kung Ni

Ph. D. in Chemistry, Columbia University, U.S.A.

Molecular dynamics

Ker-Jar Song

Ph. D. in Physics, University of Pennsylvania, U.S.A.

Surface Science

Kaito Takahashi

Ph.D in Chemistry, Keio University, Japan

Theoretical Chemical Reaction Dynamics

Wen-Bih Tzeng

Ph. D. in Chemistry, Iowa State University, U.S.A.

Mass spectrometry and molecular ion spectroscopy

Jyhpyng Wang

Ph. D. in Applied Physics, Harvard University, U.S.A.

Ultrafast optics, high-power lasers, and high-field sciences

Wei-Hua Wang

Ph. D. in Physics, Pennsylvania State University, U.S.A.

Spin-dependent phenomena in nanodevices

Yuh-Lin Wang

Ph. D. in Physics, University of Chicago, U.S.A.

Scanning tunneling spectroscopy

Ching-Ming Wei

Ph. D. in Physics, University of Wisconsin–Milwaukee, U.S.A.

Surface Science, Electron Holography, Ab initio total energy calculation

Dah-Yen Yang

Ph. D. in Chemistry, Michigan State University, U.S.A.

Nanosciences

Tsyrr-Yan Yu

Ph. D. in Chemistry, Washington University in St. Louis, U.S.A.

Membrane Protein Research, NMR spectroscopy

Institute of Chemistry, Academia Sinica

Website: http://www.chem.sinica.edu.tw/index_en.php

Ding-Kwo Chang

Ph. D. in Chemistry, University of Wisconsin at Madison, U.S.A.

Molecular biophysics

Wei-Hau Chang

Ph. D. in Biophysics, Stanford University, U.S.A.

Cryo-electron microscopy, image processing, single molecule imaging, biochemistry

Rong-Jie Chein

Ph. D. in Chemistry, National Chiao Tung University, Taiwan

Organic Synthesis, Natural Products Synthesis

Chin-Ti Chen

Ph. D. in Chemistry, University of Illinois at Urbana-Champaign, U.S.A.

Material chemistry

Yu-Ju Chen

Ph. D. in Chemistry, Iowa State University, U.S.A.

Biological Mass Spectrometry and Proteomics

Ming-Hsi Chiang

Ph. D. in Chemistry, Indiana University, U.S.A.
Inorganic, Bioinorganic and Biocatalysis

Tahsin J. Chow

Ph. D. in Chemistry, University of Cincinnati, U.S.A.
Organic chemistry

Joseph Jen-Tse Huang

Ph. D. in Chemistry, National Taiwan University, Taiwan
Biophysical Chemistry, Fluorescence-based Spectroscopy,
Drug Development for Neurodegenerative Diseases

Chen-Hsiung Hung

Ph. D. in Chemistry, University of Wyoming, U.S.A.
Bioinorganic chemistry, porphyrin synthesis and
heme model studies, and single crystal X-ray structure
determination

Chao-Ping Hsu

Ph. D. in Chemistry, California Institute of Technology, U.S.A.
Theoretical chemistry

Hsien-Ming Lee

Ph. D. in Chemistry, Purdue University, U.S.A
Development of fluorescence-reporting biosensors, Protein
chemical modifications for novel protein functions, Cellular
drug delivery using peptides, liposomes, and nanoparticles,
Development of cell-penetrating / organelle-targeting
peptides as cellular delivery vesicles

Wen-Shan Li

Ph. D. in Chemistry, Case Western Reserve University, U.S.A.
Bioorganic chemistry

Jiann-T'suen Lin

*Ph. D. in Chemistry, University of Minnesota at Minneapolis,
U.S.A.*
Organometallic chemistry and material chemistry

Ling-Kang Liu

Ph. D. in Chemistry, University of Texas at Austin, U.S.A.
Structural chemistry

Kuang-Lieh Lu

Ph. D. in Chemistry, National Taiwan University, Taiwan
Supramolecular chemistry and nanomaterials

Tiow-Gan Ong

Ph.D. in Chemistry, University of Kentucky, U.S.A.
Organometallic and Organic Catalysis

Shin-Guang Shyu

Ph. D. in Chemistry, The Ohio State University, U.S.A.
Inorganic Chemistry and Materials Science

Shih-Sheng Sun

*Ph. D. in Chemistry, State University of New York at Binghamton,
U.S.A.*

Molecular recognition chemical sensing, supramolecular
assemblies of p-conjugated systems, Light-harvesting
materials for dye-sensitized solar cells

Yu-Tai Tao

Ph. D. in Chemistry, University of Rochester, U.S.A.
Organic materials chemistry and surface chemistry

Der-Lii Tzou

Ph. D. in Chemistry, Georgia Institute of Technology, U.S.A.
NMR Spectroscopy and Protein structural and functional
relationship

Steve Sheng-Fa Yu

Ph. D. in Chemistry, National Tsing Hua University, Taiwan
Bio-organic Chemistry and Bio-Inorganic Chemistry

Department of Chemistry, National Tsing Hua University

Website: <http://www.chem.nthu.edu.tw/>

Po-Yuan Cheng

Ph. D. in Chemistry, University of Georgia, U.S.A.
Ultrafast chemistry

Chia-Min Yang

Ph. D. in Chemistry, National Tsing Hua University, Taiwan
Physical chemistry and materials chemistry of mesoporous
materials, organic-inorganic hybrid materials, and colloidal
crystals

Chin-Hui Yu

Ph. D. in Chemistry, Ohio State University, U.S.A.
Theoretical chemistry, computational chemistry, electronic
structure, and high-performance computing

Department of Physics, National Central University

Website: <http://www.phy.ncu.edu.tw/>

Wang-Yau Cheng

Ph. D. in Physics, National Tsing Hua University, Taiwan
Comb laser applications, high precision measurement,
quantum control

Pik-Yin Lai

Ph. D. in Physics, University of Pittsburgh, U.S.A.
Biophysics, Soft-matter, nonlinear physics

S.K. Lai

Ph. D. in Physics, University of Waterloo, Canada
Colloidal dispersion (structures, phase diagrams, phase
transition), Metallic pure and alloy clusters (structures,
thermal properties), Time series clustering analysis

Chien-Jung Lo

Ph. D. in Physics, University of Oxford, U.K.
Biophysics, molecular motors

Meng-Fan Luo

Ph. D. in Physics, University of Cambridge, U.K.
Surface science, Nano-scale physics

National Taiwan University

Website: <http://www.ntu.edu.tw/>

Li-Chyong Chen

Ph. D. in Applied Physics, Harvard University, U.S.A.
Material Sciences

Yit-Tsong Chen

Ph. D. in Chemistry, University of Chicago, U.S.A.
Physical chemistry and Bioanalytical chemistry

Michitoshi Hayashi

Ph. D. in Chemistry, Tohoku University, Japan
Theoretical, computational, and physical chemistry

King-Chuen Lin

Ph. D. in Chemistry, Michigan State University, U.S.A.
Reaction dynamics of 1A and 2A metal atoms with H₂, CH₄
and rare gases, Photodissociation of small molecules studied
by velocity-mapping image and FTIR, State selection and
orientation of small molecules by hexapole state selector,

Cavity ring down spectroscopy in gas and condensed phase, Single molecule detection and related studies

Minn-Tsong Lin

Ph. D. in Physics, University of Halle, Germany

Spintronics; Organic Spintronics, Nanomagnetism; Spin-Polarized Scanning Tunneling Microscopy, Surface Magnetism, Nanomaterials, Application of Synchrotron Radiation

Juen-Kai Wang

Ph. D. in Applied Physics, Harvard University, U.S.A.

Innovative Spectroscopic Studies of Nanomaterials and Nanostructures

Yi-Chun Wu

Ph. D. in Biology, Massachusetts Institute of Technology, U.S.A.

Application of nano-materials in biological systems, Systems biology in *C. elegans* cell migration, Mechanisms underlying the removal of dead cells

National Chiao Tung University

Website: <http://www.ac.nctu.edu.tw/main.php>

Dr. Yuan-Pern Lee

Ph. in Chemistry, University of California, Berkeley, U.S.A.

Spectroscopy of free radicals that are important in atmospheric or combustion chemistry, Photodissociation dynamics/kinetics, Time-resolved IR spectroscopy: step-scan FTIR emission & absorption, ultrafast transient absorption, IR-VUV ionization/time-of-flight detection, Matrix isolation using para-hydrogen

Sheng Hsien Lin

Ph. D. in Chemistry, University of Utah, U.S.A.

Spectroscopy and dynamics of molecules, protein folding, and nonlinear optics

National Taiwan Normal University

Website: <http://www2.ntnu.edu.tw/en/index.php>

Dr. Chia-Chun Chen

Ph. in Chemistry, Harvard University, U.S.A.

Preparation and Characterization of Nano-sized Materials, Energy Applications of Nanoparticles, Bio-medical Applications Using Nanomaterials, New Synthetic Approaches of nanostructures, Studies of Optical and Electrical Properties of Nano-sized Materials

Academic System

The MST program emphasizes establishment of problem-solving ability and developing individual's self-reliance and self-confidence to conduct independent research work. In this program, faculty members will take turns to serve as mentors for first-year students until they have formally joined a research group to conduct their thesis study, which should take place within the first two semesters after their admission into this graduate program. As a rule, students complete a program of required courses before embarking on the research training. The MST program adopts a team-teaching system, where each faculty member teaches the subject according to his or her expertise. Courses offered include required and elective courses. All courses will be delivered in English.

Requirements for Ph. D. Degree

(1) Student Status and Degree Conferral Policy

Based on the Regulations of the Ministry of Education in Taiwan, our degree candidates must be officially

registered students of either the Chemistry Department of National Tsing Hua University, or alternatively, the Physics Department of National Central University. Students who enter the MST program with a B.S. degree should enroll first as a pre-Ph.D. student till they are approved by a committee to enroll in the Ph.D. program (see below). Upon successful completion of the program, each student will be conferred a Ph.D. degree by the partner university and a certificate jointly signed by the President of Academia Sinica and the Director of TIGP.

(2) Course Works

Students are advised to complete the course requirement during the first one-and-a-half years. It is the responsibility of the thesis advisor to assist each student in projecting a program of study that will best satisfy his or her personal needs as well as fulfilling the graduate requirements. Depending on the background of the incoming student, a prescribed program of courses will be required as part of the requirements toward the degree conferral. The details of this prescribed course program will be determined shortly upon arrival after consultation with the Graduate Study Committee of the graduate program.

Courses Offered

Required and Elective Courses Offered by the MST Program		
Credit / Course Title	National Tsing Hua University (NTHU)	National Central University (NCU)
	Dept. of Chemistry	Dept. of Physics
Required Courses (may differ with chosen field of discipline)		
Seminar	6	6
Special Topics	12	
Chinese Conversations I,II (for International Students only)	6 (I, II)	6 (I, II)
Core Courses and Elective Courses		
Advanced Physical Chemistry I,II,III	9 (I, II,III)	9 (I, II,III)
Modern Experimental Techniques-Chemistry	2	2
Modern Experimental Techniques-Physics	2	2
Advanced Inorganic Chemistry I	3	3
Organometallic Chemistry	3	3
Advanced Organic Chemistry I	3	3
Advanced Analytical Chemistry I	3	3
Quantum Mechanics I,II		6 (I, II)
Quantum Optics		3
Introduction to Nanotechnology I,II	6 (I, II)	6 (I, II)
Computational Materials Science	3	3
Advanced Chemistry of Materials	3	3
Solid-State Physics	3	3
Special Topics on Solid State Physics: Advances and Applications	3	3
Above courses offered may vary each year		

Requirement for Ph.D. Degree

Total Credits for Ph.D. Degree Required by Partner Department/University		
Requirement	Institution	
	National Tsing Hua University (NTHU)	National Central University (NCU)
Qualify Examination	Yes	Yes
Preliminary Oral Defense	Yes	No
Credits Required for Ph.D. Degree	30	34
Thesis Oral Defense	Yes	Yes

(3) Selection of Thesis Advisor

Incoming students are required to select a thesis advisor by the end of the first year of their graduate study (refer to **Fellowship and Stipends** below). They should be exposed to the research work of a number of laboratories before signing up for a specific faculty member. The process involves attending a series of seminars delivered by faculty members on their respective research and a series of laboratory rotations, each lasting for four weeks, during the first year of students' graduate study.

(4) Qualifying Examination

A student pursuing for the Ph.D. candidacy must pass the qualifying examinations in accordance with the University regulations in which each student enrolled (Please refer to the "Student Status and Degree Conferral Policy" above), typically before the end of his/her second or third year in residence.

(5) Advancement to Ph.D. Candidacy

Each student must strive to qualify candidacy for the Ph.D. degree typically by the end of his/her second year of graduate study. The criteria for qualifying candidacy include: (i) submission of an official report describing the candidate's past accomplishments, (ii) certified completion of a series of written examinations on selected subjects required by the designated department/university, and/or (iii) certified completion of a preliminary oral defense on proposed research proposal.

(6) Thesis Defense

Prior to the final submission of a Ph.D. thesis, the candidate must fulfill all courses and earned credits required by the designated department/university at which he/she had registered. Upon completing these requirements, the Ph.D. candidate is then eligible to defend his/her graduate research under a written recommendation by his/her thesis supervisor(s). The thesis defense will take the form of a public seminar given by the Ph.D. candidate followed by an oral examination in front of a thesis examination committee, which shall consist of at least five faculty members (at least one third must come from another institution) familiar with the candidate's area of research.

Admission Requirements

TIGP offers admissions for the fall semester only. Detailed admission requirements and application materials are available on the website of TIGP (<http://tigrp.sinica.edu.tw>) The application deadline for MST Program is March 31 every year.

Either international students or domestic students from within Taiwan with a B.S. and/or a M.S. degree from an accredited institution will be considered for admission. The

applicant's qualification for admission will be based mainly, but not exclusively, on the following certified/notarized documents provided by the applicant:

- (1) Undergraduate and graduate (if applicable) academic records or transcripts.
- (2) Graduate Record Examination (GRE) scores: Subject Test is optional (but highly recommended).
- (3) English Proficiency: Applicants whose first or native language is not English are required to submit one of following English proficiency test report (the listed scores are strongly recommended):
 - (i) **TOEFL**: scores 550 on the paper-based (or 213 on the computer-based or 79 on the New Internet-based TOEFL (TOEFL-iBT)) or higher (Our institution CODE & NAME are: 7142 Academia Sinica);
 - (ii) **GEPT**: applicants in Taiwan may take the General English Proficiency Test (GEPT) administered by the Language Training and Testing Center. Applicants are required to submit their High-intermediate level certificate when applying for admission;
 - (iii) **IELTS** (International English Language Test System): score 5.5 or higher is required.Applicants who have completed a degree program in an English speaking country, or who graduated from university where English is the primary language of instruction, maybe be exempted from the test of English proficiency with an official certification issued by the Office of Registrar.
- (4) Three letters of recommendation commenting on the applicant's personal character, and qualifications for independent study, including intellectual ability, research potential, and scientific motivation.
- (5) A statement of purpose or plan for graduate study.

The above submitted application materials will not be returned to applicants under any circumstances. The complete application materials must reach TIGP before March 31 every year. Application can be submitted through the on-line application system (recommended) <http://db1x.sinica.edu.tw/tigrp/index.php> or by post to:

Admissions Office
Taiwan International Graduate Program (TIGP)
Academia Sinica
128 Academia Road, Sec. 2, Nankang,
Taipei 11529, Taiwan, Republic of China

Cost of Study

Payment for tuition fees (basic fee + credits fee, about NT\$54,000/US\$1,800 per semester) should be made by international students on Student Registration Day. Partial subsidies for the tuition fees will later be provided (by Academia Sinica) to all international students

Fellowship and Stipends

The TIGP will provide full fellowships to all graduate students for the first year. The current stipend is NT\$ 34,000 (about US\$1133) per month. Extension of the fellowship is reviewed annually. Depending on the progress of the students, the MST committee may provide full, partial or no financial support after the first year. The recommendation letter from the thesis advisor is critical in this decision. For those MST students in good academic standing, the MST program may provide the fellowships up to three years. It is expected that the thesis advisor will provide the financial support for the rest of the study period.

Medical Insurance

(For international students only.) Six months after the student receives the Alien Resident Certificate (ARC), the student will be qualified for Taiwan's National Health Insurance Program (NHI). The students are expected to pay the same premium (about NT\$749/US\$25 per month) as all the Taiwan citizens and will be entitled to the same medical coverage.

Living and Housing Costs

Options include on-campus housing and off-campus housing. A dormitory for TIGP graduate students near the Academia Sinica campus is available. This on-campus student housing facilities will be available to the TIGP graduate students at reasonable costs. Off-campus private housing is generally more expensive. Rents for off-campus apartments range from NT\$ 5,000-15,000 per month. Meals are also available at modest cost at the Activity Center Cafeteria/Dining Hall, the Café, located in the Academia Sinica campus and/or assorted restaurants nearby to the IAMS.

Correspondences and information

For general information concerning TIGP, please contact:

Administrative Assistant:
Ms. Huan-Yi Shen
E-mail: tigp@gate.sinica.edu.tw
Tel: +886-2-2789-8050; Fax: +886-2-2785-8944

Mailing Address:

Taiwan International Graduate Program (TIGP),
Academia Sinica
128 Academia Road, Sec. 2, Nankang,
Taipei 11529, Taiwan, Republic of China

For information concerning MST program, please contact:

Coordinator, Admission Committee:

Dr. Chau-Chung Han
E-mail: cchan@pub.iams.sinica.edu.tw
Tel: +886-2-2366-8235; Fax: +886-2-2362-0200

Coordinator, Curriculum and Degree Committee:

Dr. Shang-Bin Liu
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Tel: +886-2-2366-8230; Fax: +886-2-2362-0200

Administrative Assistant:

Ms. Jennifer Ma
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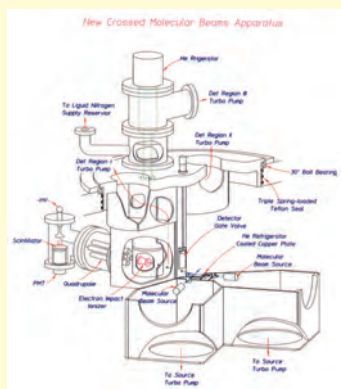
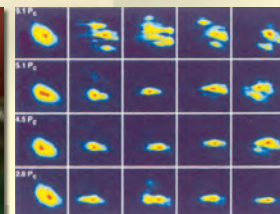
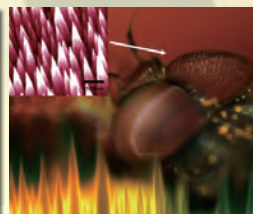
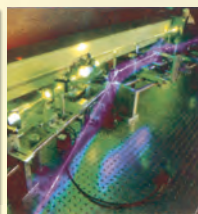
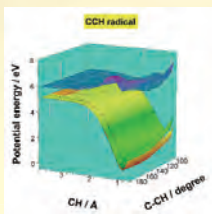
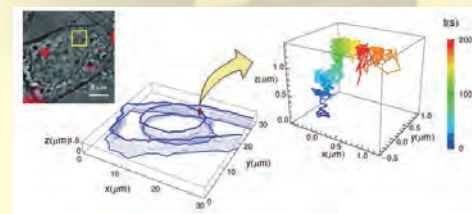
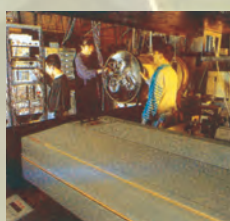
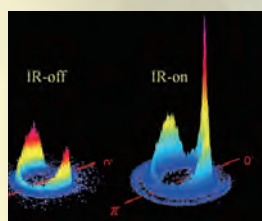
Mailing Address:

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Websites Information:

Taiwan International Graduate Program (TIGP), Academia Sinica
<http://tigp.sinica.edu.tw>

Molecular Science and Technology Program, Academia Sinica
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Institute of Atomic and Molecular Sciences (IAMS), Academia Sinica
in cooperation with
Institute of Chemistry, Academia Sinica
&
Department of Chemistry
National Tsing Hua University
&
Department of Physics
National Central University