Graduate School of Science and Faculty of Science, Tohoku University

Department of Mathematics

Department of Physics

Department of Astronomy

Department of Geophysics

Department of Chemistry

Department of Earth Science
Geoenvironmental Science
Earth and Planetary Materials Science

Department of Biology

2006


As the water planet came into being along with immeasurable time,
a very sophisticated balance over billions of years created the biodiversity.
Research on elucidating a theory of natureis progressing continuously:
Human genome sequencing is complete and a unified theory to integrate macroscopic
and microscopic systems is underway.
Though, may be an even deeper mystery.
It might be you that will solve the mystery.
Science gives you the pleasure of understanding and
comprehending nature - the generation,
mechanism and relationship between matter in the universe - through observation,
investigation, experimentation, analysis and thinking.

東北大学

CONTENTS

数学 物理学 天文学 地球物理学 化学 地圏環境科学 地球惑星物質科学 生物学

The Dean's message

Professor **Osamu Hashimoto**

"Science" is a research field that explores the basis for our understanding of nature. The graduate School of Science at Tohoku University is an "arena for science". The School has the goals of creating a culture that will endure its core values over time and cradle the next generation that will develop the future of human beings.

Tohoku University was established in 1907 with the School of Science founded in 1911. We are one of the largest centers for education and research in basic science in Japan. The School of Science has expanded today to include six graduate and seven undergraduate courses, covering almost all fields of basic science. We have 1300 undergraduates, 1000 graduate students, and 400 faculty and administrative staff.

The School of Science offers world class research programs and quality education both in its undergraduate and graduate courses based on the 21st century COE (Centers of Excellence) programs, through which the Ministry of Education, Culture, Sports, Technology and Science (MEXT) intends to cultivate a competitive academic environment for Japanese universities. We have recently been endowed with the responsibility of administering three COE programs in the disciplines of: (1) Chemistry; (2) Physics, Astrophysics and Mathematics; and (3) Earth Sciences. All six graduate courses are involved in these COE programs demonstrating high standards in education and committed research at the School of Science. In addition, the recently established IGPAS (International Graduate Program for Advanced Science) program provides international students with a wide range of curriculum and support for campus life.

All national universities throughout Japan were incorporated in 2004 and are now in the transition stage. Under these circumstances, the School of Science at Tohoku University is expected to play an even more comprehensive role with its tradition. We are determined to put all the necessary effort into further strengthening the School to become a leading international center for education and research in basic science.
Come and join us at our Aoba-yama campus, which has an ideal atmosphere for study with its magnificent views overlooking Sendai city and the Pacific.

O. Hashimoto

Tohoku University

Tohoku University was founded in Sendai in 1907 as the Tohoku Imperial University. It was the third Imperial University in Japan, following Tokyo University (1877) and Kyoto University (1897), and was comprised of the College of Agriculture and College of Science. Since its foundation, the university has been very progressive and provided a stimulus to society. To give a few examples, it was the first Imperial University to admit applicants who had not finished regular preparatory courses, i.e., it accepted graduates from Medicine and Technical Colleges and holders of certificates for secondary school teachers. It was also the first Japanese university to introduce coeducation. It presented university extension lectures to the public well ahead of its time. Tohoku University also opened its doors to foreign students and conferred degrees on foreign graduates as far back as 1911. Today the university is one of the largest and oldest national institutions in Japan with five campuses in Sendai. It will celebrate its 100th anniversary in 2007.

Fundamental Principles and Objectives

Tohoku University is committed, first and foremost, to excellence based on the principles of its foundation, "Research First" and "Open-door" policies. The following objectives are being pursued to uphold these principles.

A Research-intensive University

Tohoku University's prime objective is to contribute to the well-being and advancement of humanity through its research.

A University Open to the World and the Community

Tohoku University strives to contribute to global as well as local communities as an open university.

Development of Future Leaders

At Tohoku University, those in charge of education in the various departments and graduate schools are faculty members who are leaders in their own fields of research.

Katahira Campus of Tohoku University

1916, the first women baccalaureates in Japan graduated from Department of Mathematics.

1922, Einstein visited Tohoku University.

Headquarters of Tohoku University

School of Science

The Faculty of Science came into being as the College of Science of Tohoku Imperial University in 1907. The Departments of Mathematics, Physics, and Chemistry began offering courses in 1911, followed by the Department of Geology the next year. The College of Science was renamed the Faculty of Science in 1919. Many departments and research laboratories have been added since then.

Tohoku University is committed, first and foremost, to excellence based on the principles of its foundation, i.e., "Research First" and "Open-door" policies. The School of Science has been playing important roles in the university to achieve these goals. The principle of "primary emphasis on research" is based on the belief that leading researchers can provide the best education. This ideology has remained the basis of education and research with an emphasis on creativity within our faculty for more than 90 years. An example of our "open-door" policy can be seen in the break with tradition in the era of modernization in Japan, the Meiji and early Taisho Periods, by our accepting female students and students graduating from schools not affiliated with the faculty based on their individual ability. Chika Kuroda, the first women in Japan to be awarded the Doctor of Science degree, and Kaya Seiji, who graduated from Tokyo Technical College (later renamed Tokyo Institute of Technology) and became president of Tokyo University are both excellent examples.

These two principles have been upheld since the foundation of the College of Science and have been the driving force behind our research. However, recent global changes have required universities in Japan to establish new objectives based on globalization and their contribution to society. The new objectives of the Faculty of Science, which can be achieved by promoting creative research and training new researchers, should be for it to gain recognition throughout the world for higher levels of research and for it to play a major global role in the advancement and propagation of new scientific technology. To achieve these objectives, steps were taken in 1994 and 1995 toward expanding the graduate schools of the university and giving them greater importance. This shift toward emphasis on graduate school study started with the reorganization of the Faculty of Science into the Graduate School of Science, which was aimed at achieving higher levels of research and education. The Graduate School of Science was reorganized with six departments, mathematics, physics, astronomy, geophysics, chemistry, and geoenvironmental science, and affiliated research centers and facilities had been rearranged to 8 affiliated research centers and facilities.

Undergraduate 7 Departments	Graduate 6 Departments
Department of Mathematics	Department of Mathematics
Department of Physics	Department of Physics
Department of Physics	Department of Astronomy
Department of Astronomy and Geophysics	Department of Geophysics
Department of Chemistry	Department of Chemistry
Department of Earth Science: Geoenviromental Science	Department of Earth Science
Department of Earth Science: Earth and Planetary Materials Science	
Department of Biology	

Graduate 6 Research Centers

Laboratory of Nuclear Science

Research and Analytical Center for Giant Molecules

Center for Atmospheric and Oceanic Studies

Research Center for Prediction of Earthquakes and Volcanic Eruptions

Research Center for Neutrino Scicnce

Planetary Plasma and Atmospheric Research Center

Statistics

Academic Staff Statistics (January,2006)

Departments & Research Centers			Professor	Associate Professor	Lecturer	Research Associate	Total
Mathematics			18	11	1	7	37
Physics			23	18	0	24	65
	Cooperative Groups	Institute for Materials Research	8	7	1	18	34
		Institute of Multidisciplinary Research for Advanced Materials	4	2	0	7	13
		Center for Low Temperature Science	1	2	0	2	5
		Cyclotron and Radioisotope Center	1	1	0	2	4
Astronomy			5	4	0	3	12
Geophysics			6	5	1	4	16
Chemistry			14	11	3	25	53
	Cooperative Groups	Institute for Materials Research	2	2	1	6	11
		Institute of Multidisciplinary Research for Advanced Materials	10	5	2	11	28
		Center for the Advancement of Higher Education	1	0	0	0	1
Earth Science			10	8	2	9	29
	Cooperative Groups	Tohoku University Museum	1	3	0	1	5
		Center for Northeast Asian Studies	1	1	0	2	4
Laboratory of Nuclear Science			3	3	0	4	10
Research and Analytical Center for Giant Molecules			0	3	0	2	5
Center for Atmospheric and Oceanic Studies			4	2	0	0	6
Research Center for Prediction of Earthquakes and Volcanic Eruptions			4	6	0	4	14
Research Center for Neutrino Science			2	4	1	7	14
Planetary Plasma and Atmospheric Research Center			2	1	0	2	5
Total			91	76	8	91	266
	Cooperative Groups		29	23	4	49	105

Student Statistics

▼ Undergraduate (May,2005)

Departement		1st year		2nd year		3rd year		4th year		Total	
		Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Mathematics		49	6	47	3	42	3	58	3	196	15
Physics	Physics	106	16	109	15	66	11	98	8	455	68
	Astronomy and Geophysics					34	8	35	9		
Chemistry		65	12	66	7	64	12	83	12	278	43
Earth Science	Geoenviromental Science	45	7	39	14	13	6	20	6	171	48
	Earth and Planetary Materials Science					23	8	28	7		
Biology		37	10	32	19	33	14	37	9	139	52
Total		302	51	293	58	275	62	359	54	1239	226

▼ Graduate (May,2005)

Departement	Master Course						Doctoral Course							
	1st year		2nd year		Total		1st year		2nd year		3rd year		Total	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Mathematics	28	2	30	2	58	4	16	0	8	0	13	4	37	4
Physics	77	5	85	7	162	12	14	1	26	1	34	0	74	2
Astronomy	9	3	11	3	20	6	3	1	2	0	7	2	12	3
Geophysics	23	4	24	10	47	14	12	1	7	4	12	1	31	6
Chemistry	49	8	60	8	109	16	18	6	29	3	25	7	72	16
Earth Science	27	5	29	5	56	10	10	1	15	5	24	0	49	8
Total	213	27	239	35	452	62	73	10	87	13	116	15	275	39

International Affairs

Division for International Research and Educational Cooperation
(Graduate School of Science, Tohoku University)

Contact

6-3, Aramaki Aoba, Aoba-ku, Sendai, Miyagi 980-8578, Japan
Tel: +81-22-795-5829 Fax: +81-22-795-5831

1. Introduction

The Division for International Research and Educational Cooperation of the Graduate School of Science of Tohoku University (DiRECT) was established on December 9, 2002 to support various international activities including student exchange programs and collaborative research. DiRECT provides services that meet the special needs of international students and researchers and supports them in fulfilling their academic goals.

2. Education

A) English Presentation course

Covers basic knowledge and skills required to make English Presentations at international conferences.

B) Japanese language classes for international students and researchers

- Japanese I

Introduction to Japanese for beginners and survival Japanese

- Japanese II

Basic Japanese and commonly used daily expressions

3. Support and Assist

Provide assistance with application procedures, including immigration and counseling services for international students and researchers.

4. Publicity

Transmission of scholarship, housing, recreational, and other essential information through our web-site *(http://sciserv.sci.tohoku.ac.jp/direct/)* and e-mail. *(direct@sci.tohoku.ac.jp)*

5. Other Activities

Plan and support various events (e.g., parties and excursions) and international exchange programs.

Center for International Exchange
(Tohoku University)

1. Introduction

The Center for International Exchange (formerly International Student Center) was established in 1993 to 1) educate international students in Japanese language and culture, 2) provide information to students wishing to study abroad, and 3) foster international exchanges through various activities.

2. Organization

- Japanese Education Division
- Foreign Student Guidance Division
  * Provides general consultation service to international students
- Division for Short-term Exchange Programs
- International Affairs Department
  * Provides assistance with registration, applications for scholarships, and the issuing of certificates and other documents.

Contact

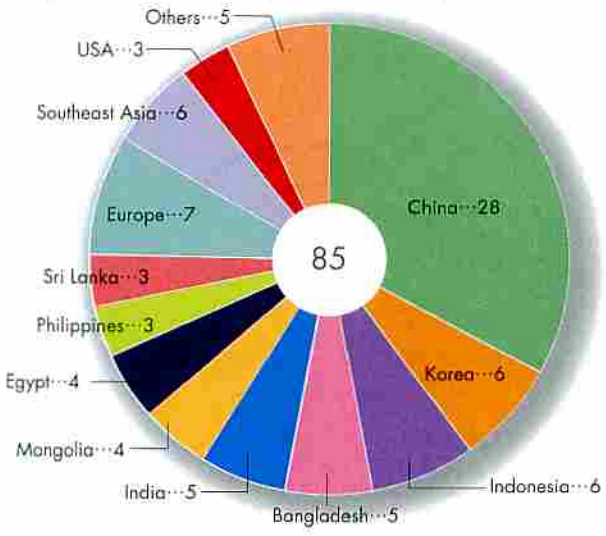
Student Exchange Division
International Affairs Department
Center for International Exchange
Tohoku University
41 Kawauchi, Aoba-ku, Sendai 980-8576, Japan
Tel : +81-22-217-7820
Fax : +81-22-217-7826

3. Foreign Student Association

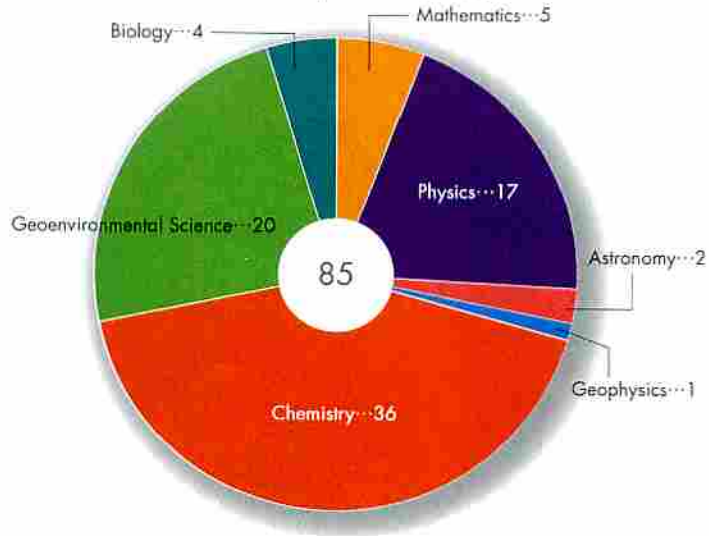
The Tohoku University Foreign Student Association (TUFSA) was organized in 1965 for the purpose of cementing friendship with international students and promoting cultural exchange and fostering mutual understanding with Japanese students. The association is a private organization, which is managed by an executive committee elected by the members. TUFSA plans various events throughout the year, such as international festivals, disco parties, sports activities, and the annual Christmas party which is open to international students.

International Students

▼ Number of international students in the School of Science by their Nationalities (November, 2005)



▼ Number of international students in each departments of the School of Science (November, 2005)



Academic Programs

The academic year is divided into two semesters with 15-week coursework, examinations and vacation in each.

Spring Semester : April 1 - September 30
Fall Semester : October 1 - March 31

Undergraduate Program

Bachelor of Science

In general, the duration of Undergraduate Program is 4 years with courses commence in April of each year. In final year, students are expected to undertake a research project to prepare a thesis. All of the courses are taught in Japanese so students are expected to possess sufficient Japanese skill. After successfully completing the Undergraduate Program, students are awarded with Bachelor of Science degree. The major requirements to obtain the degree are: 1) a minimum of 4 years of study, 2) completion of 124 credits, and 3) *submission of a final thesis and/or project. (Depending on each department's regulation)

Graduate Program

Master of Science and Doctor of Science

In general, the duration of the Graduate Program is 2 years for Master's program and 3 years for Doctoral Program. These programs commence twice a year, in April and October. Most of the courses are taught in Japanese except for some elective courses which are taught in English. The major requirements to obtain the Master of Science degree are: 1) 2 years of academic study in the Master's program, which may be shortened in case of outstanding research performance, 2) completion of 30 credits, 3) submission of a master's thesis, and 4) oral examination. Students must complete Master's program in order to proceed to Doctoral Program. The major requirements to obtain the Doctor of Science degree are: 1) 3 years of the academic study in the Doctoral Program, which may be shortened in case of outstanding research performance, 2) completion of 20 credits, 3) submission of a doctoral dissertation, and 4) oral defense of the doctoral dissertation.

International Graduate Program for Advanced Science (IGPAS)

The International Graduate Program for Advanced Science (IGPAS) is a graduate program commenced in October 2004 at Graduate School of Science, Tohoku University and has been accepting new students every October. IGPAS is a special program for international students who demonstrate outstanding scholastic ability in the field of Science. The program covers three specific areas: 1) The Chemistry and Biochemistry Program, 2) The Muli-scale Natural Science Program, and 3) The Earth and Planetary Science Program. These programs are designed to be interdisciplinary so that students can study variety of fields within science. No Japanese skill is necessary to join the program since all the lectures for IGPAS are taught in English. IGPAS is basically a 5-year graduate program including 1-2 year of Master's program followed by 2-3 year of Doctoral program. Applicants who have completed Master's program in their colleges or universities may select to join either the Master's program or the Doctoral program. However, applicants who are selected for the Monbukagakusho (MEXT) scholarship must fulfill the 5-year graduate program, both the Master's and the Doctoral program.

The Master's program consists of series of lectures, seminars, and graduate research for a Master's thesis. The requirements to obtain Master of Science degree are: 1) 2 years of academic study in the Master's program, 2) completion of 30 credits, and 3) final evaluation.

The Doctoral program consists mainly of graduate research for a Doctoral thesis and seminars. The requirements to obtain Doctor of Philosophy (Science) degree are: 1) 3 years of academic study in the Doctoral program, 2) completion of 20 credits, 3) approval of the Doctoral dissertation, and 4) final evaluation.

Overview of the Science Curricula

Other Programs

Research Student (Kenkyusei) Program

The research student program is a non-degree and non-credit program open to students who wish to study specific subjects at the Graduate School of Science or related research institutes. In most cases, international students are urged to register first as research students before applying for the regular graduate programs. Applicants must contact a prospective academic advisor and discuss details of their research work in order to be admitted as a Research Student. Students from the partner institutes of the Graduate School of Science or Tohoku University are admitted as Special Research Student(Tokubetsu Kenkyugakusei). Please contact the international office of a partner's institute for more information.

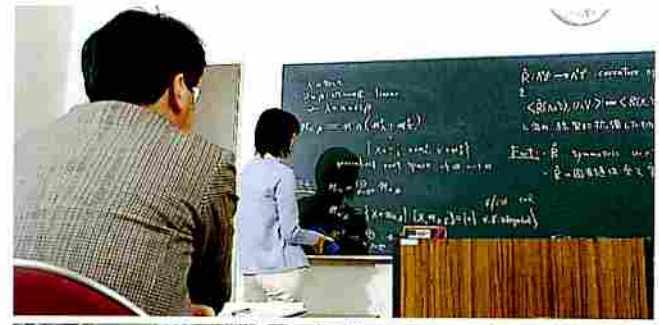
Special Auditor (Tokubetsu Chokogakusei) Program

International students can audit some courses and earn credits if they are enrolled in a partner institute of the Graduate School of Science or Tohoku University. Contact the international office of a partner institute for more information.

Junior Year Program in English (JYPE)

The JYPE is designed for international exchange students who are interested in taking courses in education, science, and engineering at Tohoku University without Japanese proficiency requirement. All the courses for JYPE are taught in English. The JYPE benefits only undergraduate juniors of full-time status from institutes with formal exchange agreement with Tohoku University. Most of the courses are designed to last one year so students are recommended to join the program from October. Approximately 30 students are admitted each year. Contact the international office of a partner institute for more information.

http://insc.tohoku.ac.jp/JYPE/



International Exchange

Agreements on Academic Exchange with Foreign Universities

Region and Country		University/Institute	Starting Date
Asia	China	Northeastern University	Aug. 5,1983
		University of Science and Technology of China	Jun.15,1998
		Tsinghua University, Beijin	Aug.31,1998
		Nanjing University	Sep. 1,1999
		Peking University	Nov.10,1999
		Jilin University	Mar. 1,2001
		Zhejiang University	Apr. 9,2001
		Fudan University	Apr.19,2001
		Wuhan University of Technology	Apr.30,2001
		Chongqing University	Jul. 4,2001
		Tongji University	Aug.13,2002
		Ocean University of Qingdao (Ocean University of China)	Oct.21,2002
		University of Science and Technology Beijing	Oct.25,2002
		Nanjing University of Aeronautics and Astronautics	Mar.10,2003
		Shaanxi University of Science & Technology	May.30,2004
		Qingdao University of Science & Technology	Jul. 7,2004
		Xiamen University	Jun.29,2005
		Huazong University of Science and Technology	Oct.12,2005
	India	Indian Institute of Technology Bombay	Aug.21,2000
	Indonesia	University of Indonesia	Mar.19,2004
	Korea	Chonbuk National University	Nov. 12,1991
		Seoul National University	Jul. 8,1998
		Gwangju Institute of Science and Technology	Aug.21,2000
		Pukyong National University	Aug.21,2000
		Pohang University of Science and Technology	Sep.22,2000
		Korea Advanced Institute of Science and Technology	Apr.24,2001
		Chungnam National University	Jul. 9,2001
		Kyungpook National University	Sep. 2,2002
		Yeungnam University	Dec. 3,2003
		Dong-eui University	Dec.19,2003
		Chosun University	Mar.18,2004
		Korea University	Mar.31,2004
		Changwon National University	Oct. 2,2005
	Mongolia	Mongolian Academy of Sciences	Aug.21,2000
	Mongolian	University of Science and Technology	Nov.16,2001
	Singapore	National University of Singapore	Sep.16,2000
	Taiwan	National Taiwan University	Nov.18,2000
		National Taiwan Ocean University	Mar. 8,2002
		National Chung Cheng University	Nov.14,2003
		National Cheng Kung University	Aug. 9,2005
		National Chiao Tung University	Dec.15,2005
	Thailand	Asian Institute of Technology	Nov. 9,1998
		Suranaree University of Technology	Mar. 1,2001
		King Mongkut's Institute of Technology Ladkrabang	Apr.15,2004
Middle and Near East	Iran	University of Tehran	Aug.25,1999
Africa	Morocco	Universite Mohammed V-Agdal Rabat	Apr.30,2001
Oceania	Australia	The University of Sydney	Jan. 8,1993
		The University of New South Wales	Apr. 7,2001
		The Australian National University	Jul.16,2002
	New Zealand	The University of Auckland	Nov.15,2002
North America	U.S.A.	Pennsylvania State University	Nov.29,1988
		University of California	Mar.15,1990
		University of Washington	Jul. 3,1996
		Purdue University	Sep.23,1997
		University of Alaska	Jan.12,1999
		Colorado School of Mines	Jan. 7,2004
Europe	Belgium	The Belgian Nuclear Research Centre	Jun.16,2005
	Finland	Helsinki University of Technology	Nov.5,2001
		University of Oulu	Aug.9,2004
	France	Université Pierre and Marie Curie (PARIS VI)	Aug.19,1999
		Université Rennes 2-Haute-Bretagne	Dec. 3,1999
		Universities Grenoble and Universities Strasbourg: Université Joseph Fourier	Mar.31,2000
		Universities Grenoble and Universities Strasbourg: Université Pierre Mendès-France	Mar.31,2000
		Universities Grenoble and Universities Strasbourg: Université Stendhal	Mar.31,2000
		Universities Grenoble and Universities Strasbourg: Institut National Polytechnique de Grenoble	Mar.31,2000
		Universities Grenoble and Universities Strasbourg: Université Louis Pasteur	Mar.31,2000
		Universities Grenoble and Universities Strasbourg: Université Marc Bloch	Mar.31,2000
		Universities Grenoble and Universities Strasbourg: Université Robert Schuman	Mar.31,2000
		Université de Rennes 1	Dec.20,2000
		The Global Education for European Engineers and Entrepreneurs	Nov.14,2002
		Ecole Centrale de Lyon	May.21,2003
		Institut National des Sciences Appliquées de Lyon	Jul.13,2004
		University of Bordeaux 1	Jul.28,2005
	Germany	University of Technology Aachen	May.19,1998
		University of Dortmund	Mar. 2,1999
		Saarland University	Oct. 5,1999
		Darmstadt University of Technology	Apr.30,2003
		University of Göttingen	Oct.23,2003
	Italy	Universita Degli Studi DiRoma "La Sapienza"	Sep.27,1990
	Poland	Institute of Catalysis and Surface Chemistry, Polish Academy of Sciences	Aug. 4,1999
	Sweden	Umea University	Nov.20,2000
		KTH Royal Institute of Technology	Aug.18,1997
		Uppsala University	Sep.20,2000
		Stockholm University	Mar.20,2002
		Lund University	Jan.14,2003
	Switzerland	The Swiss Federal Institute of Technology, Lausanne	Apr.10,2003
	U. K.	Imperial College of Science, Technology and Medicine, University of London	May. 4,1988
		The London School of Economics and Political Science, University of London	Jan. 3,1989
		The School of Oriental and African Studies, University of London	Apr.10,1989
		The University of Nottingham	May.15,2001
		The University of York	Jun. 7,2004
NIS	Russia	Siberian Branch of Russian Academy of Sciences	Aug.10,1992
		Moscow State University	Feb.19,1998
		Novosibirsk State University	Jul. 4,2003
	Ukraine	National Technical University of Ukraine "Kyiv Polytechnic Institute"	Jun. 2,2004

Agreements on the Department Level on Academic Exchange with Foreign Universities

University	Country	Starting Date
The Faculty of Science of the University of Sydney	Australia	6-Jun-86
The Pensylvania State University	U.S.A	29-Nov-88
The Faculty of Science of The University of Melbourne	Australia	15-Mar-88
The Faculty of Biology of Utrecht University	Holland	28-Jul-93
University of Alaska Fairbanks	U.S.A	12-Jan-95
School of Chemistry, Physics and Environmental Science, The University of Sussex	U.K.	17-Mar-97
Suranaree University of Technology	Thailand	18-Jun-99
The University of Copenhagen	Denmark	20-Sep-99
University of Illinois, Chicago	U.S.A	1-May-00
College of Oceanography and Environmental Science, Xiamen University	China	6-Dec-02
Faculty of Science, Chulalomgkorn University	Thailand	14-Feb-03
Faculty of Chemistry, Georg-August University of Göttingen	Germany	25-Jun-03
Faculty of Chemistry and Earth Science, Faculty of Physics and Astronomy, Faculty of Mathematics and Computer	Germany	19-Aug-03
The College of Life Science and Technology, Jinan University	China	15-Oct-03
The National Fisheries Research and Development Institute	South Korea	31-Mar-04
Umea University	Sweden	18-Aug-97
University of Dortmund	Germany	2-Mar-99
The Department of Chemistry, University of York	England	19-Jul-04
South China Sea Institute of Oceanology Chinese Academy of Sciences	China	4-Oct-04
V.I. Il'ichev Pacific Oceanological Institute of Far-Eastern Branch, Russian Academy of Sciences	Russia	20-Dec-04
Institute of Automation and Control Processes of Far-Eastern Branch of Russian Academy of Sciences	Russia	17-Dec-04
The Hanoi University of Science Vietnam National University	Vietnam	30-May-05

Admission

Undergraduate Programs

Foreign applicants are required to take Examination for Japanese University Admission for International Students (EJU) and a special entrance examination given by Tohoku University. EJU is conducted twice a year in June and November while the entrance examination given by Tohoku University is conducted once a year in February. For information about application procedure, contact (1) Division for International Research and Educational Cooperation, Tohoku University (DiRECT) : *direct@sci.tohoku.ac.jp* or (2) School Affairs Section, School of Science : *sci-kyom@bureau.tohoku.ac.jp*

In most cases, applicants must submit these documents:
1) an official transcript for the upper secondary school
2) scores for Examination for Japanese University Admission for International Students (EJU)

Graduate Programs

Master's Programs

Foreign applicants must have completed 16 years of formal education and have earned a bachelor's degree which is equivalent to those in Japan.*

Doctoral Program

Foreign applicants must have earned master's degree which is equivalent to those in Japan.*

For both programs, all applicants are required to pass written and oral examinations on respective academic subjects as well as foreign language tests.*

*(One might be exempted from these requirements if one can show the academic ability equal to or superior to the requirement.)

International Graduate Program for Advanced Science (IGPAS)

Applicants must satisfy a condition below by September, which is a month before the commencement of the program.

For Master's program

1) The applicants must have finished at least 16 years of school education and graduated from the university or an equivalent institution. *

For Doctoral Program

1) The applicants must have earned master's degree which is equivalent to those in Japan. *

*One might be exempted from these requirements if one can show the academic ability equal to or superior to the requirement.

If the applicant wishes to receive a financial support from Monbukagakusho (MEXT), he or she must be under 35 years of age as of April of the year admitted to the program, and must be a citizen of a country that has diplomatic relations with Japan. However, Military personnel and employees from military institutions are not eligible for this program. For more information contact the Division for International Research and Educational Cooperation Office, Tohoku University (DiRECT) : *direct@dic.sci.tohoku.ac.jp* or check the web-site : *http://sciserv.sci.tohoku.ac.jp/direct/IGPAS/*

University Fees

	Entrance Examination	Admission	Tuition
Undergraduate	¥17,000	¥282,000	¥535,800/year
Graduate	¥30,000	¥282,000	¥535,800/year
Research Student	¥9,800	¥84,600	¥29,700/month
Special Research Student	—	—	*¥29,700/month
Special Auditor	—	—	*¥14,800/credit

exchange rate : 1US Dollar =117yen (as of December, 2005)

* Student might be exempted from the tuition depending on the exchange agreement between the student's home institutions.

Programs

	Status	Duration	Degree Granted	Enrollment	Application Period
Undergraduate	Full-time Student	4 years	B.Sci	April	Late January
	Special Auditor	1-2 semesters	—	April and October	*
Graduate	Master Student	2 years	M.Sci.	April and October	Early January and Mid June
	Doctoral Student	3 years	D. Sci	April and October	Early January and Mid June
	Research Student	1-12months	—	Every month	**
	Special Research Student	1-12months	—	Every month	*
	Special Auditor	1-2 semesters	—	April and October	*

* Contact the international office at the home institute ** Contact the Graduate Academic Affairs Section at Graduate School of Science, Tohoku University

Campus

Tohoku University Kita-Aobayama Library

Contact

6-3, Aramaki Aoba, Aoba-ku, Sendai, Miyagi 980-8578, Japan
Tel : +81-22-795-6372 Fax : +81-22-795-3753
Email : klib-s@library.tohoku.ac.jp

Opening hours

- During the semester : 9:00 - 20:00 Mon - Fri
- During the summer, winter, and spring vacations : 9:00 - 17:00 Mon - Fri

*Kita-Aobayama Library is closed on weekends and holidays.

Books and other materials for Science and Pharmaceutical sciences are available at this library.

Tohoku University Co-op for School of Science

The cafeteria, restaurant, and bookstore are located in Co-op.

	Weekday	Saturday	Tel
Cafeteria	11:00~20:00	11:00~13:30	+81-22-263-2990
Noodle Corner	11:00~15:00	11:00~13:30	+81-22-263-2990
Restaurant AOSIS	11:00~20:00	Closed	+81-22-263-2990
Bookstore	8:30~21:30	10:00~13:30	+81-22-263-0126

Division of Engineering Support

Contact

Email : gijyutsu-info@tech.sci.tohoku.ac.jp
URL

These are organizational technological staff members who provide technical support for research and education. The organization itself provides production processing technology, instrument analysis, and observation control technology, through the support of computer technology and experiments. Its skilled members meet both researcher and student needs.

◀ Providing support for counters that measure the flight times of charged particles.

▲ This is a container to collect the samples of the mesosphere above the South Pole. There is a department to make the glass parts for these containers.

▲Photograph of thin section of mineral (Cassiterite from Bolivia) observed under crossed polarizers using petrographic microscope. There is a department to prepare such thin sections from natural or artificial ores and minerals.

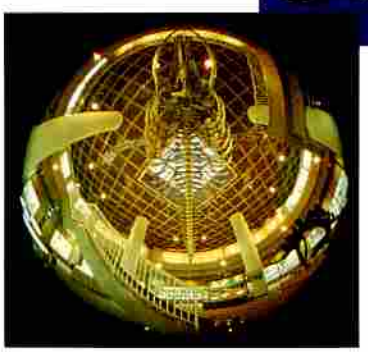
The Museum of Natural History

Contact

URL : http://www.dges.tohoku.ac.jp/museum/museum.html/

Over 600,000 specimens of fossils, minerals, and rocks, including old topographic maps are stored in the museum. These materials have mainly been collected by successive scholars for their own research, or partly purchased for education purposes. About 1,200 examples are exhibited.

Opening hours : 10:00 - 16:00 Close in every Monday



▲ Holotype specimen of *Utatsusaurus hataii* Shikama, Kamei et Murata 1978, found in Miyagi Prefecture. *Utatsusaurus* is considered to be the ancestor of ichthyosaurs.

◀ View of exhibition hall

The 21st Century COE Programs
– Center of Excellence –

Unexplored Chemistry
- Giant Molecules and Complex Systems -

Exploring New Science by Bridging
Particle - Matter Hierarchy

Advanced Science and Technology
Center for the Dynamic Earth

Unexplored Chemistry -Giant Molecules and Complex Systems-

The 21st century COE program on "Unexplored Chemistry-Giant Molecules and Complex Systems-" was started by the Chemical Departments of Tohoku University (Graduate Schools of Science and Gradual School of Engineering) in the 2002 fiscal year. As can be seen from Fig. 1, large molecules of about 1- 10 nm have so far scarcely been studied, affording a relatively unexplored domain in the range of natural objects of various sizes. We plan to analyze the construction and structure of, and do experimental and theoretical studies on, either large molecules or complicated molecular associates in the present program.

What is this research aimed at, and what can be achieved through it? Giant molecules are mostly unexplored, and for scientists there is always the simple motive of being the first to mine what wealth can be found. Engineers know that gold ore is often hidden in unexplored ground, and the hope of excavating it provides them with strong motivation. There may also be those who do not care whether they are an engineer or a scientist, but want to have both - the achievement and the gold ore as well. Whatever their motivation might be, these studies on giant molecules strive at making Sendai an internationally recognized research center leading in this field.

Another important objective is to raise the level of education to international standards. By developing the skills of Ph.D. students in making scientific presentations in English as well as by compelling them to present their own research before overseas professors, graduates would be able to improve their linguistic abilities and deliver brilliant lectures at international meetings. If one compares this expectation with sports, they should be groomed not merely as participants at the National Championships, but as winners at the Olympic Games.

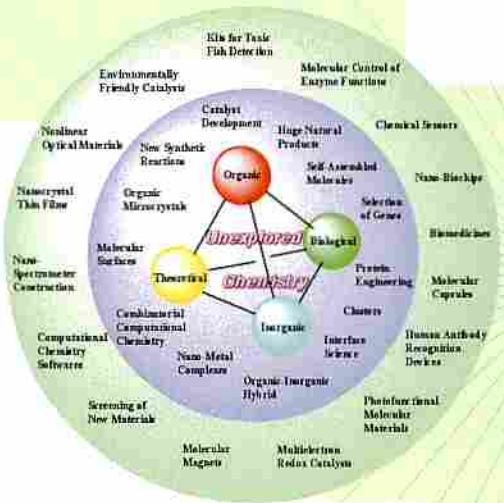
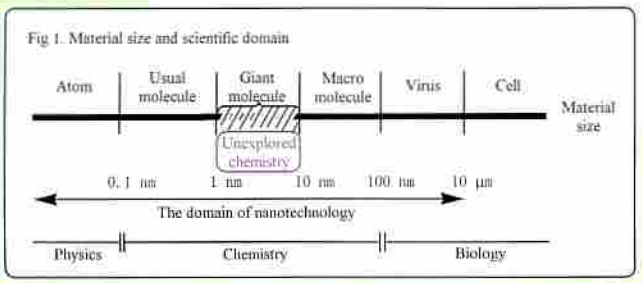
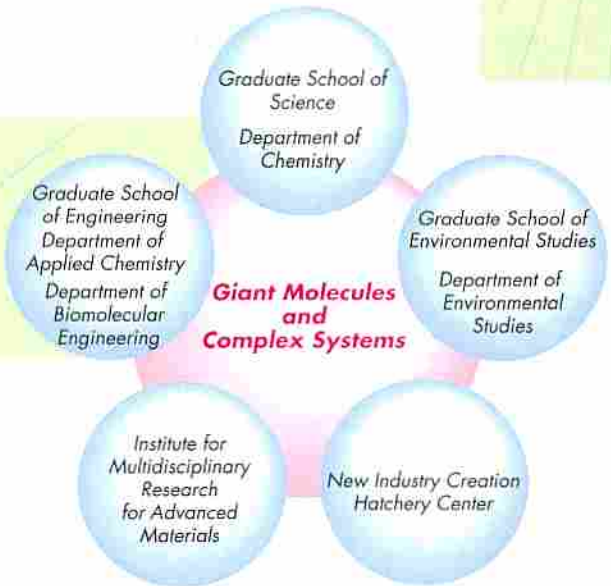


Fig 1. Material size and scientific domain





Contact

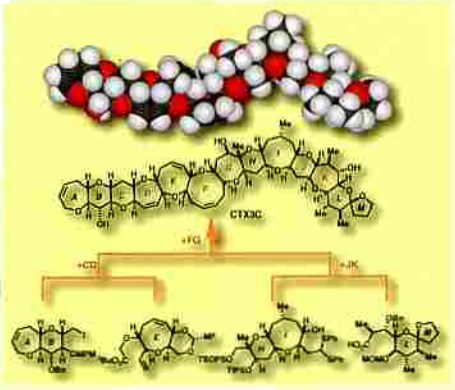
TEL +81-22-795-6581 TEL +81-22-795-6784

Email chem-coe@mail.tains.tohoku.ac.jp

URL http://www.chem.tohoku.ac.jp/COE/

Total Synthesis and Biological Application of Ciguatoxins

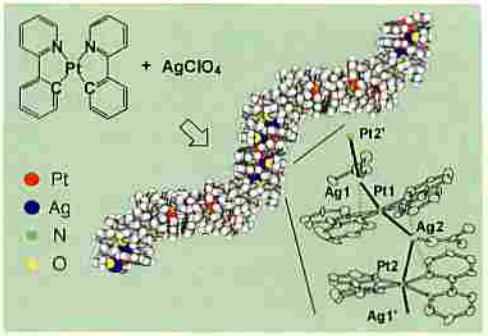
Ciguatera is a major source of food poisoning in tropical and subtropical regions, and often causes long-lasting health problems with diverse symptoms. Causative toxins, such as ciguatoxin CTX3C, are produced by a marine dinoflagellate and accumulate in more than 400 fish species through the food chain. Pharmacological studies have revealed that ciguatoxins exert toxicity through the activation of voltage-sensitive sodium channels (VSSC). However, detailed biological studies at the atomic level as well as the preparation of anti-ciguatoxin antibodies for detecting ciguatoxins prior to consumption have been hampered by the extremely low availability of causative agents. Ciguatoxins consist of 12 trans-fused polycyclic ethers, ranging from six- to nine-membered, and include a spirally attached five-membered cyclic ether at one end. Because the linear construction of the ether rings is virtually impossible due to their long (3nm) and complex structures, the development of an efficient methodology for coupling the fragments, which is suitable for use in the advanced stages of synthesis, has been particularly important for total synthesis. In 2001, we achieved the first total synthesis of ciguatoxin CTX3C, by assembling four structural fragments (*Science*, 2001, *294*, 1904). Since then, protocols to combine the fragments have significantly improved in terms of overall stereoselectivity, efficiency, and practicality. Our practical total synthesis first ensured a practical supply of ciguatoxins so that we could develop the highly sensitive immunochemical methods for detecting these toxins. Furthermore, synthetic CTX3C was found to have multimodal effects on VSSC, with simultaneous stimulatory and inhibitory aspects.



Total synthesis of giant polyether natural product, CTX3C, was achieved by assembling four fragments.

Use of Pt→M Dative Bond for Construction of Nano-Wire

It has been shown that the occupied d_z2 orbital of a d^8 transition metal ion with square-planar coordination geometry can act as a potential donor to another metal ion (M) resulting in a dative M(d^8)→M bond. However, this type of dative bond is weak and is generally supported by a bridging ligand or weakly supported interaction. To achieve our stated objective, it was necessary to devise a method to make the Pt(II)→M dative bonds stronger. The molecular orbital scheme for Pt(II)→M dative bonds suggests that stronger dative Pt(II)→M bonds will be formed as the d_z2 level moves at a higher energy. This occurs when platinum is placed in a strong ligand field. We used platinum(II) complexes with carbon donor ligands such as 2-(2-thienyl)pyridine (Hthpy), 2-phenylpyridine (Hphpy), and biphenyl, which exert a strong ligand field. Using this approach, we succeeded in producing some large cluster complexes and extending structures constructed with Pt(II)→M dative bonds. An example is the structure of $[\{Pt(phpy)_2\}_2\{Ag(acetone)\}_2]_n(ClO_4)_{2n} \cdot n$ acetone shown in the figure. This compound consists of an alternating stack of platinum and silver units which are connected by a short Pt(II)→Ag^+ dative bond, forming a 1-D helical chain (nano-wire). *J. Am. Chem. Soc.* 123, 743- 744 (2001), cited in *Science* 291, 401 (2001).

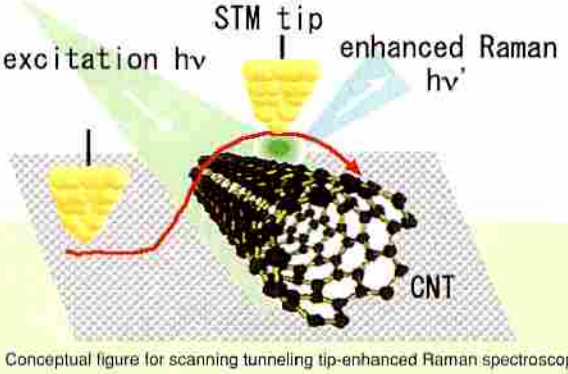


Helical chain structure of $[\{Pt(phpy)_2\}_2\{Ag(acetone)\}_2]_n^{2n+}$ and its asymmetric unit.

Experimental Physical Chemistry for Giant Molecules and Complex Systems

We need equipment to obtain local vibrational spectra with a spatial resolution of nanometers to study local structures in giant molecules and complex systems. We are trying to improve the spatial resolution of Raman spectroscopy by combining a scanning tunneling microscope with a high-sensitive Raman spectrometer. The concept behind this method is presented in the figure. We have recently succeeded in measuring both a topographical image and a vibration-spectral image of carbon nanotubes deposited on a graphite surface with a spatial resolution of 200 nm. The vibrational modes specific to carbon nanotubes could clearly be distinguished from those of graphite substrates. Further improvements to the spatial resolution of this technique are now in progress.

It is well known that x-ray diffraction can clarify the structures of crystals, and x-ray absorption spectroscopy can clarify those of electron densities in metal complexes. We are trying to extend these methods to femto/picosecond time-resolution by developing a table-top pulsed x-ray source. We have succeeded in generating pulsed x-rays by focusing sub-picosecond infrared laser light onto aqueous solutions of alkali-metal chlorides. The intensity of the generated x-ray pulses is sufficiently high to obtain x-ray diffraction and x-ray absorption when highly sensitive x-ray detectors are employed. The electronic excited states of giant molecules or complex systems can be generated with femtosecond UV/visible light pulses and then be monitored with the laser-induced x-ray pulses. The structures and electronic densities of giant molecules and complex systems in these photo-excited states can thus be examined.



Conceptual figure for scanning tunneling tip-enhanced Raman spectroscopy.

Exploring New Science by Bridging Particle-Matter Hierarchy

The COE aims at exploiting new research fields on quark matter, weak/strong correlated matter, stellar/interstellar matter and dark matter in the universe, which are transition forms of middle states or integrated forms formed by links between hierarchies, by dealing with elementary particles, nuclei, solids/liquids (condensed matter), and celestial bodies/the universe, which are successively formed by creationary and evolutionary processes in the universe, as a particle-matter hierarchy, and developing appropriate research on all these hierarchies. To accomplish projects covering such a broad range of interests, the COE program is jointly managed by researchers in the Physics, Astronomy, and Mathematics departments.

Quality shortfalls and hollowing out in graduate school education have been occurring for a long time. The purpose of the 21st century COE program is to correct this situation by training graduate students to the highest levels and grooming young researchers who will lead us in the 21st century. Our approach to their education is allowing them to collaborate in COE research programs. We attach therefore importance to the repletion of basic and practical education, making the most of interactive international collaboration where all departments have achievements in physics, astronomy, and mathematics.

Unified View of Dark Matter and Galaxy Evolutions in Young Universe

Understanding how the nature of galaxies is related to that of underlying dark matter is one of the fundamental issues in modern cosmology. Many observational evidences have suggested that baryonic components are closely correlated with their hosting dark matter halos, where galaxies were formed with cooling and condensation gas. Therefore, the mass of the hosting dark halo could be an important clue to understand the galaxy evolution. The stellar mass and star-formation rate of galaxies in young universe are the most fundamental properties to trace the galaxy mass assembly.

Under the fixed cosmological framework, the comparison of the observed galaxy distribution to the theoretical predictions can be used to obtain the information, for example, the typical mass of the dark matter halo hosting galaxies, or how many galaxies reside in a single halo of a given mass. For the observations of galaxies in young universe, we have invented a new instrument for wide field imaging and multi-object spectroscopy in near-infrared (named MOIRCS) for the Subaru Telescope (Figure 1). MOIRCS equipped with state-of-the art infrared array sensors provides the widest filed of view and the highest image quality among large telescopes. A novel design of MOIRCS allows us to perform multi-slit spectroscopy fifty times or more efficiently than current instruments.

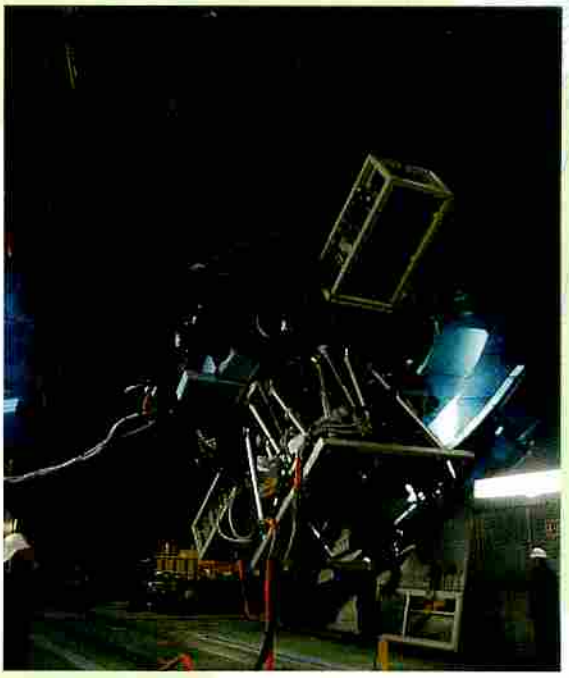
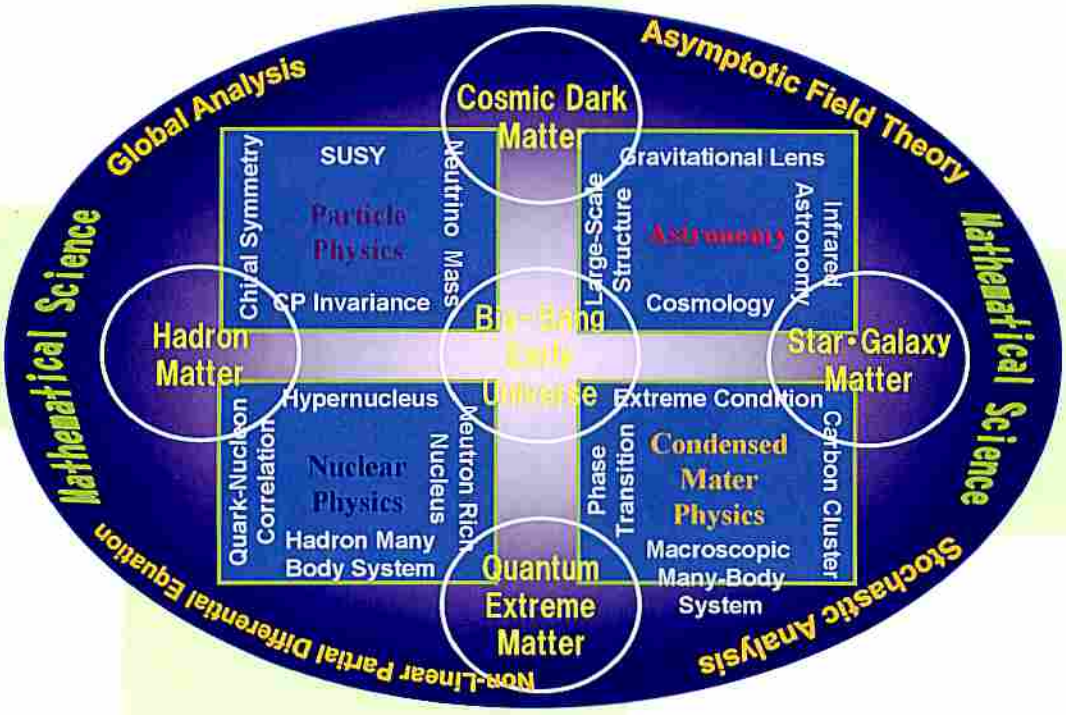
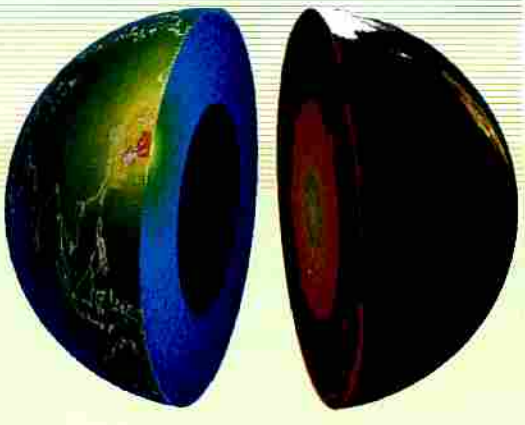


Fig. Multi-object near-infrared camera and spectrograph (MOIRCS) attached to Subaru telescope.

Contact
TEL +81-22-795-3487 FAX +81-22-795-6471
URL http://www.sci.tohoku.ac.jp/coe-office/index-e.html/



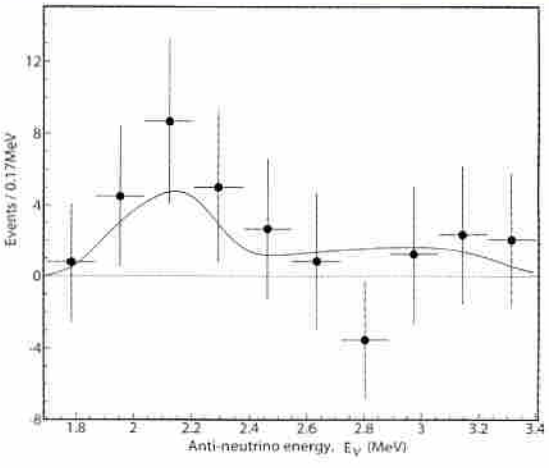
Hot topics



First experimental observation of geologically-produced neutrinos

Earth is our most familiar astronomical object. However, its properties are not very well known. One of the most important parameters in understanding Earth is heat generation. This has controlled its formation and evolution and is a driving force for the mantle and outer-core convection. It is thus important to understand its structure and also various phenomena close to us, such as earthquakes, volcanoes, eruptions, and terrestrial magnetism. Its interior is optically invisible and it is difficult to directly measure heat generation.

A large part of this heat is generated by the decay of radioactive elements, accompanying neutrino emissions, in the earth. Therefore, observing geologically produced neutrinos provides direct access to heat generation. Neutrinos penetrate matter quite freely and even the earth is not an obstacle for neutrinos to travel. KamLAND, i.e., the Kamioka Liquid-scintillator Anti-Neutrino Detector, has revealed how neutrinos travel, observing neutrinos from distant nuclear power reactors and making neutrinos their new tool to see through astronomical objects that are opaque. Success in the first observation of geologically-produced neutrinos with KamLAND was a break-through for observational geophysics and was the start of "Neutrino Geophysics" bridging two different fields.



Advanced Science and Technology Center for the Dynamic Earth

Outline

the 21st century COE program at Tohoku University

The objective of our COE Program is to investigate the evolution of the Earth in a wide time-scale, ranging from super long-term fluctuations over hundreds of millions of years (mantle convection) to fluctuations of the order of microseconds (celestial body collisions with the Earth, destructive earthquakes etc.). Our investigations are conducted along with the development of advanced technology in Earth Science, where Tohoku University's strength lies.

The present Earth has not been created gradually, but after various catastrophic changes. Recognizing varied time-scale phenomena in the Earth's fluctuations as a sequence of precursory events, catastrophic changes, their relaxation and restoration, we will identify the factors and the evolving processes of the phenomena. This is an essential approach to understanding the whole picture of the evolution of the Earth and envisioning its future (Fig. 1).

Our COE program is conducted in collaboration with science and engineering departments related to Earth and Planetary sciences at Tohoku University (Fig. 2). These research organizations have been devoted to distinct research areas, such as developing unique and state-of-the-art technology and theoretical studies, attaching importance to field work, observation, and laboratory experiments. We are facilitating extensive research and educational alliances to advance the relationship between science and engineering. With further developments in cutting-edge technology in earth science, we also expect to clarify the whole picture of Earth's evolution. Our goals are to successfully contribute to the integration of these research fields, to achieve understanding of the whole picture of Earth's evolution, and to envision its future (Fig. 3).

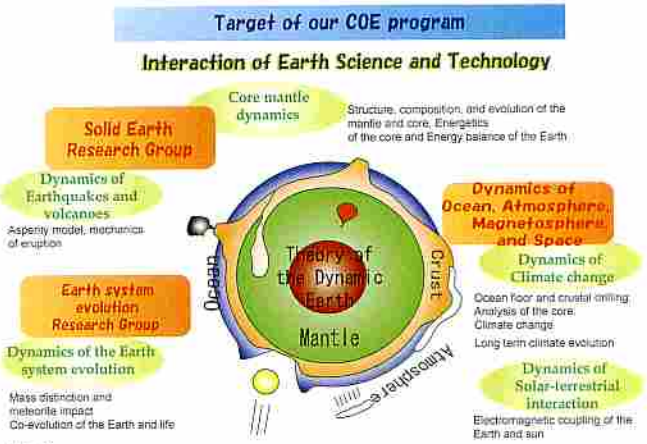


Fig. 1.

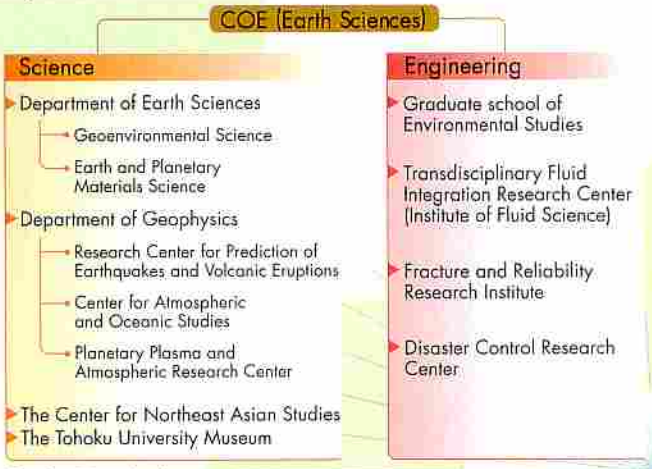


Fig. 2. Organization

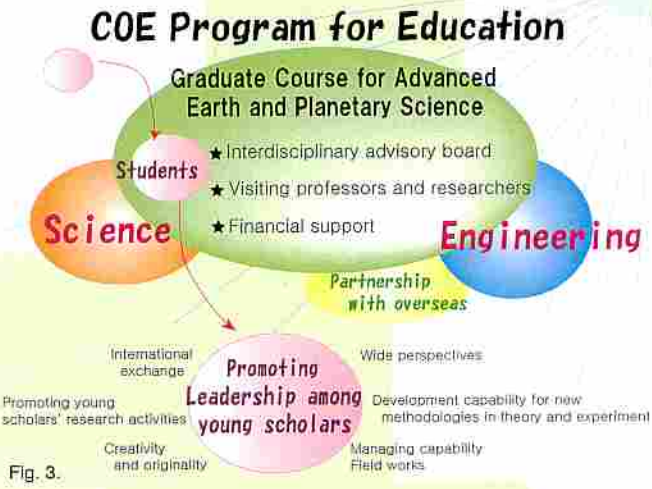


Fig. 3.

Educational achievements

Our COE program facilitates International Symposia/Workshops/Lectures to provide a global research and education environment (3 International Symposia, 4 workshops, 72 COE lectures). The program promotes and supports graduate students' research through working as research assistants (RAs) (58 in 2003, 69 in 2004, and 50 in 2005). In particular, several outstanding students from these RAs are selected as "Super Doctors (SDCs)", receiving even more financial supports (6 in 2003, 9 in 2004, and 15 in 2005). RAs are actively encouraged to attend international conferences to present their research accomplishments. To promote this, the program covers their oversea travel expenses (12 COE Post-Docs, 9 RAs in 2003, 25 RAs in 2004 and 25 RAs in 2005).

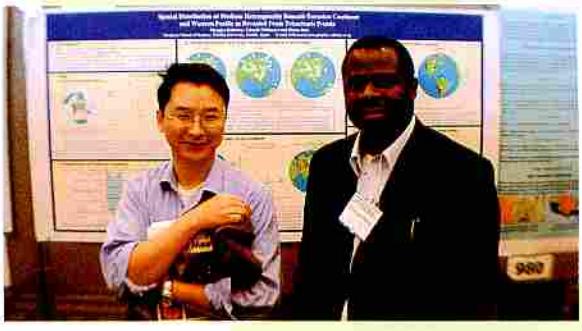


Fig. 4.

Contact

URL http://www.21coe.geophys.tohoku.ac.jp/index-e.htm/

Tel & Fax 81-22-795-6668

Scientific achievements

Earthquake generating process on plate boundaries -Rupture of asperities surrounded by creep regions-

We found many small repeating earthquakes on the plate boundary off Sanriku. We verified the asperity model based on studies on these repeating earthquakes, moment release distributions of interplate earthquakes, and GPS data. The model can be summarized as follows. Plate boundaries are composed of asperities (seismic patches) and creep (aseismic slip) regions (Fig. 5a). The asperities are locked during interseismic periods while the surrounding creep regions are aseismically slipping to load stress onto the asperities. Eventually, the asperities are ruptured as earthquakes (Fig. 5b). Large asperities are responsible for large earthquakes and small asperities cause small repeating earthquakes. We can estimate the cumulative slip in the creep regions from those for the small repeating earthquakes because the cumulative slip at an asperity should be the same as in the surrounding creep region. If the cumulative slips thus estimated for the regions around a large asperity become very large, we will be able to issue a prediction to some extent that a large earthquake is approaching there.

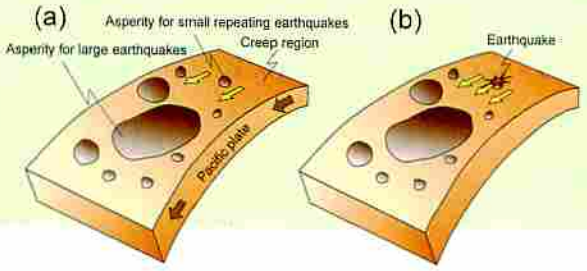


Fig. 5. Schematic representation of plate boundary based on asperity model. (a) Interseismic period. (b) Earthquake occurrence.

Dynamic structures of Earth's core and mantle based on ultra high-pressure experiments: fate of subducting plates

The core-mantle dynamics research group studies phase transitions and chemical reactions at the core-mantle boundary, and the global cycle of plate materials (Fig. 6). They resolved the transportation mechanism of water from the surface to the deep mantle, and the storage capacity and content of water in minerals at the transition zone and lower mantle. They also developed a state-of-the-art technique to stably generate ultra high-pressure and high-temperature corresponding to the Core-Mantle Boundary (CMB: 135GPa, 3500K) by using a laser-heated diamond anvil cell, and revealed phase transition in the FeH, FeSi, FeO and (Mg, Fe)O system at the CMB. Moreover, they determined the solubility of potassium, silicon and oxygen into molten iron under high-pressure and high-temperature conditions to clarify unsolved problems with the origin of Earth's heat source.

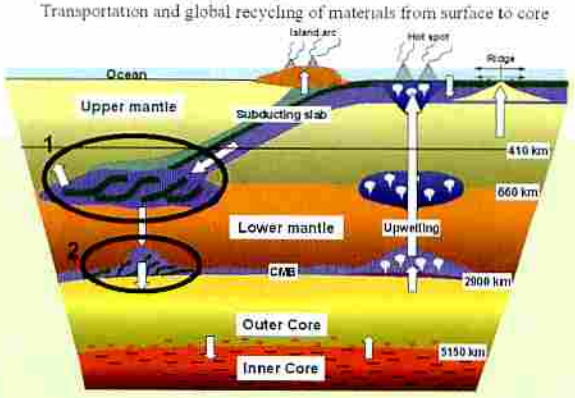


Fig. 6. 1. Transportation and storage of water in to mantle transition zone. Water content of transition zone is about 0.4 wt% and varies with depth. 2. Chemical reaction between iron (core) and silicate (mantle) was confirmed at CMB. Silicon and oxygen can be dissolved enough into molten iron to explain light elements of outer core. Significant amount of potassium can also exist in outer core to generate part of heat flux from core.

Reconstruction of past El Niño Southern Oscillation

A monthly resolved, 213-year stable isotope time series has been revealed from Guam coral, which documents significant oceanographic changes related to thermal and hydrologic variations in the northwestern equatorial region (Fig. 7a). Statistical analyses of the oxygen isotopes for the years 1790-2000 identified past ENSO events, demonstrating significant variability with ~3 to ~8-year periodicities. We also found decadal to inter-decadal variability with distinct climatic shifts from warmer to cooler conditions and vice versa (Fig. 7b). An accumulative decrease in the oxygen isotope time series may imply warming of sea surface temperature and freshening of seawater in this region over the last two centuries.

◀ Fig. 7a. Undersea drilling survey of coral.

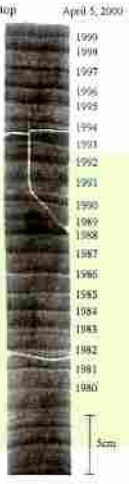
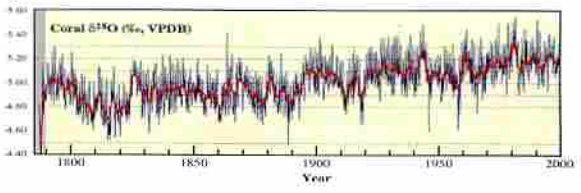
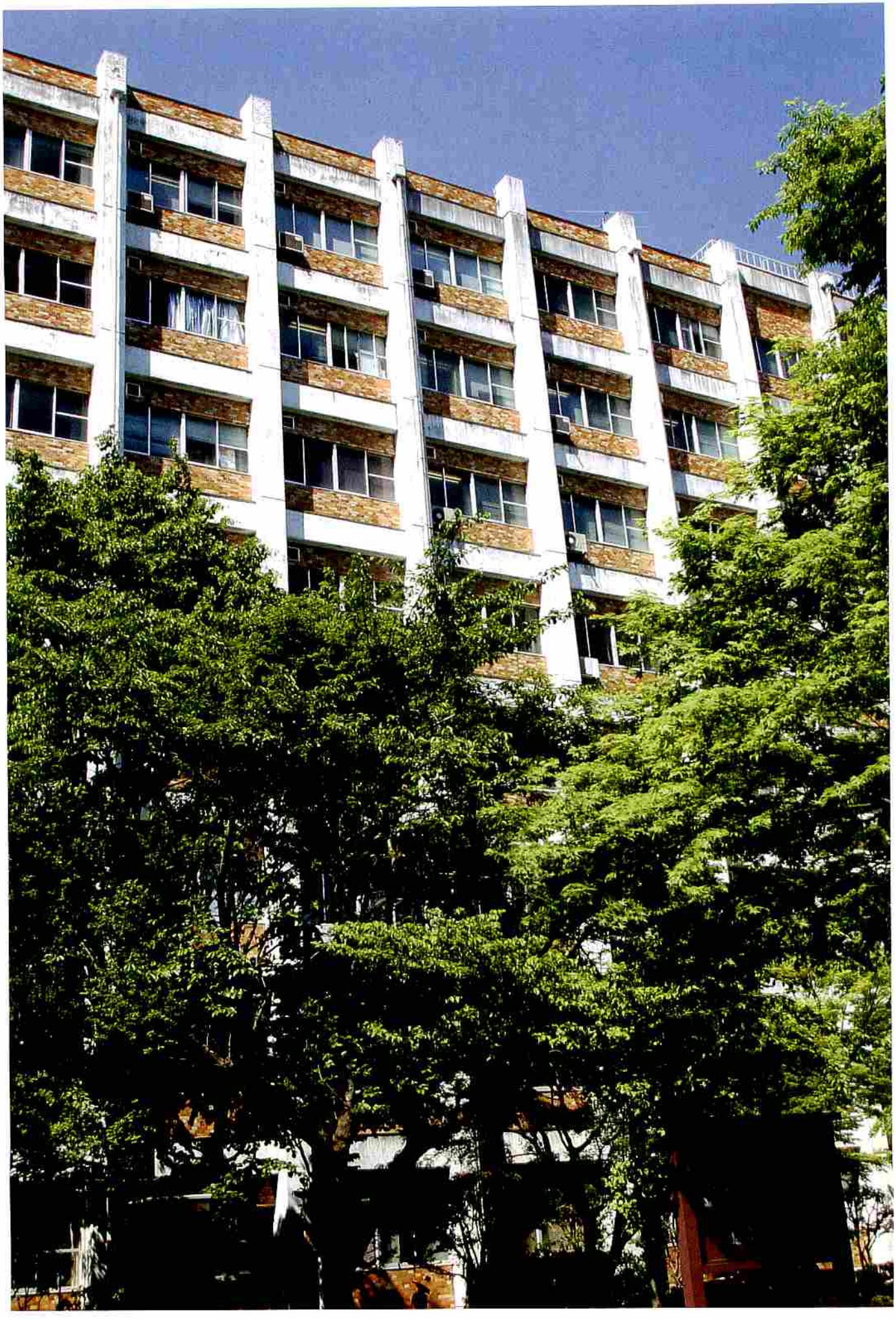


Fig.7b. ▶ X-radiograph image of coral skeletons. Well-developed annual growth bandings can clearly be observed. Data from Asami et al. (2004).

Fig. 7c. Time series of oxygen isotope composition from Guam coral for years 1787-2000 (blue: monthly data, red: 25-month moving average). Data from Asami et al. (2005).





Departments

Department of Mathematics

Department of Physics

Department of Astronomy

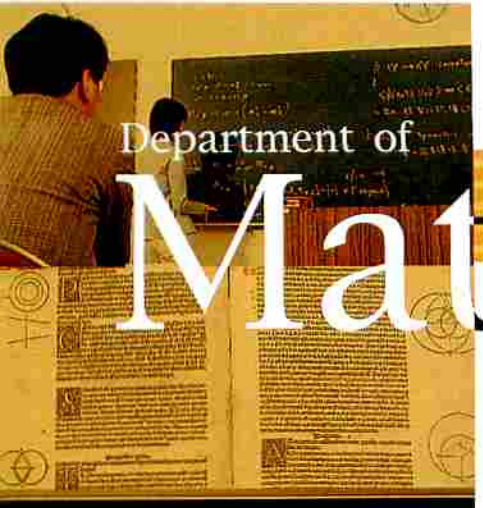
Department of Geophysics

Department of Chemistry

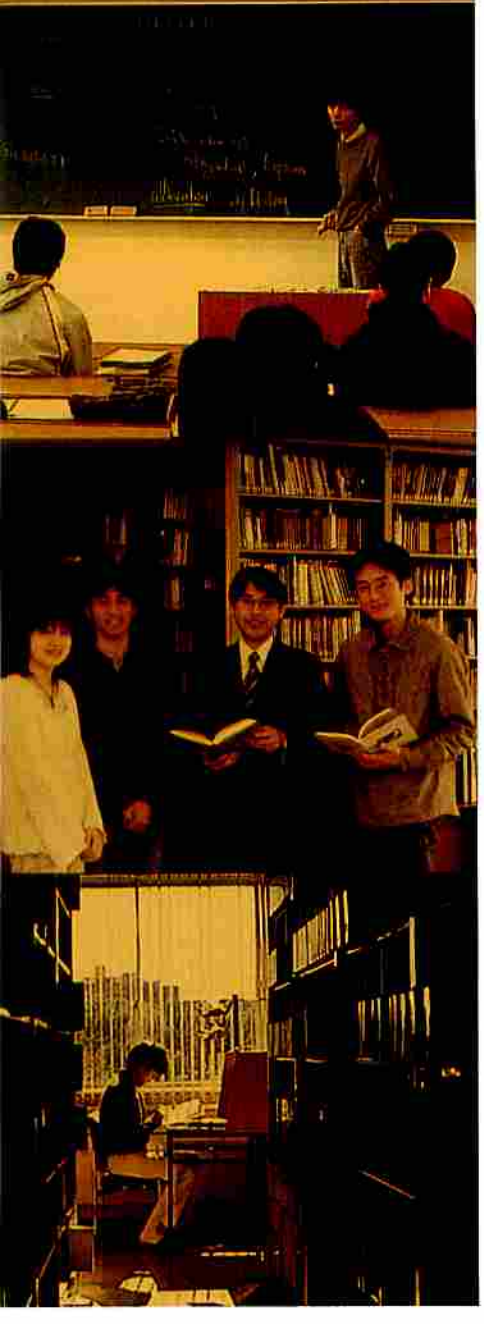
Department of Earth Science:
Geoenvironmental Science

Department of Earth Science:
Earth and Planetary Materials Science

Department of Biology



Department of Mathematics



Introduction

Mathematical points of view are important in several scientific fields. The most typical example is Einstein's general theory of relativity, which can clearly be explained using the theory of Riemannian geometry. Many other theories in physics, chemistry, biology, information science, technology, and social science can be explained from a mathematical perspective.

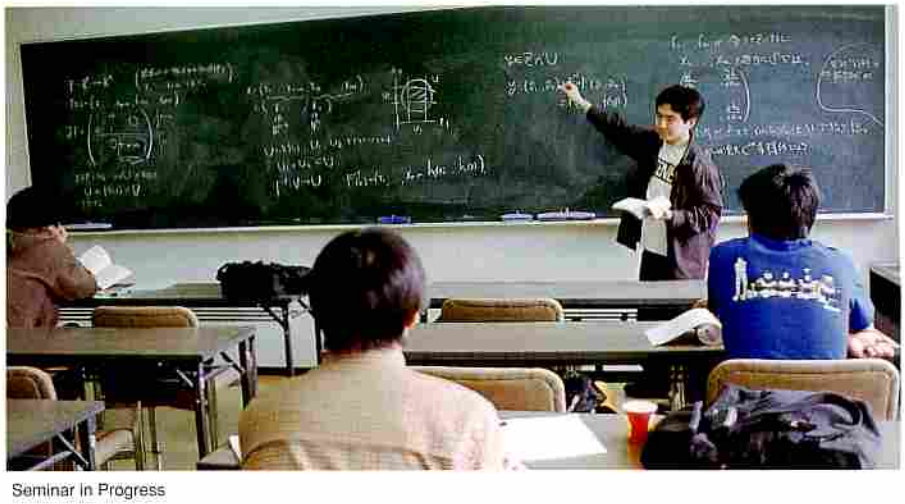
The Mathematical Institute of Tohoku University was established in 1911, and a great deal of excellent work has emanated from this institute. For example, Professor Tadao Tannaka, who is famous for his duality theorem, and Professor Shigeo Sasaki, who is known for his manifold theory, studied ultra-modern subjects in their days at this institute. At present, many researchers, including staff and graduate students, are actively studying within such fields as algebra, analysis, and geometry.

Our institute's library possesses more than 60,000 books and journals on mathematical studies, which is one of the largest on mathematics in Japan. Researchers and students can study without being inconvenienced in this environment. Moreover, our institute publishes the "Tohoku Mathematical Journal", which is one of the most authoritative journals on mathematics. This was the first international journal in Japan on mathematical studies and began being published at the same time the institute was established.

Tohoku Mathematical Journal

Mathematical Institute, Tohoku University

1. Algebra
2. Geometry
3. Analysis
4. Manifold Theory
5. Applied Mathematics



Seminar in Progress

Contact

▶ Phone +81-22-795-6401
▶ Facsimile +81-22-795-6400
▶ Email web-admin@math.tohoku.ac.jp
▶ URL http://www.math.tohoku.ac.jp/english/

Undergraduate Studies, Graduate Studies

The undergraduate program, which consists of Subjects Common across Campus (zenngaku-kyoiku kamoku) and Specialized Subjects (senmonn-kamoku), continues for four years. Until their third year in Specialized Subjects on Mathematics, students can take introductory lectures and voluntary seminars on subjects such as Algebra, Geometry, and Analysis. Fourth-year students can take part in lectures and seminars on specialized fields in mathematics. Students in the master's (or doctoral) program study for a required standard period of two years (or three for doctoral) after finishing their undergraduate (or master's) program. They are required to complete 30 (20) credits toward subjects in their graduate course and a master's (doctoral) thesis. Those who fulfill the requirements and pass the final oral examination are awarded a "Master (or Doctor) of Science Degree". During their period of study they are encouraged to take part in lectures and seminars in mathematics and study their fields of specialization in more depth. They are expected to do individual research and obtain advice from supervisors.

(Basic and Advanced) Subjects

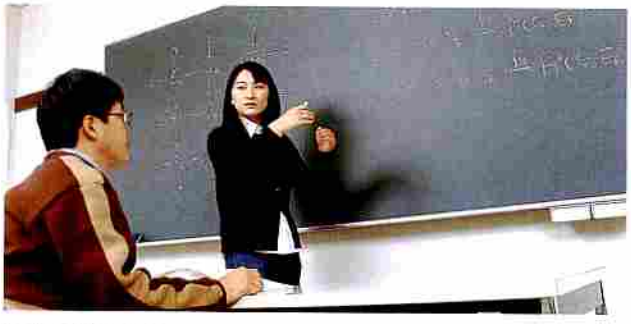
1. Introductory lectures
   Calculus, Linear algebra, Set theory, and General topology
2. Algebra
   Group theory, Ring and ideal, and Field theory
3. Geometry
   Manifold theory, Differential geometry, and Topology
4. Analysis
   Complex analysis, Lebesgue integral, Differential equations, and Functional analysis
5. Computer programming
6. Actuarial Mathematics for insurance
7. Seminars

Master's Program

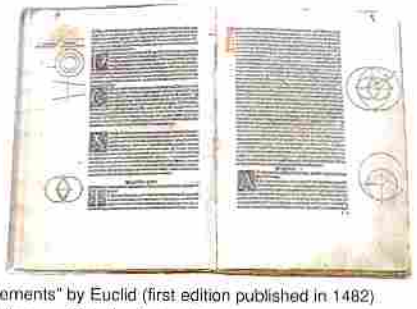
Geometric group theory
Advanced Functional Analysis and Fourier Analysis
Introduction to Modern Theory of Partial Differential Equations
Introduction to Homological Algebra
Geometric variational convergences
Stochastic Processes
Introduction to Oscillatory Integrals
Introduction to complex differential geometry
Introduction to Nonlinear Analysis
Introduction to Mathematical Logic

Doctoral Program

Introduction to Homological Algebra
Introduction to complex differential geometry
Geometric variational convergences
Advanced Functional Analysis and Fourier Analysis
Geometric group theory
Introduction to Nonlinear Analysis
Introduction to Oscillatory Integrals
Modern Theory of Partial Differential Equations
Stochastic Processes
Introduction to Mathematical Logic



Seminar in Progress



"Elements" by Euclid (first edition published in 1482) in Library of Tohoku University

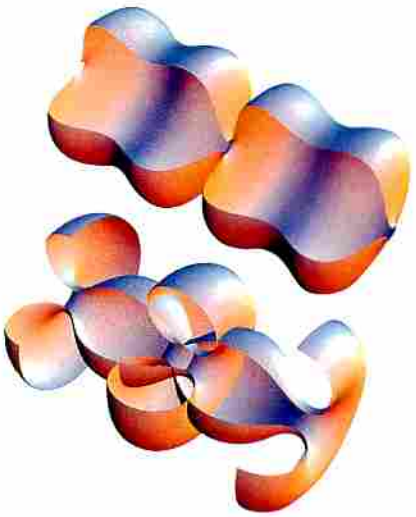
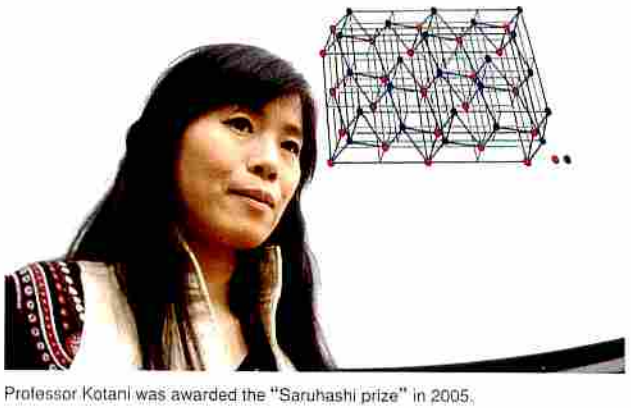


Figure to explain Studies done by Professor Kenmotsu



Professor Kotani was awarded the "Saruhashi prize" in 2005.

Professors

Shigetoshi BANDO.
His research interests include differential geometry with analytical methods. He is particularly interested in Einstein metrics on real manifolds, Einstein-Kaehler metrics, and Einstein-Hermitian metrics on holomorphic vector bundles.

Masaki HANAMURA.
His research interests include algebraic geometry. He is particularly interested in algebraic cycles, cohomology theories, and the theory of motifs.

Tetsuya HATTORI.
His research interests include mathematical physics and probability theory with emphasis on renormalization group approaches.

Masanori ISHIDA.
His research interests include algebraic geometry varieties. He is particularly interested in complexes of modules associated with toric algebraic varieties.

Katsuei KENMOTSU.
His research interests include differential geometry. He is particularly interested in submanifold geometry, which includes minimal surfaces, constant mean curvature surfaces, and submanifolds with parallel mean curvature in various spaces.

Motoko KOTANI.
Her research interests include differential geometry. She is particularly interested in harmonic maps and related topics. She is also interested in graph theory.

Hideo KOZONO.
His research interests include mathematical physics and functional analysis.

Yasuo MORITA.
His research interests include arithmetic geometry and number theory. He is especially interested in the arithmetic of rational and integral points on algebraic varieties.

Tetsuo NAKAMURA.
His research interests include algebraic number theory. He is particularly interested in abelian varieties (including elliptic curves) and formal groups over algebraic number fields and over local fields.

Seiki NISHIKAWA.
His research interests include differential geometry. He is particularly interested in geometric variational problems, i.e., nonlinear problems arising in geometry and topology studied from the point of view of global analysis.

Takayoshi OGAWA.
His research interests include real analysis, harmonic analysis and applied analysis related to partial differential equations.

Takashi SHIOYA.
His research interests include Riemannian geometry and global analysis. He is especially interested in convergence of Riemannian manifolds, geometry and analysis on metric spaces.

Izumi TAKAGI.
His research interests include nonlinear partial differential equations. He is particularly interested in reaction-diffusion equations, which model biological pattern formations and mathematical models of shape transformation in red blood cells.

Toyofumi TAKAHASHI.
His research interests include algebraic number theory. He is particularly interested in Galois cohomology over number fields and the theory of Drinfeld modules over function fields.

Masayoshi TAKEDA.
His research interests include probability theory. He is particularly interested in symmetric Markov processes generated by Dirichlet forms and large deviation theory.

Kazuyuki TANAKA.
His research interests include mathematical logic and the theory of computation. He is more specifically interested in models of first and second order arithmetic, reverse mathematics, descriptive set theory, and higher-order computation.

Eiji YANAGIDA.
His research interests include nonlinear analysis, particularly reaction-diffusion systems, nonlinear parabolic and elliptic problems, and dynamical systems.

Akihiko YUKIE.
His research interests include invariant theory and number theory.

Associate Professors

Yohji AKAMA.
His research interests include constructive mathematics.

Hirayuki CHIHARA.
His research interests include partial differential equations. He is particularly interested in initial value problems for dispersive-type equations describing nonlinear waves.

Koji FUJIWARA.
His research interests include geometric group theory, hyperbolic groups, Bass-Serre theory, and ergodic theory for discrete groups.

Nobuo HARA.
His research interests include commutative algebra and algebraic geometry. He is particularly interested in ring-theoretic studies of singularities of algebraic varieties in positive characteristic.

Kazuhiro ISHIGE.
His research interests include partial differential equations. He is particularly interested in parabolic equations.

Hiroyasu IZEKI.
His research interests include differential geometry. He is particularly interested in conformally flat manifolds and Kleinian groups from the viewpoint of the conformal geometry of the ideal boundary.

Makoto NAKAMURA.
His research interests include partial differential equations. He is particularly interested in nonlinear dispersive equations.

Shoetsu OGATA.
His research interests include algebraic geometry. He is particularly interested in the topological investigation of cusp singularities and degenerations of curves.

Satoru SHIMIZU.
His research interests include several complex variables. He is particularly interested in the geometry of complex bounded domains with groups of automorphisms including Reinhardt domains and tube domains.

Sumio YAMADA.
His research interests include geometry and partial differential equations. He is particularly interested in: 1) the harmonic map and its applications in understanding the geometry of moduli spaces, 2) minimal subvarieties, and 3) general relativity.

Takeshi YAMAZAKI.
His research interests include mathematical logic. He is particularly interested in models of first and second order arithmetic, reverse mathematics, and computability theory.

Lecturers

Koji HASEGAWA.
His research interests include representation theory and its application to integrable systems. He is currently working on quantum groups, the Yang-Baxter equation, and two-dimensional solvable lattice statistical models.

Research Associates

Kazuhiro HORIHATA.
His research interests include nonlinear partial differential equations. He is particularly interested in their application to differential geometry and physics such as harmonic mapping on Minkowski space and Ginzburg-Landau equations.

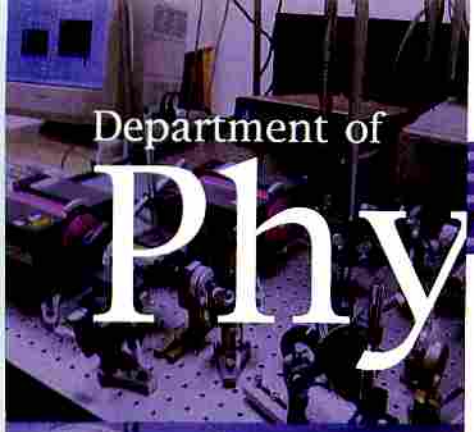
Takeshi KAJIWARA.
His research interests include arithmetic algebraic geometry. He is particularly interested in algebraic geometry with logarithmic structures, which includes degenerations of algebraic varieties and compactifications of various moduli spaces.

Gen KUROKI.
His research interests include representation theory and mathematical physics. He is particularly interested in 2-dimensional conformal field theory, quantum integrable systems, and the geometric Langlands program for complex algebraic curves.

Koichi NAGANO.
His research interests include Riemannian geometry. He is especially interested in spaces with non-positive curvature [in the sense of/based on studies done by?] A.D. Alexandrov.

Atsushi SATO.
His research interests include number theory. He is particularly interested in rational points on algebraic varieties defined over algebraic number fields, and Diophantine geometry.

Tokushi SATO.
His research interests include nonlinear partial differential equations. He is particularly interested in singular solutions to semilinear elliptic equations in Euclidean spaces and the structure of solution spaces by means of nonlinear functional analysis.



Department of Physics

Introduction

The Department of Physics at Tohoku University is one of the oldest and largest in Japan, having almost a 100-year history since the university's foundation in 1907 and it now has a faculty of more than 160 professors and about 250 students in the graduate school. Not only the faculty members but also those from research institutes and laboratories are actively involved in the school's programs. Research in our department covers all physics fields from particle and nuclear physics to condensed-matter physics, and extends even further to biophysics and industrial physics. Our graduate students are undertaking world-class research at the highest levels at the frontiers of physics under the guidance of their experienced supervisors. The advanced research facilities of our Department assist in their activities. Our Department ranks second in Japan and thirteenth in the world in physics in 2005 according to a report by ISI Web of Science.

Our Department is currently conducting a 21st century center of excellence (COE) program, Exploring New Science by Bridging Particle-matter Hierarchy, in collaboration with Department of Astronomy and Department of Mathematics of Tohoku University. This COE program is supported by the Ministry of Education, Science, Sports and Technology (MEXT) of Japan. The aim of the program is to train and educate young researchers who will be world leaders in basic science fields in the next several decades. The program actively promotes international collaboration and education, in particular, for young researchers. Many young researchers and students from all over the world are participating in a variety of international programs/projects supported by the COE program and are presently engaged in world-class research at the highest levels.

Organization

Graduate School of Science
Department of Physics

Related Institutes
- Center for Low Temperature Science
- Research Center for Neutrino Science
- Laboratory of Nuclear Science
- Cyclotron and Radioisotope Center

Related Institutes in Tohoku University
Institute for Materials Research
Institute of Multidisciplinary Research for Advance Materials

Other Related Institutes and Organization
Japan Atomic Energy Agency
High Energy Accelerator Research Organization
NTT Basic Research Laboratories

Educational Programs

Undergraduate Programs (Department of Physics)

Graduate Programs (Department of Physics and related institutes)
- Master's Program
- Doctoral Program

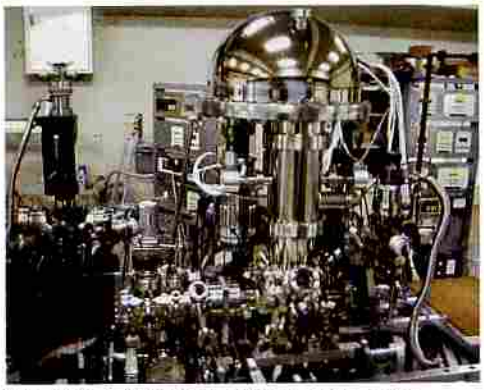
Multi-scale Natural Science Program (IGPAS)

Undergraduate Studies

Undergraduate course is a four-year program. During the first three semesters, students are assigned collectively to the Division of Physical Sciences (Physics, Astronomy, and Geophysics) and taught basic mathematics and physics (classical mechanics, electromagnetism, and thermodynamics). After being assigned to the Department of Physics, the program starts with Quantum Mechanics and Statistical Physics as fundamentals of modern physics, as well as laboratory studies. Specific subjects such as particle, nuclear, and condensed matter physics are then taught. Students join one of the research groups of the department in the final year to earn the bachelor's degree. The course aims at both preparing students in the basics necessary for graduate studies and providing sound basic scientific knowledge for employment in industry.

Subjects

Classical Mechanics, Thermodynamics, Mathematics for Physics, General Physics, Analytical Mechanics, Theory of Waves, Symmetry in Physics, Electromagnetism, Electrodynamics, Relativity, Quantum Mechanics, Relativistic Quantum Mechanics, Statistical Mechanics, Physics Experiments, Computational Physics, Nuclear Physics, Elementary Particle Physics, Cosmology, Condensed Matter Physics, Optics, Biophysics, Fluid Mechanics, Continuum Mechanics, Astrophysics, Plasma Physics, Scientific Article Reading, Information Science, Scientific English, History of Science, Studies in Physics, and Seminars.



Ultra-high-resolution photoemission spectrometer

High-resolution hypernuclear spectroscopy by the (e,e'K) reaction, JLab E01-011 experiment

Graduate Studies

The graduate course consists of the two-year's master program followed by the three-year doctoral program. Graduate students can choose from a broad range of advanced subjects on modern physics and related areas of science offered by our graduate school to acquire advanced skills and knowledge under the guidance of a thesis or dissertation supervisor. The lectures in the center of excellence (COE) program are delivered in English.

Master's Program Subjects

Quantum Field Theory, Elementary Particle Physics, Nuclear Physics, Mathematical Quantum Mechanics, Astrophysics, Intermediate Energy Physics, High-energy Physics, Electronic Properties of Materials, Condensed Matter Physics, X-ray and Neutron Physics, Low Temperature Physics, Spectroscopy of Solids, Physics on Photonic and Electronic Excitation, Optical Properties of Materials, Chemical Physics, Solid-state Physics, Statistical Physics, Properties of Biological Material, Cell Biology, Nuclear Reactions, Electron-nuclear Physics, High-energy Nuclear Physics, Accelerator Physics, Physics of Crystals, Surface Physics, Metal Physics, Magnetic Properties of Materials, Electronic Properties of Metal, Spectroscopy, Physics on Diffraction and Spectroscopy, Radiation Physics, Strongly-correlated Electron Systems, Accelerator Science, Actinide Physics, Quantum Optics on Lasers, Specialized Lectures on Condensed Matter Physics, Specialized Lectures on Particle and Nuclear Physics, Specialized Lectures in 21st Century COE Program, and Master's Seminars on Physics.

Doctoral Program Subjects

Fundamental Quantum Physics, Particle and Nuclear Physics, Electron Physics, Quantum Solid-state Physics, Solid-state and Statistical Physics, Physics on Correlated Systems, Interdisciplinary Physics, Nuclear Physics, High-energy Physics, Physics of Crystals, Metal Physics, Spectroscopy, Radiation Physics, Advanced Lectures on Elementary Particle Physics, Advanced Lectures on Nuclear Physics, Advanced Lectures in 21st century COE Program, and Doctoral Seminars on Physics.

High-Resolution Stimulated Brillouin Spectroscopy System

Contact

▶ Phone +81-22-795-6494
▶ Facsimile +81-22-795-6498
▶ Email kyomu@mail.phys.tohoku.ac.jp
▶ URL http://www.phys.tohoku.ac.jp/

Research Groups

Particle and Nuclear Theory

(i) Theoretical Nuclear and Particle Physics

●*Particle Theory*

Keywords : Particle physics - elementary particles and their interactions, physics beyond the standard model, supersymmetry, extra space dimensions, grand unification, dynamics of QCD and gauge theories, spontaneous symmetry breaking, superstring theory, non-commutative geometry, particle cosmology, and field theoretical approach to condensed matter physics

URL: http://www.tuhep.phys.tohoku.ac.jp/

●*Nuclear Theory*

Keywords : Heavy-ion reactions, quantum tunneling phenomena, structure and reaction of unstable nuclei, nuclear astrophysics, quantum many-body theory, superheavy elements, phase transition in finite systems, and hadron physics

URL: http://www.nucl.phys.tohoku.ac.jp/index-e.html/

Condensed Matter Theory

(i) Theoretical Condensed Matter Physics

●*Theoretical Condensed Matter and Statistical Physics*

Keywords : Quantum many-body theory, correlated electron systems, physical properties of carbon nanotubes, density matrix renormalization group, fractional quantum Hall effect, correlation transport in quantum dots, soft materials, and nonlinear dynamics of complex systems

URL: http://www.cmpt.phys.tohoku.ac.jp/eng/

(ii) Metal Physics (Institute for Materials Research)

●*Quantum Condensed Matter Theory*

Keywords : High temperature superconductivity, nonlinear optics in strongly correlated materials, quantum phenomena in superconductors/ferromagnets and nano-hybrid structures

URL: http://www.maekawa-lab.imr.tohoku.ac.jp/index_e.html/

●*Quantum Transport Theory*

Keywords : Phase transition of strongly correlated systems, and disorder-induced antiferromagnetic long-range order

Experimental Nuclear and Particle Physics

(i) Experimental Nuclear and Particle Physics, High Energy Physics (Department of Physics and Research Center for Neutrino Science)

●*Experimental Particle Physics*

Keywords : CP violations, B-physics, BELLE, international linear collider, neutrino physics, neutrino geophysics/astronomy, and KamLAND

URL: http://www.awa.tohoku.ac.jp/

●*Experimental Nuclear Physics*

Keywords : Strangeness physics, hypernuclear spectroscopy, electromagnetic production of strangeness, hypernuclear gamma-ray spectroscopy, radioactive isotope beams, unstable nuclei, nuclear astrophysics, in-beam gamma spectroscopy using RI beams, and nuclear structure far from stability

URL: http://lambda.phys.tohoku.ac.jp/

●*Intermediate Energy Nuclear Physics*

Keywords : Photonuclear reactions, photo-meson production, mesons in nuclei, baryon resonance in nuclei, and strangeness in nuclei

URL: http://nuclear.phys.tohoku.ac.jp/

(ii) Nuclear Science (Laboratory of Nuclear Science)

●*Nuclear Science*

Keywords : 300-MeV electron Linac, 1.2-GeV stretcher booster ring (STB Ring), quark nuclear physics with tagged photons, photoproduction of pentaquark baryons, relativistic effects in nuclei, charge distribution of unstable nuclei, quantum tunneling in ultra-low energy nuclear physics, material science with radioisotopes, non-linear beam dynamics, and free electron laser (FEL)

URL: http://www.lns.tohoku.ac.jp/home/pamphlet/

(iii) Nuclear Radiation Physics (Cyclotron and Radioisotope Center)

●*Nuclear Radiation Physics*

Keywords : Cyclotron accelerator, on-line isotope separator, structure of unstable nuclei, gamma-ray spectroscopy, fast-neutron reactions, spin and isospin excitations, three-nucleon force effects, and alpha cluster structures

URL: http://www.cyric.tohoku.ac.jp/

(iv)Accelerator Science (Japan Atomic Energy Agency)

●*Accelerator Science*

Keywords : High-intensity proton accelerator, and detectors for large scale experiments

Condensed Matter Experiment 1

(i) Condensed Matter Physics — Electronic Properties and Strongly Interacting Many Particle Quantum Systems —

●*Microscopic Research on Magnetism*

Keywords : Magnetism of f-electron systems, multipolar interactions in rare-earth compounds, Mossbauer spectroscopy, and nuclear magnetic resonance

URL: http://www.nhpm.phys.tohoku.ac.jp/index_j.html

●*Materials Structure Physics*

Keywords : Synchrotron X-ray scattering, neutron scattering, orbital physics, and multipole ordering

URL: http://calaf.phys.tohoku.ac.jp/english/

●*Low-dimensional Quantum Physics*

Keywords : Organic conductors, nanoporous materials, biological systems, and electrodynamics

URL: http://ldp.phys.tohoku.ac.jp/

●*Photoemission Solid State Physics*

Keywords : High-resolution photoemission spectroscopy, high-temperature superconductors, strongly-correlated electron systems, and low-dimensional materials

URL: http://arpes.phys.tohoku.ac.jp/

●*Solid State Physics on Nano-network Solids*

Keywords : Nano-clusters composed of IVth-group elements, fullerenes and nanotubes, superconductivity appearing in C, Si, and Ge network solids, magnetism resulting from materials with nano-spaces, and narrow-band systems with unusual properties

URL: http://sspns.phys.tohoku.ac.jp/

●*Very Low Temperature Physics (Center for Low Temperature Science)*

Keywords : f-electron physics, quantum matter, charge order, orbital order, unconventional superconductivity, metamagnetism, electronic structures, high-quality single-crystal growth, quantum oscillation(de Haas-van Alphen effect), high-pressure, and high-field and low-temperature

URL: http://www.clts.tohoku.ac.jp/vlt/index.html/

(ii) Metal Physics (Institute for Materials Research and Low Temperature Science Division - Center for Low Temperature Science)

●*Superconductivity Physics*

Keywords : Copper oxide superconductors, organic superconductors, vortex, scanning probe microscopy/spectroscopy, and single-crystal growth

URL: http://ltp.imr.tohoku.ac.jp/

●*Condensed Spin Matter*

Keywords : Spin and lattice dynamics in high-Tc superconductors, magnetic properties in strongly correlated electrons systems, spin and lattice dynamics in dielectric materials, multipolar interactions in rare-earth compounds, neutron scattering, neutron science, synchrotron radiation x-rays, and mu-SR

URL: http://www.yamada-lab.imr.tohoku.ac.jp/

●*Nanostructured Materials*

Keywords : Carbon nanotubes, and organic transistors

●*High-magnetic-field Condensed Matter*

Keywords : Quantum nanomagnetism, THz-ESR, x-ray and neutron scattering, and material processing in magnetic fields

URL: http://www.hfpm.imr.tohoku.ac.jp/

●*Low Temperature Material Science - Center for Low Temperature Science*

Keywords : Spin-injection study in superconductor/ferromagnet junctions, vortex matter physics, heavy fermion system, and non-Fermi liquids

URL: http://ltsd.imr.tohoku.ac.jp/index-e.html/

(iii) Physics of Actinide Group (Japan Atomic Energy Agency)

●*Actinide Physics*

Keywords : Strongly correlated electronic states in actinide and transition metal compounds, magnetism,

SPring-8

superconductivity, multipolar effects, high-quality single-crystal growth, neutron and synchrotron radiation x-ray scattering, synchrotron radiation x-ray spectroscopy, and high-pressure

Condensed Matter Experiment II

(i) Quantum Condensed Matter Physics, Biophysics

● *Synchrotron Radiation and Photoelectron*

Keywords : Photoemission and inverse-photoemission spectroscopy, low-dimensional nano-structured metals, and synchrotron light

URL: http://srpe2.phys.tohoku.ac.jp/

● *Surface Physics*

Keywords : Elementary excitations at surfaces and growth of nano-structures at surfaces

URL: http://surface.phys.tohoku.ac.jp/

● *Laser Spectroscopy*

Keywords : Nonlinear laser spectroscopy, hole burning, Rayleigh and Brillouin scattering, phonon resonance, femtosecond time-resolved spectroscopy, and ultrafast dynamics in carotenoids

URL: http://www.laser.phys.tohoku.ac.jp/index-e.html/

● *Biophysics*

Keywords : Relationship between functions and physical properties in biomembranes, microscopic imaging of physical properties of membranes, dynamic structure of cells, and physics of biomotions

URL: http://www.bio.phys.tohoku.ac.jp/

● *Solid State Photophysics*

Keywords : Photonic crystal, metamaterials, ultra-fast phenomena, correlated electron systems, and photoinduced phase transition

URL: http://sspp.phys.tohoku.ac.jp/

(ii) Crystal Physics (Institute for Materials Research)

● *Lattice Defect Physics*

Keywords : Lattice defects, imperfections, nano-structures, semiconductors, and crystals

URL: http://www-lab.imr.tohoku.ac.jp/~wsuezawa/

● *Crystal Growth Physics*

Keywords : Crystal growth physics, solar cells, high-quality Si multi-crystals, multi-component bulk substrate crystals, Si thin film crystals, Si crystal lenses and mirrors, hetero-epitaxial structures with controlled stress, organic semiconductor thin film crystals, and protein crystals

URL: http://www.xtalphys.imr.tohoku.ac.jp/

● *Surface/Interface Science*

Keywords : Scanning tunneling microscopy (STM), low energy electron microscopy (LEEM), atomic force microscopy (AFM), surface structure, and thin film growth

URL: http://apfim.imr.tohoku.ac.jp/

(iii)Solid State Spectroscopy (Institute of Multidisciplinary Research for Advanced Materials)

● *Solid State Ion Physics*

Keywords : Superionic conductor, solid state ionics, glass transition, nuclear magnetic resonance (NMR), and laser optics

URL: http://www.tagen.tohoku.ac.jp/labo/kawamura/

● *Correlated-electron Solid State Physics*

Keywords : Novel magnetic properties and transition-metal compounds

URL: http://www.tagen.tohoku.ac.jp/labo/arima/index-j.html/

● *Electron-Crystallography and -Spectroscopy*

Keywords : Electron microscopy, -diffractometry and -spectroscopy

URL: http://xes.tagen.tohoku.ac.jp/

● *Structural Physics and Crystal Physics*

Keywords : Physical properties of materials based on crystal structures, including electronic structures, studied with diffraction techniques

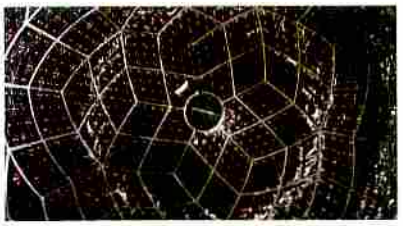
URL: http://www.tagen.tohoku.ac.jp/labo/noda/index.html/

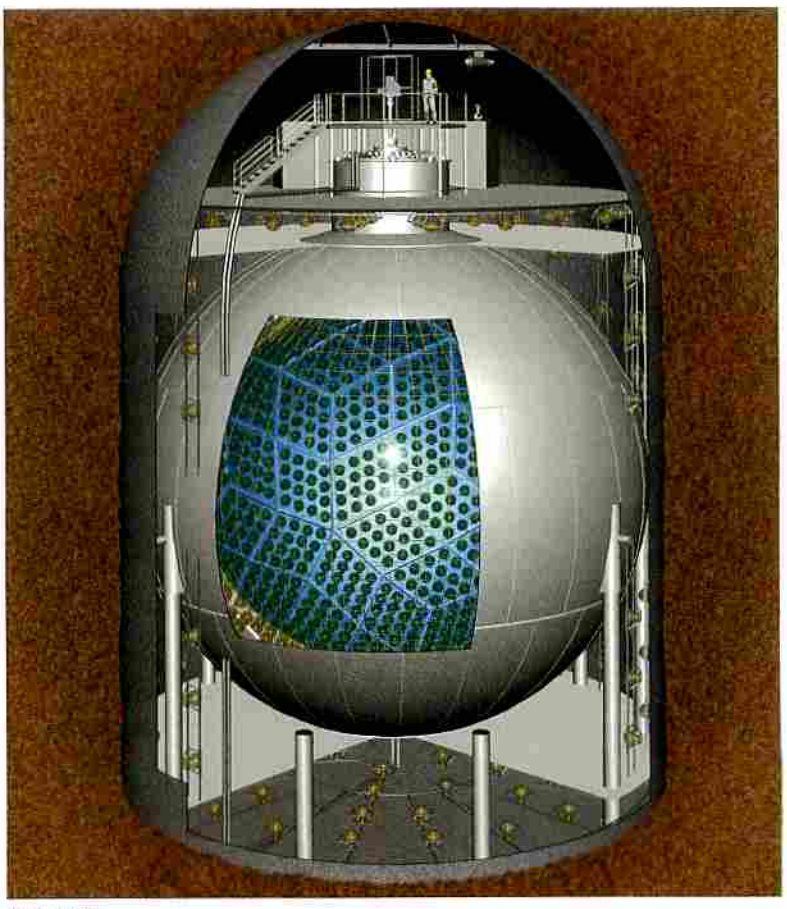
(iv) Laser Quantum Optics (NTT Basic Research Laboratories)

● *Quantum Sensing and Measurement*

Keywords : Quantum transport measurements, carrier and spin interactions, and mechanical sensing based on semiconductors

URL: http://www.brl.ntt.co.jp/E/organization/psrl/psrl.html/





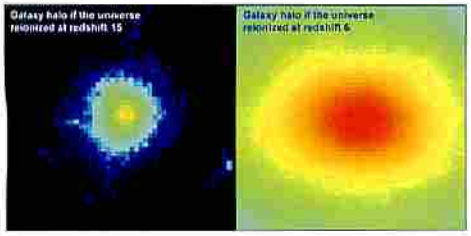
KamLAND

Department of

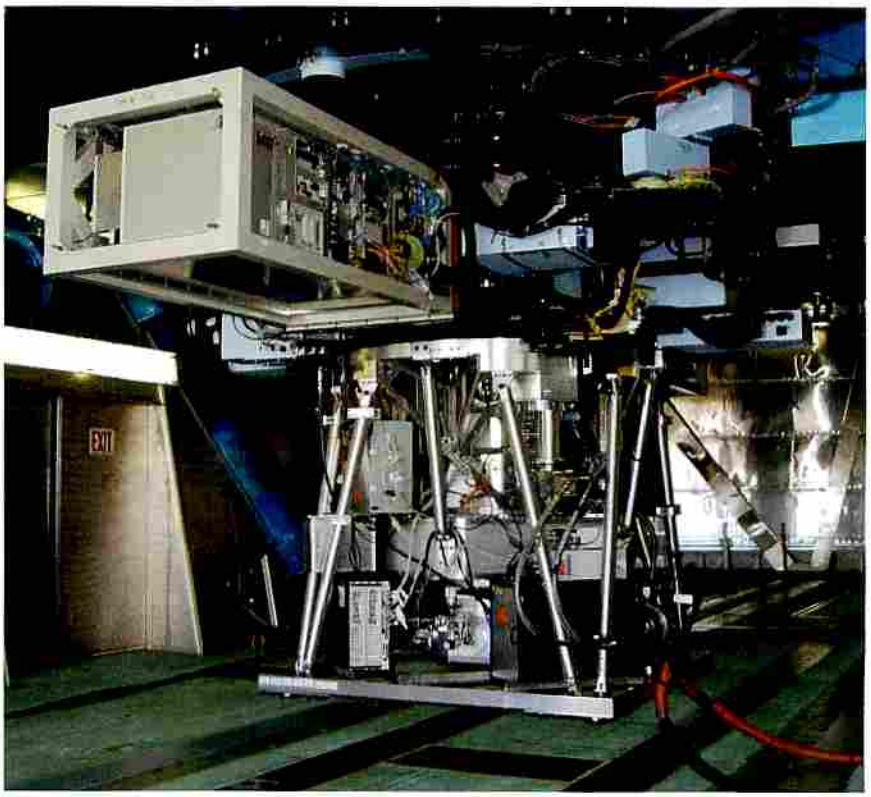
Astronomy

Introduction

The Astronomical Institute at Tohoku University includes faculty members, postdoctoral researchers, and students working on a wide variety of problems in astronomy and astrophysics; there are a total of about 80 members at present. Research in our institute is directed toward understanding the physical properties of stars, the interstellar medium, galaxies, clusters of galaxies, large-scale structures, and the history of the universe. These subjects are mainly studied in two ways. The first is through theoretical research, where models are created and/or analyzed to help understanding of a variety of fundamental astronomical phenomena on the basis of physics and mathematics, occasionally using computational resources such as super-computers. The second is through observational research, where cutting-edge observational facilities, including the 8.2-m Subaru Telescope at the 4,200-m summit of Mauna Kea on the island of Hawaii, are used to discover new phenomena in the universe, e.g., distant galaxies that have just formed from the relic, primeval gas of the Big Bang. In astronomy, the universe can be viewed through the window of electromagnetic waves at all wavelengths (radio, infrared, optical, and ultra-violet, and X-rays and gamma-rays), revealing the various aspects of each phenomenon.



Numerical simulation of galaxy formation



Subaru telescope and Multi-Object Infra-Red Camera and Spectrograph (MOIRCS) developed by members of our institute Credit : National Astromical Observatory of Japan

Contact

▶ Phone +81-22-795-6512
▶ Facsimile +81-22-795-6513
▶ URL http://www.astr.tohoku.ac.jp/~index-e.html/

Undergraduate Studies

Undergraduate education has primarily been organized to teach fundamental physics and basic mathematics, which are the basis of studying astronomy/astrophysics. The courses include Basic Mathematics, Mechanics, Thermodynamics, Statistical Mechanics, Electromagnetism, Quantum Mechanics, Theory of Radiation, and General Relativity. Introductory courses to astronomy/astrophysics are also provided.

Subjects

Stellar Physics
Interstellar Medium
Galaxy Astronomy
Extragalactic Astronomy
Cosmology
Instrumentation Development

Graduate Studies

Graduate students select their own research field and thesis supervisor and begin research. Subjects can be selected from a wide range of course subjects offered by the institute stuffs, i.e., stellar physics, interstellar physics, galactic astronomy, the cluster of galaxies, cosmology, and instrument development. Graduate students are also required to take a variety of advanced courses in astronomy/astrophysics.

Contact

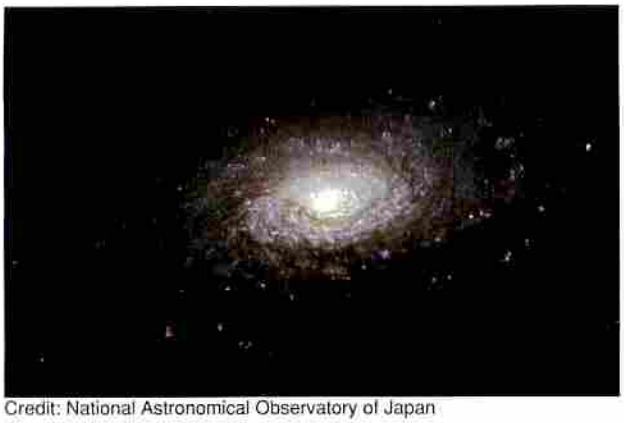
Tel : +81-22-795-6512
Fax : +81-22-795-6513
URL: http://www.astr.tohoku.ac.jp/index-e.html/

Subjects

Theoretical astrophysics (stellar physics, interstellar physics, galaxy dynamics, cluster of galaxies, cosmology, and general relativity)
Observational astronomy (stellar astronomy, interstellar astronomy, galactic astronomy, and observational cosmology)
Development of observational instruments

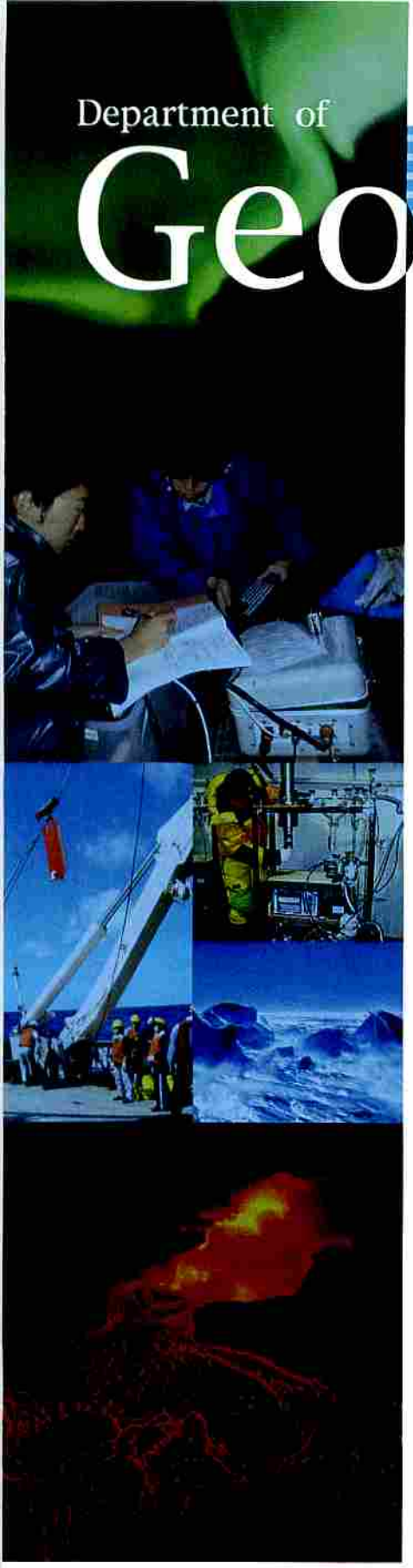
Related institute

National Astronomical Observatory of Japan (NAOJ)



Credit: National Astronomical Observatory of Japan

M42 Orion nebula taken with MOIRCS



Department of Geophysics

Introduction

The Department of Geophysics is a unique institution that pursues disciplines of Earth and planetary physics, and of related interdisciplinary sciences. It consists of three research fields on Solid Earth Physics (Field A), Atmospheric and Oceanic Sciences (Field B), and Planetary and Space Physics (Field C). They actively collaborate on education and research.

Field A

Field A mainly deals with seismology and volcanology and is aimed at improving predictive skills of earthquakes and volcanic eruptions to mitigate these hazards. Much effort has been expended to study the interior structures of Earth and their evolutionary dynamics, because both seismic and volcanic activities are deeply related to plate-techtonics.

Field B

Field B enhances understanding of atmospheric and oceanic variability based on geofluid dynamics and disciplines such as radiation, boundary layers, cloud physics, and air-sea interactions. Its goal is to improve the accuracy of weather, climate, and environment predictions. Global warming is of great concern to society.

Field C

Field C focuses on dynamical, photochemical, and electromagnetic phenomena in the upper atmosphere of Earth and other planets, with strong emphasis on the formation of the solar-planetary system. The planetary atmosphere and space plasma are investigated through our own radio/optical observations, space mission data, and numerical simulations.

To advance the research frontiers of geophysics, we develop and introduce innovative technologies. Intensive use of satellite remote sensing and other new instruments upgrades the earth observation system. Numerical simulations enable us to integrate various disciplines and reproduce the complex Earth system.

Undergraduate

Department of Astronomy and Geophysics

Graduate

Department of Geophysics
Research Center for Prediction of Earthquakes andVolcanic Eruptions
Center for Atmospheric and Oceanic Studies
Planetary Plasma and Atmospheric Research Center

Undergraduate Studies

The Department of Astronomy and Geophysics offers two major courses in astronomy and geophysics. The objective of undergraduate education in geophysics is to give students a broad scientific background to understand the structure and evolution of Earth and the solar-planetary system, environmental sciences, natural disasters, and earth resources. After studying basic physics and mathematics for three semesters, undergraduates undertake a course in geophysical experiments and attend various geophysics lectures. Senior students do research for graduation at laboratories under the supervision of faculty.

Basic subjects

Electromagnetism I and II
Exercises in Electromagnetism I and II
Exercises in Mechanics I and II
Electro-mechanics
Wave Theory
Analytical Dynamics
Fluid Dynamics
Exercises in Fluid Dynamics
Mechanics of Elastic Bodies
Exercises in Mechanics of Elastic Bodies
Statistical Physics I and II
Exercises in Statistical Physics I and II
Quantum Mechanics I, II, and III
Exercises in Quantum Mechanics I, II
Physics and Symmetry
Computer Physics
Theory of Relativity I
Experimental Physics I and II
Introduction to Communication Science
Communication Science I and II
Nuclear Physics I
Elementary Particle Physics I
Condensed Matter Physics I
Physics of Earth's Interior
Experiments in Geophysics I and II
Seismology
Crust Physics
Exercises in Crust Physics
Meteorology
Physical Oceanography
Space Physics
Planetary Atmosphere Physics
Exercises in Planetary Atmosphere Physics
Astrophysics I, II, and III
Astronomical Measurement I
Practice in Astronomical Measurement I
Stellar Astrophysics I
Astronomical Observation
Selected Topics on Astronomy A and B
Physical Chemistry of Earth' Interior
Introduction to Earth and Planetary Physics I
Climatology I and II
Biophysics
English in Science

Advanced subjects

Physics of Earthquake Sources
Exercises in Physics of Earthquake Sources
Physical Volcanology
Dynamical Oceanography
Atmospheric Dynamics
Atmospheric Physics
Climate Physics
Plasma Physics
Ionospheric and Magnetospheric Physics
Exercises in Ionospheric and Magnetospheric Physics
Introduction to Earth and Planetary Physics II
Interstellar Physics
Physics of Galaxies and Universe I and II
Astronomical Measurement II
Selected Topics on Astronomy C, D, E, and F
Studies on Astrophysics and Geophysics
Stellar Astrophysics II
Seminar on Astrophysics
High-energy Astronomy
Cosmology
Thermodynamics of Earth and Planets
Relativistic Quantum Mechanics
Atomic and Molecular Physics
Condensed Matter Physics II and III
Statistical Physics III
Optics
Nuclear Physics II
Special Course on Solid State Physics
Elementary Particle Physics II
Relativistic Quantum Mechanics
History of Science I and II

Graduate Studies

The objective of graduate education is to provide advanced knowledge and research skills on geophysics to students who will work as scientists and engineers on the research front or as specialists in industrialized society. The staff of both the department and three affiliated facilities (Research Center for Prediction of Earthquakes and Volcanic Eruptions, Center for Atmospheric and Oceanic Studies, and Planetary Plasma and Atmospheric Research Center) cover wide geophysical research fields such as 1) seismology, volcanology, and Earth's interior, 2) boundary-layer meteorology and global atmosphere dynamics, 3) air-sea boundary processes, large scale ocean-atmosphere interactions, geophysical fluid dynamics, and satellite oceanography, 4) plasma physics and upper atmospheric physics of Earth and the other planets, and 5) solar and planetary physics and planetary magnetospheres.

All graduate students can choose their thesis supervisor from our faculty or the three research centers at the time of enrollment. To complete the master's course in two years, students are required to attend advanced lectures and seminars. They must submit their master's thesis on their research project. Students who complete the course work and pass the final oral examination are awarded the Master of Science degree. The doctoral course is offered to graduate students who wish to acquire the expertise and broader range of knowledge required for leaders in academic and/or industrial research fields. To complete the doctor course in three years, students are required to attend special lectures and seminars. They must submit their doctor's dissertation on their special research project. Doctoral candidates are strongly encouraged to publish research papers in international academic journals. Students who complete the course work and pass the final oral examination are awarded the Doctor of Science degree.

Master's Programs

Advanced Lectures on Seismology
Advanced Lectures on Physics of Earthquake Source
Advanced Lectures on Crustal Physics
Advanced Lectures on Solid Earth Physics I and II
Advanced Lectures on Observational Seismology
Advanced Lectures on Physical Volcanology
Advanced Lectures on Observational Volcanology
Advanced Lectures on Solar System Physics
Advanced Lectures on Space Plasma Physics
Advanced Lectures on Planetary Atmosphere Physics
Advanced Lectures on Ionospheric and Magnetospheric Physics
Advanced Lectures on Upper Atmosphere Physics
Advanced Lectures on Planetary Radio Wave Physics
Advanced Lectures on Instrumentation in Space Research
Advanced Lectures on Atmospheric Physics
Advanced Lectures on Meteorology
Advanced Lectures on Atmospheric Dynamics
Advanced Lectures on Physical Oceanography
Advanced Lectures on Coastal Air-Sea-Land Interaction
Advanced Lectures on Atmospheric Radiation
Advanced Lectures on Climate Physics
Advanced Lectures on Satellite Oceanography
Advanced Lectures on Fluid Dynamics
Atmospheric Science
Advanced Physical Oceanography
Seminars on Geophysics
Geophysics Research for Master's Thesis

Doctor's Programs

Special Lectures on Solid Earth Physics
Special Lectures on Solar Planetary Physics
Special Lectures on Fluid Geophysics
Special Lectures on Climate System Physics
Special Lectures on Atmospheric and Oceanic Variability
Special Seminars on Geophysics
Geophysics Research for Doctoral Dissertation

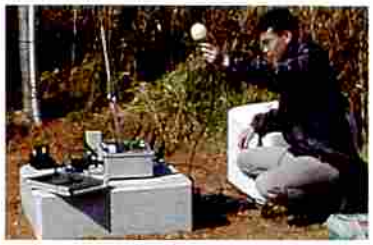
Contact

▶ Phone +81-22-795-6494
▶ Facsimile +81-22-795-6498
▶ URL http://www.geophys.tohoku.ac.jp/

Laboratories

● *Solid Earth Physics Laboratory*

Keywords : Structure and evolution of solid Earth, seismology, seismic wave propagation, earthquake source process, and volcanic eruption.
URL: http://www.zisin.geophys.tohoku.ac.jp/index.html/



Development of spacecraft-borne equipment

● *Atmospheric Science Laboratory*

Keywords : Meteorology, hydrology, planetary boundary layer, land-atmosphere interaction, turbulence, vegetation, remote sensing, evapotranspiration, atmospheric dynamics, numerical weather prediction, general circulation model, chemical transport model, nonhydrostatic model, cloud resolving model, cyclone, typhoon, monsoon.
URL: http://wind.geophys.tohoku.ac.jp/

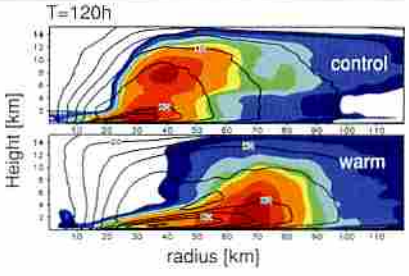


Fig.1 Axisymmetric structure of ideal typhoon simulated in cloud resolving model. Upper and lower panels indicate control and warm rain simulations, respectively. Warm rain is without ice (or snow) phase. Contours and colors indicate tangential wind speeds (m/sec) and condensed water substance (kg/m3), respectively. Ice phase was found to significantly change structure of typhoon.

● *Earth Environmental Physics Laboratory (Physical Oceanography Group)*

Keywords : large-scale ocean-atmosphere interaction, water mass formation process, oceanic general circulation, VOS monitoring, Argo float, El Nino/Southern Oscillation, decadal-scale variation, the Kuroshio
URL:http://www.pol.geophys.tohoku.ac.jp/index-j.html/

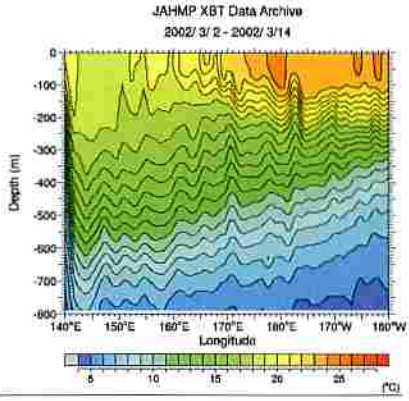
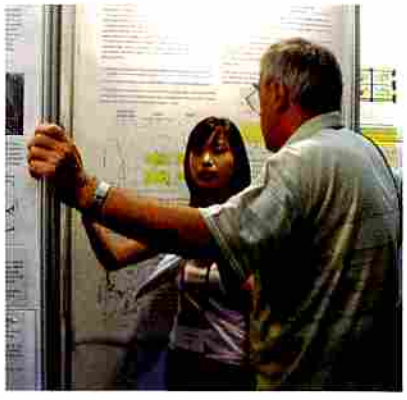


Fig.2 XBT temperature cross section between Japan and Hawaii obtained by Japan-Hawaii Monitoring Project (JAHMP)



Observation at Mauna Loa in Hawaii

● *Planetary Plasma Physics Laboratory*

Keywords : Plasma waves, wave particle interaction, surface and subsurface sounding of moon and planets, ground based observation of radio waves, theory and simulation, Akebono satellite, SELENE spacecraft, Jovian decameter radiation, solar radio bursts, inner-magnetosphere, primitive solar nebula
URL: http://stpp1.geophys.tohoku.ac.jp/

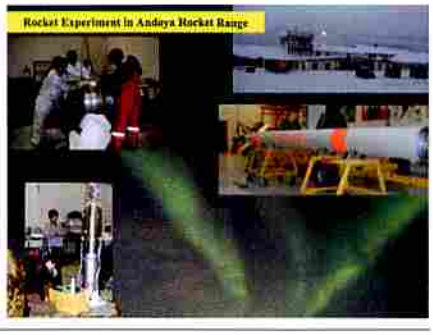


Fig.3 Sounding Rocket Experiment at the Andøya Rocket Range, in Norway

● *Planetary Atmosphere Physics Laboratory*

Keywords : Planetary atmosphere, Venus, Earth, Mars, Jupiter, aurora, sprites, elves, magnetosphere, ionosphere, upper atmosphere,middle atmosphere, ozone
URL: http://pat.geophys.tohoku.ac.jp/

Department of Chemistry

Introduction

Tohoku Imperial University, predecessor to the present-day Tohoku University, was established in June, 1907, by combining the Science College of Sendai and the Agricultural College of Sapporo. The original College of Science consisted of the Departments of Mathematics, Physics, and Chemistry. The Chemistry Department had three professors, and in 1911, eight students enrolled. In 1919, the College of Science became the School of Science. In 1949, following the end of World War II, Tohoku Imperial University became Tohoku University. In the 80 years since its founding, it has grown to accommodate a total of ten schools, twelve research departments, seven laboratories, and three university hospitals, becoming one of the most prestigious institutions in Japan. Researchers from around the nation also utilize its state-of-the-art facilities to carry out their own projects. The Chemistry Department, with its 65-member faculty, is the largest in the nation. As seventy-three students are accepted each year by the chemistry department, this means that there is almost a 1:1 student/teacher ratio, thus creating a highly conducive environment for student research and study.

The members of the Department of Chemistry are all instilled with a strong desire to seek out and investigate the unknown, and many of our most outstanding scientists have left a legacy of important work in their respective fields. Majima Riko, Akabori Shiro and Nozoe Tetsuo, all recipients of the National Culture Award of Japan, are three of the most distinguished former members of our faculty.

The Chemistry Buildings for the Chemistry Department were constructed in 1972 at the Aobayama Campus and house the Research Building, Student Experiments Building, and the Instrumental Analysis Center for Chemistry, covering an area of approximately 10,000 square meters. Surrounded by green forests, it is based on a high top of a hill overlooking the pristine waters of the Hirose River with a magnificent view of Sendai and the surrounding countryside. The Pacific Ocean lies to the east, the Zao Mountain Range to the southwest, Izumigatake to the northwest, and the Ou Mountains rise in the north.

Undergraduate

Faculty of Science
Department of Chemistry

Graduate

Graduate School of Science
Department of Chemistry

Research and Analytical Center for Giant Molecules

Closely Related Organization

Institute of Mutidisciplinary Research for Advanced Materials (Tohoku University)

Institute for Materials Research (Tohoku University)

Graduate School of Life Sciences (Tohoku University)

Japan Atomic Energy Research Institute

Tohoku National Industrial Research Institute

Contact

- Phone +81-22-795-6601
- Facsimile +81-22-795-3681
- Email chem-jm@bureau.tohoku.ac.jp
- URL http://www.chem.tohoku.ac.jp/index-e.html/

Undergraduate Studies

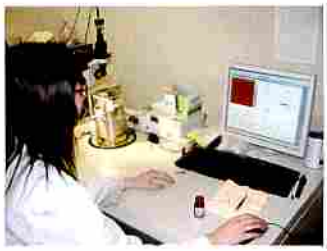
Undergraduate education in our department has been organized to provide students a broad background in the field of Inorganic Chemistry, Analytical Chemistry, Organic Chemistry, Physical Chemistry, Polymer Chemistry, Radiochemistry, and Biochemistry.

Basic Subjects

Inorganic Chemistry, Analytical Chemistry, Organic Chemistry, Physical Chemistry, Theoretical Chemistry, Polymer Chemistry, Radiochemistry, and Biochemistry.

Advanced Subjects

Inorganometallic Chemistry, Nano-sciences on Advanced Metal Complexes, Characterization of Molecules at Solid/Liquid and Liquid/Liquid Interfaces, Environmental Analytical Chemistry, Dynamic Natural Product Chemistry, Total Synthesis of Natural Products, Novel pi-Electronic Compounds, Chiral Lanthanide NMR Shift Reagents, Phase Change Dynamics Induced by Pulsed Laser Irradiation, Structures and Dynamics of Ultra-Cold Molecules and Clusters, Interaction Potential of Atoms/Molecules, Quantum Control of Photophysical Processes and Reaction Dynamics, Organometallic Chemistry, Organosilicon Chemistry, Porphyrins and Phthalocyanines, Design and Synthesis of Novel Catalyst Molecules, Nuclear and Radiochemistry, and Eukaryotic Transcription.



Graduate Studies

The department is devoted to the study of basic and advanced inorganic, analytical, organic, physical, and biochemistry, within the divisions of Inorganic and Analytical Chemistry, Organic Chemistry, Physical Chemistry, and Interdisciplinary Chemistry. Graduate students can choose from a wide range of course subjects offered by the departmental and research institute staff. Students can select their thesis supervisor from either departmental or research institute staff.

Master's Program

Topics in Inorganic and Analytical Chemistry, Current Topics in Inorganic and Analytical Chemistry, Topics in Organic Chemistry, Current Topics in Organic Chemistry, Topics in Physical Chemistry, Current Topics in Physical Chemistry, Topics in Interdisciplinary Chemistry, Current Topics in Interdisciplinary Chemistry, Topics in Biochemistry and Biophysics, Current Topics in Biochemistry and Biophysics, Topics in Advanced Atomic and Molecular Chemistry, Current Topics in Advanced Atomic and Molecular Chemistry, Topics in Reaction Mechanism and Dynamics, Topics in Solid-State Chemistry, Topics in Biofunctional Chemistry, Topics in Separation Chemistry, Topics in Chemistry of Heavy Elements, Seminar, Research

Doctoral Program

Special Lecture in Chemistry I, II, III, & IV, Special Seminar in Inorganic and Analytical Chemistry, Special Seminar in Organic Chemistry, Special Seminar in Physical Chemistry, Special Seminar in Interdisciplinary Chemistry, Special Seminar in Biochemistry and Biophysics, Special Seminar in Advanced Atomic and Molecular Chemistry, Special Seminar in Reaction Mechanism and Dynamics, Special Seminar in Solid-State Chemistry, Special Seminar in Biofunctional Chemistry, Special Seminar in Separation Chemistry, Special Seminar in Chemistry of Heavy Elements, Special Research in Inorganic and Analytical Chemistry, Special Research in Organic Chemistry, Special Research in Physical Chemistry, Special Research in Interdisciplinary Chemistry, Special Research in Biochemistry and Biophysics, Special Research in Advanced Atomic and Molecular Chemistry, Special Research in Reaction Mechanism and Dynamics, Special Research in Solid-State Chemistry, Special Research in Biofunctional Chemistry, Special Research in Separation Chemistry, Special Research in Chemistry of Heavy Elements

Laboratories

Division of Inorganic and Analytical Chemistry

● *Laboratory of Inorganic Chemistry*

Keywords : Organo-transition Metal Chemistry, Metal-element Multiple Bond, and Dynamic Complex.

● *Laboratory of Analytical Chemistry*

Keywords : Molecule Recognition Based on Self-assembled Molecular Systems, SNPs Typing Based on a Oligo-DNA Duplex Containing an Abasic Site, and Nanoporous Alumina Membrane Containing Mesoporous Silica-Surfactant Nano-Composites.

● *Laboratory of Coordination Chemistry*

Keywords : Nano-sciences of Advanced Metal Complexes, Single-molecule and Single-chain Quantum Magnets, and Gigantic Optical Nonlinearity of Nano-wire Metal Complexes.

● *Laboratory of Environmental Chemistry*

Keywords : Petroleum, Chemical Speciation, and Metalloporphyrin.

Division of Organic Chemistry

● *Laboratory of Organic Chemistry*

Keywords : Bioactive Natural Products, Chemical Biology, and Protein Chemistry.

● *Laboratory of Synthetic and Structural Organic Chemistry*

Keywords : Novel Aromatic Chemistry, Extended π-electronic System, and Multi-functional Material Science.

● *Laboratory of Natural Product Chemistry*

Keywords : Natural Product Synthesis, Design of Bioactive Molecules, and Protein-ligand Interactions.

● *Laboratory of Fundamental Organic Chemistry*

Keywords : Determination of Absolute Configuration, Chiral NMR Shift Reagent, and Transition Metal Complex.

Division of Physical Chemistry

● *Laboratory of Quantum Physical Chemistry*

Keywords : Quantum Physical Chemistry, Chemical Reaction Dynamics, and Computational Chemistry.

● *Laboratory of Quantum Chemistry*

Keywords : Laser Molecular Spectroscopy, Cluster, and Hydrogen Bond.

● *Laboratory of Organic Physical Chemistry*

Keywords : Laser Chemistry in Condensed Phase, Ultrafast Spectroscopy, and Nanoscopic Spectroscopy.

● *Laboratory of Theoretical Chemistry*

Keywords : Atto and Femto second Chemistry, Quantum Control of Chirality, and Excited State Dynamics of Biomolecules.

Division of Interdisciplinary Chemistry

● *Laboratory of Organic Reaction Process*

Keywords : Organometallic Chemistry, Synthesis of Natural Products, and Environmentally Benign Organic Reaction Processes.

● *Laboratory of Organic Chemistry II*

Keywords : Organosilicon and Related Chemistry, Polysilanes and Silicon-based Macrocycles, and Photochemistry of Organometallic Compounds.

● *Commemorative Laboratory of Troponoid*

Keywords : Fine Organic Synthesis, Asymmetric Catalysis, and Enzymatic Reaction.

● *Laboratory of COE Fellow*

Keywords : Asymmetric Catalysis, Transition Metal Complexes, and Intramolecular Dynamics.

● *Laboratory of Functional Molecular Chemistry & Radiochemistry*

Keywords : Functional Molecules, Phthalocyanines, and Porphyrins.

● *Research and Analytical Center for Giant Molecules*

Keywords : Giant Molecule, Analysis, and Synthesis.

Division of Advanced Atomic and Molecular Science

● *Laboratory of Biochemistry*

Keywords : Gene, Transcription Factor, and Live Cell Imaging.

Cooperative Research Groups

Institute of Multidisciplinary Research for Advanced Materials

● *Laboratory of Surface Chemistry*

Keywords : Surface Chemistry, Single Molecule Spectroscopy, and Nanochemistry.

● *Laboratory for Analysis of Quantum Processes*

Keywords : Atomic and Molecular Dynamics, Synchrotron Radiation, and Femtosecond Pulse Laser.

● *Laboratory of Photochemical Reactions*

Keywords : Photo-induced Electron Transfer, Fullerene Photochemistry, and Laser Flash Photolysis.

● *Laboratory of Reaction Dynamics*

Keywords : Spin, Photochemistry, and Nanomaterial Analysis.

● *Laboratory of Reaction Intermediates*

Keywords : Advanced Electron Spin Resonance (EPR), Excited High Spin States, and Photoreceptor Proteins.

● *Laboratory of Organic Materials Chemistry*

Keywords : Organic and Polymeric Materials, Nanocrystals, and Photonics Materials.

● *Laboratory of Bioreaction Design*

Keywords : Heme Proteins, Sensor Proteins, and Metal Proteins.

● *Laboratory of Bioreaction Analysis*

Keywords : Isoprenoid Biosynthesis, Enzyme Reaction Mechanism, and Biological Function Analysis.

● *Laboratory of Molecular Function Control*

Keywords : Molecular Chirality, Light-powered Molecular Motor, and Chiral Molecular Tool.

● *Laboratory of Hybrid Nano-Bio*

Keywords : Heme Proteins, Oxygen Activation Mechanism, and Macromolecular Crystallography.

Institute for Materials Research

● *Laboratory of Superstructured Thin Film Chemistry*

Keywords : Oxide Electronics, Combinatorial Chemistry, and Semiconductors.

● *Laboratory of Crystal Chemistry*

Keywords : Phase Equilibria between Solid and Liquid, Solute Redistribution, and Crystal Growth under External Fields.

Advanced Industrial Science and Technology Tohoku

● *Laboratory of Reaction and Separation Processes*

Keywords : Separation of Metal Ions, Detection of Metal Ions, and Supercritical Fluids.

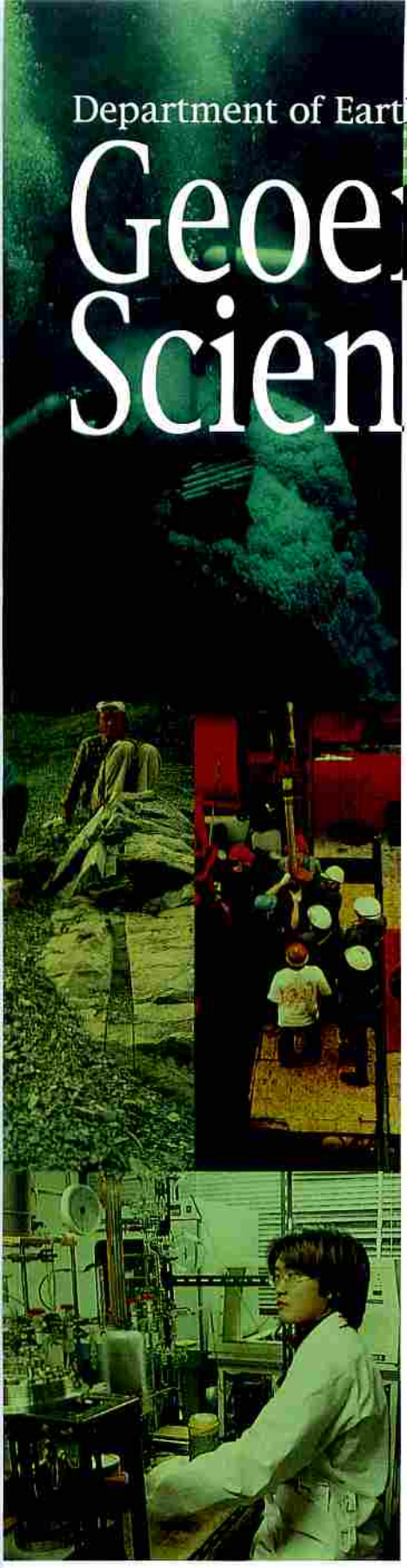
Japan Atomic Energy Agency

● *Laboratory of Heavy Elements Chemistry*

Keywords : Superheavy Elements, Single Atom chemistry, and Actinide Chemistry.

Department of Earth Science:

Geoenvironmental Science



Introduction

The land that we stand on, the air that we breathe, the food that we eat, are all products of the past 4.6 billion years of Earth's history. We humans are also products of this evolution. How were we created ? What is our destiny?

The integrated system of atmosphere, hydrosphere, and biosphere is alive because of the energy of solar radiation, as we ourselves are. Even the system of solid Earth (lithosphere) is sustained by the energy of decaying radioactive elements. The boundary between these four spheres is the called the geosphere. The four spheres interact with one another through the recycling of energy and materials. During Earth's long history, the geosphere has experienced a huge variety of episodes and has been continually evolving. We human beings are one of the latest products in its evolutionary pathway.

Our Department of Geoenvironmental Sciences aim is to study past and present day environmental changes in Earth to integrate short-term variations in its evolutionary history and predict its future. The latter objective requires us not only to consider natural phenomena but also to study what effect human activities have on the environment. The department offers courses on the evolution of the geosphere and on environmental geography. Education and research are conducted in cooperation with the Tohoku University Museum, the Graduate School of Environmental Studies, and the National Institute of Advanced Industrial Science and Technology.

Undergraduate

Department of Earth Science,Geoenvironmental Sciences

- Evolution of Geosphere
- Environmental Geography

Graduate

- Graduate Scool of Science
- Graduate Scool of Environmental Studies
- The Tohoku University Museum
- National Institute of Advanced Industrial Science and Technology

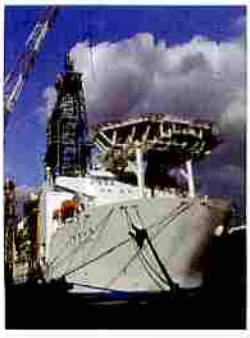
Research Groups

●*Environmental Change*

The importance of Lake Baikal as a large fresh-water resource makes it urgent to study and understand the biological, physical, and chemical mechanisms of its dynamics in time and space, and to assess the role of anthropogenic changes occurring in the system. The coral reef research team is investigating paleoceanographic/paleoclimatic changes on various timescales from a day to millions of years from carbonate deposits and calcareous skeletons such as corals and tridacnid shells. The microfossil team also provides information on global Earth history and paleoceanographic construction by using foraminifers and radiolarians in pelagic sediments through DSDP, ODP, and IODP projects.

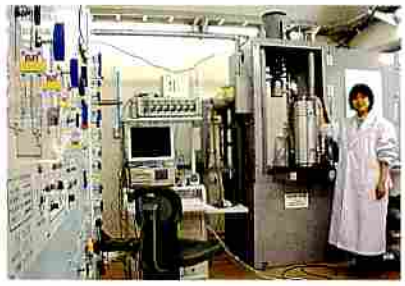
●*Evolution and Mass Extinction of Life*

This research group is seeking causes of mass extinctions and diversifications of life as imprinted in deep sea and continental margin sediments using multiple geochemical analyses, including isotopes and fossil analyses. Evolutionary morphological changes in mollusks are also studied using molecular phylogenetical methods and fossil data.



●*Fault and Earthquake*

We investigate geomorphic distributions, deep structures, and future activities of active faults by interpreting aerial photographs, seismic reflections, and trenching surveys. Based on these investigations, we suggest land use planning to mitigate hazards along active faults. We also attempt to explore source processes for earthquakes from textural, geochemical, and rheological viewpoints, and the electromagnetic properties of natural fault rocks. High temperature-pressure experiments are also conducted for constitutive equations of rock friction, state equations of crustal fluids, and frictional electrification. To evaluate interplate seismic activities, we are monitoring precursory fluctuations in underground water temperature precisely at the fault plane across deep boreholes.



Active fault map of Tohoku district

●*Human and Physical Geography*

Interest in the areal differentiation of the physical environment and human phenomena is a starting point for geographical studies. We are entering an age of change on a global scale, such as globalization in the economy and climatic changes. We are studying the dynamics between humans and the physical geography of the world through various methods such as field surveys, digital mapping, and statistical analysis.

Gully erosion observed in Inner Mongolia, China

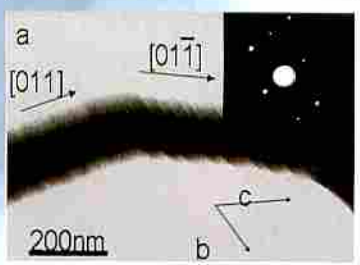
Divided urban space : Downtown in Old Delhi and shopping mall in suburb of New Delhi

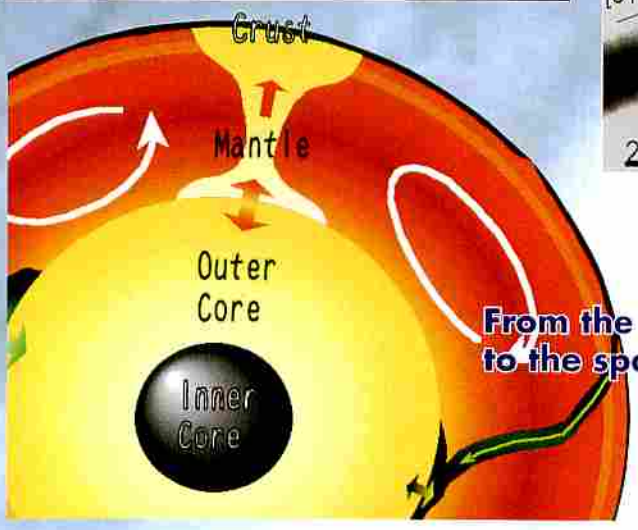
Department of Earth Science:

Earth and Planetary Materials Science

Introduction

Research on highly advanced earth and planetary sciences is required to address new topics and find new tools to understand phenomena not only of Earth but also those of space environments. These include studies on the ultra-high pressure of planetary minerals, the evolution of materials and life on Earth and in space environments, the formation of low gravity materials in space, and various molecular-scale materials-formation mechanisms. The Department of Earth Science has not hesitated to adopt novel methods and to develop advanced techniques for synchrotrons, microgravity, and novel in-situ observation systems for crystal growth and phase transition.





From the depth of the Earth to the space and planets

Closely Related Organizations and Programs at Tohoku University

Center for Northeast Asian Studies
The Tohoku University Museum
The 21st Century COE Program:Advanced Science andTechnology Center for the Dynamic Earth

Contact

▶Phone +81-22-795-6674
▶URL http://www.ganko.tohoku.ac.jp/

Research Groups

●*Mineralogy*

Keywords : Mineralogy and Crystallography, Optical Anomalies, Growth Sectors and Non-equilibrium Crystal Growth of Minerals, Fine Texture of Minerals by Transmission Electron Microscope, and Crystal Structures of Minerals under High Pressure.
URL: http://www.ganko.tohoku.ac.jp/Mineral/mineralE.html/

●*Petrology and Solid Geochemistry*

Keywords : Petrology, Geochemistry, Radiogenic Isotope Geology, Volcanology, Cosmochemistry. Current Research: Magma Genesis in Island Arcs and Continents, Elemental Cycle between Crust and Mantle, Origin and Evolution of Volcanos, Origin, Evolution, and Destruction of Meteorite Parent Bodies, and Evolution of Oceans Recorded in Fossils.
URL: http://www.ganko.tohoku.ac.jp/ganseki/indexE.html/

●*Natural Resources and Environmental Geochemistry*

Experiments under microgravity are conducted to simulate the formation of cosmic materials to illustrate materials evolution at the initial stage of the early solar system and the subsequent evolution of life materials on the earth. Crystallization under extreme conditions is studied by highly advanced optical in-situ observation on the molecular scale. The "origin" of life and "environments" of the early Earth are also focused on by this group. Experiments to synthesize amino acids and proteins are performed under a simulated environment with meteorite impact. The early environments and evolution of life are investigated by field surveys of ancient rocks in Greenland, Australia, and South Africa.
URL: http://www.ganko.tohoku.ac.jp/shigen/

●*Earth and Planetary Material Physics*

This group conducts research on High Pressure Physics of Earth and Planetary materials, and Origin and Evolution of Earth and Planets. Current researches are Partitioning of Elements between Metal and Silicate at High Pressure and its application to the Core Formation process of Earth, Melting and Phase Relations of Mantle Materials, Physical Properties and of Equation of State of Minerals and Magmas at High Pressure, and Diffusion and Kinetics of Phase Transition of Mantle Minerals. We also conduct studies of material transport from surface to the core and a large scale circulation of earth's materials including volatiles in the Earth.
URL: http://www.ganko.tohoku.ac.jp/bussei/english/

●*Arc Magmatism*

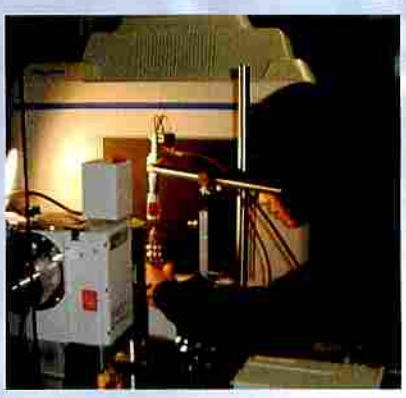
Keywords : Geochemistry, Petrology, and Volcanology. On-going Research: Correlative Study of Granitic Rocks in Continental and Island-arc Crust, Spatial and Temporal Variations in Composition of Island Arc Igneous Rocks, and Petrological and Geochemical Studies of Quarternary Island Arc Volcanic Rocks.
URL: http://www.ganko.tohoku.ac.jp/touko/english/

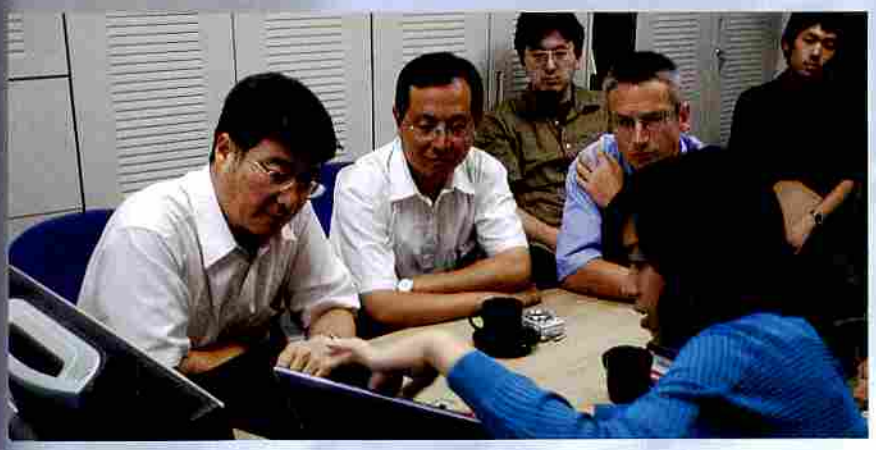
●*Volcanology Science*
(Division of Geochemistry, Area Studies on Environment)

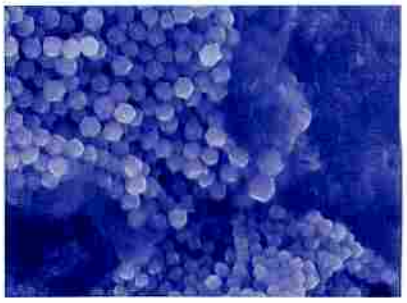
A number of volcanoes are distributed across the northeast Asian region, including Kamchatka, the Kuril islands of Russia, Cheju island and P'aektu San of Korea, and Wu Ta Lien Ch'ih of China. Some volcanoes have historically been active, probably influencing the culture and history of the region. Our division aims to study volcanic activities from the perspective of natural sciences. Through future cooperation with liberal arts researchers, we hope to reveal what influence volcanic activities have on human society.

●*Reaction and Kinetics in the Earth's Interior*
(Cooperation programes with Agency of Industrial Science and Technology)

Geochemical Studies of Sea Floor Hydrothermal Activities, Origin of Island Arc Magmas and Crystal Evolution, Nature of Lunar and Planetary Volcanism, and Flow and Fracture of Rocks in Earth's Interior.







Department of Biology

Contact
Phone +81-22-795-6714
Facsimile +81-22-263-9206
Email www-admin@biology.tohoku.ac.jp
URL http://www.biology.tohoku.ac.jp/english/

Introduction

The land that we stand on, the air that we breath, the food that we eat, all are products of the past 4.6 billion years Earth history. We human beings too. How were we created ? Where will we go ?

The Department of Biology was established in 1922 and has been producing a number of graduates and postgraduates active in both academic and non-academic world. Since the Department was founded, the priority-in-research and open-door spirits of Tohoku University prevail over the Department as well. While the Department has kept the spirit and tradition founded by the pioneers on one hand, it is promoting updated research activities in response to ever-developing biological sciences on the other. Present research activities cover the wide range of basic biology, from molecular and cellular biology through ecology and evolutionary biology. Three facilities, the Asamushi Laboratory of Marine Biology, the Mount Hakkoda Botanical Laboratory, and the Botanical Garden, also contribute to the education and research activities in the Department. In 2001, the whole Department was reorganized to establish the Graduate School of Life Sciences. The Graduate School of Life Sciences consists of 36 laboratories that were established by reorganization of 3 faculties and 4 institutes of Tohoku University. Our Department receives 40 undergraduates and our Graduate School receives 47 doctor course students and 106 master course students every year. We more than welcome talented biologists and students to promote and enjoy biological sciences in Sendai.

Undergraduate

Department of Biology

Molecular Cell Biology (Molecular Physiology, Plant Physiology, Developmental Biology, Molecular Genetics, Cell Biology, Neuroethology)

Ecology and Evolutionary Biology (Animal Ecology, Plant Ecology, Evolutionary Biology)

Molecular Bioregulation (Molecular Bioregulation, Biomembrane Regulation)

Asamushi Laboratory of Marine Biology
Botanical Garden
Mount Hakkoda Botanical Laboratory

Graduate

Graduate School of Life Sciences

Division of Biomolecular Sciences
Division of Developmental Biology and Neuroscience
Division of Environmental Life Sciences

Research Centers

Laboratory of Nuclear Science

Research and Analytical Center for Giant Molecules

Center for Atmospheric and Oceanic Studies

Research Center for Prediction of Earthquakes and Volcanic Eruptions

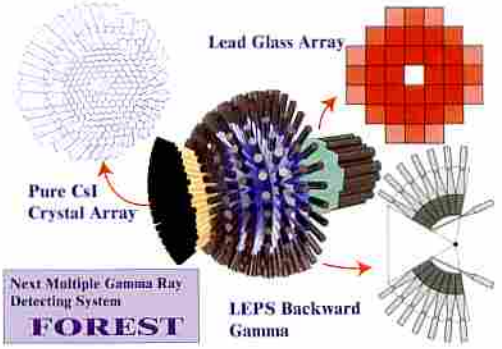
Research Center for Neutrino Science

Planetary Plasma and Atmospheric Reseach Center

Laboratory of Nuclear Science (LNS)

Introduction

LNS operates a 300-MeV electron linear accelerator (LINAC) and a 1.2-GeV Stretcher-Booster (STB) ring. LINAC provides an intense pulsed beam and has been used in nuclear physics, solid state physics, radiochemistry, biology, and engineering. A 200-MeV continuous beam is available for coincidence experiments. A GeV tagged photon beam from an electron beam stored in the STB ring is utilized for hadron-physics experiments.



Hadron Physics

Since the mass of constituent quarks depends on the environment, the properties (e.g., mass and width) of hadrons in nuclei are expected to differ from those in free-space. They are investigated via photo-production of mesons with electro-magnetic calorimeters. A new calorimeter FOREST that covers a solid angle of 4π is under construction. Photo-production experiments for penta-quark states will be conducted with a magnetic spectrometer.

Nuclear Physics

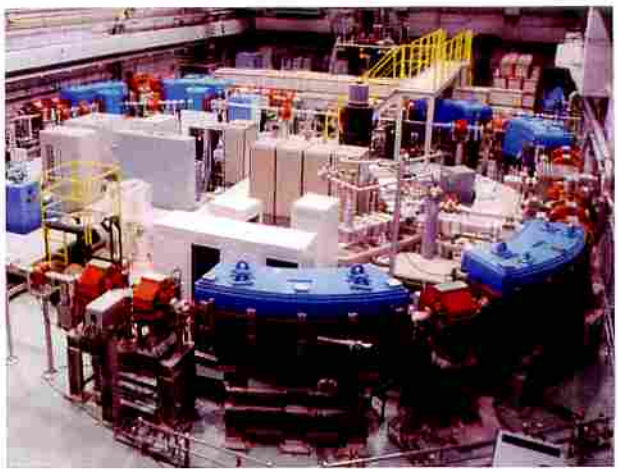
Relativistic effects and meson exchange currents have been investigated in electron scattering, and the measurement of charge distributions in unstable nuclei is explored. Quantum tunneling phenomena in ultra-low energy nuclear reactions have also been studied.

Beam Physics/Accelerator Science

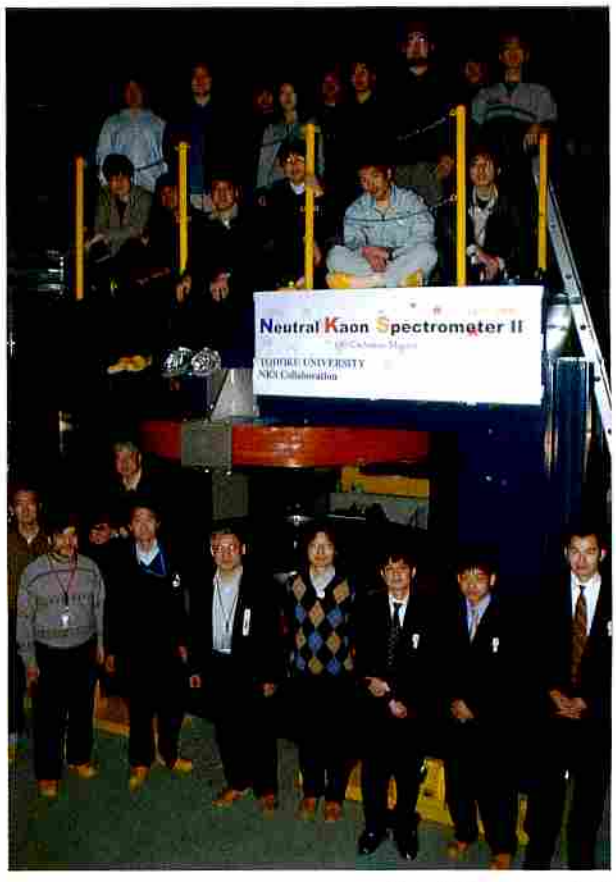
Non-linear beam dynamics in circular accelerators is being studied by using the STB ring and the main ring of SPring-8. In addition to fundamental accelerator science and technology, the production of a low emittance beam using a novel RF gun for a high brilliant coherent light source such as the free electron laser (FEL) is also being studied.

Radio-chemistry

Photo-nuclear reactions have been applied to the micro-analysis of various elements in the environment and in biological materials. Recently, a method to produce a radioactive fullerene (C_{60}) has been developed by bombarding fullerenes with electrons and charged particles. The production mechanism is being investigated in detail.



1.2 GeV STB Ring



Neutral Kaon spectrometer II

Contact

- Phone +81-22-743-3400
- Facsimile +81-22-743-3401
- Email koho@lns.tohoku.ac.jp
- URL http://www.lns.tohoku.ac.jp/home/pamphlet/

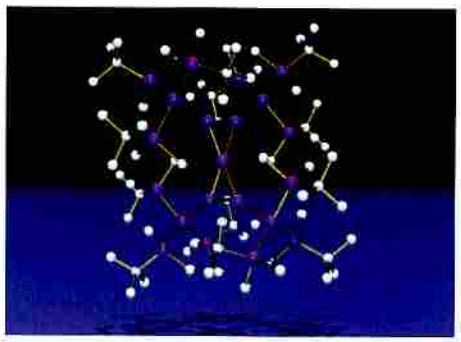
Research and Analytical Center for Giant Molecules

Introduction

The Research and Analytical Center for Giant Molecules was newly organized in April 2004 and consists of two sections for analytical and experimental research. The analytical section has the latest high-performance instruments for organic microanalysis, plasma emission analysis (ICP), mass spectrometric analysis (MS), nuclear magnetic resonance (NMR) analysis, and X-ray crystal structure analysis. These instruments play an important role in the structural determination of small and giant molecules in research on fundamental and applied sciences. The experimental research section investigates the development of new synthetic reactions using organometallics and their application to the synthesis of new materials and biologically active natural products. The development of new heavy-element based π-electron systems with unique structures and electronic properties are also investigated.

Research and Analytical Center for Giant Molecules

Structure of Gambierol, a Marine Polycyclic Ether



Molecular Structure of Spiropentasiladiene

Mass Spectrometry Facility

NMR Spectrometry Facility

Elemental Analysis Facility

Research Subjects

Conformational analyses of organic compounds using NMR spectroscopy

X-ray crystal structure analyses of the unique structures with high distortion, unusual coordination, unstable species, inclusion, conductivity and self-assembly

Synthetic studies of biologically active natural products such as marine polycyclic ethers

Development of nano-sized heavy-element based π-electron systems

Organization of the Center

Research and Analytical Centerfor Giant Molecules

- Experimental Research
- Instrumental Analysis

Contact

- Phone +81-22-795-6752
- Facsimile +81-22-795-6752
- HomePage http://www.kiki.chem.tohoku.ac.jp/

Center for Atmospheric and Oceanic Studies

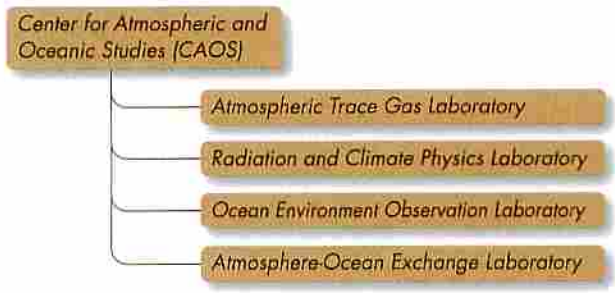
Introduction

The center has four laboratories. The Atmospheric Trace Gas and the Atmosphere-Ocean Exchange Laboratories conduct collaborative research, where concentrations and isotopic ratios of various greenhouse gases (GHGs) are extensively measured with platforms such as ground-based stations, ships, aircrafts, and balloons to establish temporal and spatial variations. Polar ice cores are analyzed to reconstruct past variations in GHG species. We also investigate the exchange processes in GHG related materials, and the heat and momentum between the atmosphere and ocean. Numerical models are developed on the basis of these results to provide a quantitative understanding of the global cycles of GHGs.

The Radiation and Climate Physics Laboratory is aiming to improve the understanding of the processes involved in aerosol/cloud-radiation-climate interactions. Research includes observations of the radiative properties of atmospheric constituents such as aerosols, clouds, and water vapor, as well as their effects on climate. Theoretical modeling and numerical simulations of interaction processes are an important component of this research, which also includes advanced remote sensing analysis of the optical and physical properties of aerosols and clouds by synergetically using passive and active sensors and satellites.

The Satellite Oceanography Laboratory is researching the ocean environment by using a variety of satellite data. Topics include air-sea interactions, regional oceanic circulation, and bio-geophysical interactions, where satellite data analysis as well as numerical simulations are employed utilizing various ocean models. A large wind-wave tank is also used for laboratory experiments on air-water boundary processes and microwave remote sensing.

Organization



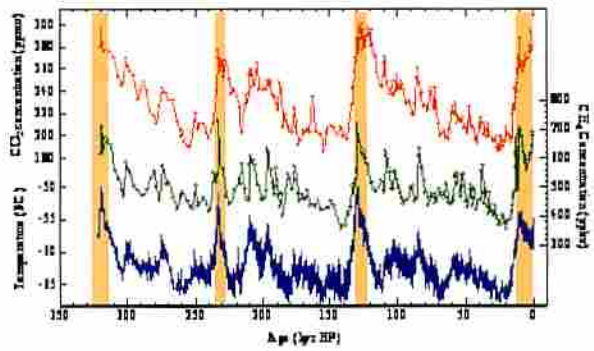


Fig.1 Variations of atmospheric CO_2 and CH_4 concentrations and air temperature for the last 320 kyr deduced from Dome Fuji ice core.

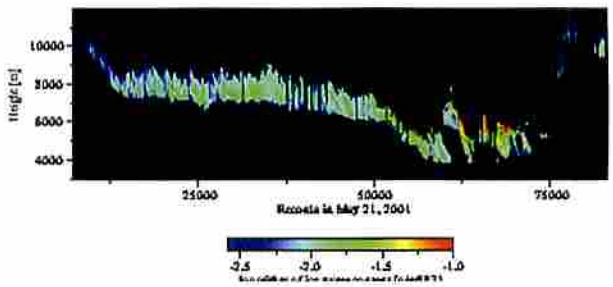


Fig.2 Time-height cross section of ice water content in mid-latiude hight-level clouds derived from the synergy use of lidar and cloud profiling radar.

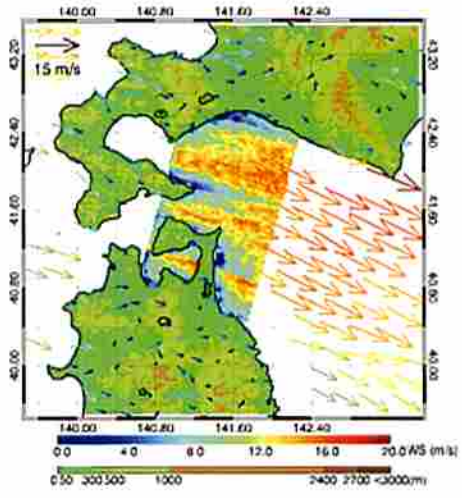


Fig.3 Wind jets and wind waves off the Pacific coast of northern japan under winter monsoon captured by combined use of scatterometer,SAR and altimeter.

Contact

▶ Phone +81-22-795-5791
▶ Facsimile +81-22-795-5797
▶ URL http://www.caos-a-geophys.tohoku.ac.jp/
http://www.ocean.caos.tohoku.ac.jp/

Research Center for Prediction of Earthquakes and Volcanic Eruptions

Introduction

This center, was newly established in 1997, and it originated from Aobayama Seismological Observatory founded in 1912 and from the Observation Center for Earthquake Prediction founded in 1974. It is divided into three laboratories, the first for crust physics related to earthquake prediction, the second for physical volcanology related to the prediction of volcanic eruptions, and the third for marine geophysics related to the study of plate dynamics in subduction zones. More than 60 observation stations operated by the center are widely distributed in the Tohoku district to provide invaluable data not only for prediction studies but also for fundamental studies in geophysics. The center is thus the leading center for solid earth physics in northeast Japan. It is essential to advance research from a global perspective to attain a deeper understanding of the plate subduction process. Consequently, we have been conducting internationally collaborative research with experts from all over the world; one example is the Pacific-rim plate subduction zone in Alaska and South America. We hope that further international research will contribute to discoveries on the tectonics of earthquakes and volcanoes in the plate subduction zone and on plate subduction dynamics. We aim to become one of the most comprehensive centers of study on the plate subduction zone.

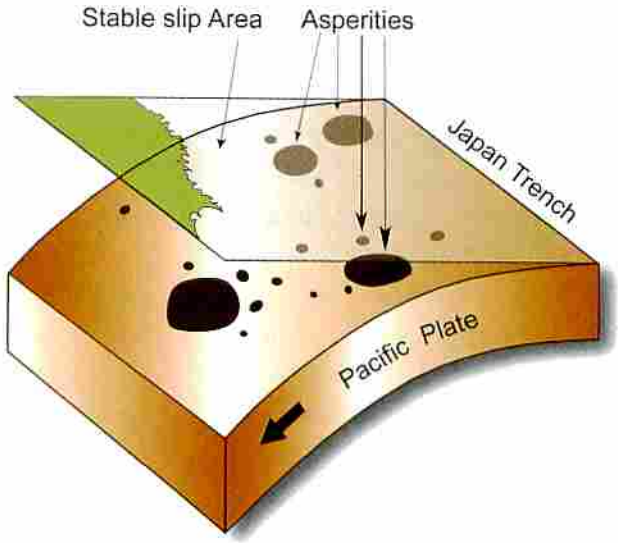


Fig. 1 Plate Boundary in the Northeastern Japan
There are asperities (seismic regions) of various sizes on the plate boundary. Stress on asperities is thought to be concentrated because of the quasi-static slips in surrounding areas to repeatedly generate earthquakes . Small asperities generate earthquakes with intervals of several years; earthquakes are identified as small repetitive earthquakes (similar earthquakes).

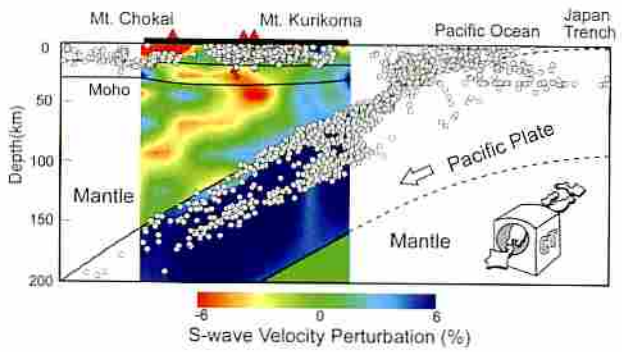


Fig.2 Structure beneath the Northeastern Japan Arc Imaged by Seismic Tomography
Using phase data of natural earthquakes, we can estimate three-dimensional seismic velocity structure in Earth. We can see vertical cross-section of S-wave velocity structure beneath area around Mts. Chokai and Kurikoma. Blue indicates high-velocity (low-temperature and high-density) region while red to yellow correspond to low-velocity (high-temperature and low-density) regions. White circles denote hypocenters and red triangles denote active volcanoes. Pacific plate subducting beneath northeastern Japan arc is clearly imaged as blue belt. There is clear low-velocity zone in mantle wedge inclining sub-parallel to subducting plate. Inclined low-velocity zone probably corresponds to upwelling flow from deep mantle and is thought to be closely related to arc magmatism. Red circles indicate deep low-frequency events that are also thought to be related to deep magmatism.

Organization

Research Center for Prediction of Earthquakes and Volcanic Eruptions
- Crustal Physics Laboratory
- Physical Volcanology Laboratory
- Marine Geophysics Laboratory

Contact
- Phone +81-22-225-1950
- Facsimile +81-22-264-3292
- URL http://www.aob.geophys.tohoku.ac.jp/aob-e/

Research Center for Neutrino Science (RCNS)

Introduction

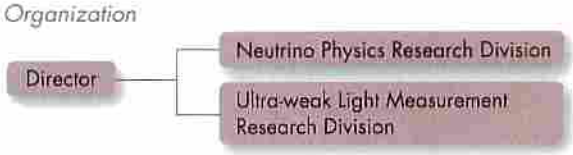
Research Center for Neutrino Science (RCNS) Graduate School of Science of Tohoku University was reorganized from the Bubble Chamber Physics Laboratory of the Faculty of Science in April 1998. Its purpose was to study elementary particle physics, geophysics and astrophysics through detecting low-energy neutrinos and anti-neutrinos.

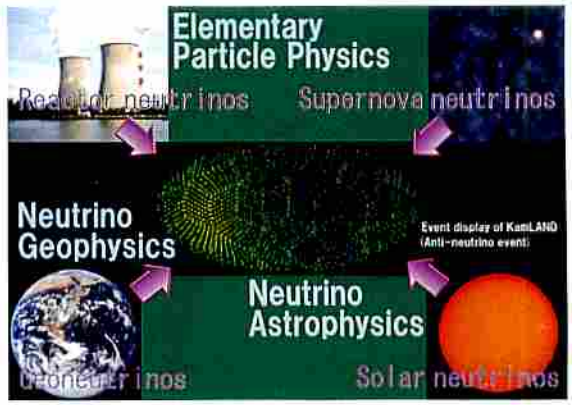
Neutrinos are fundamental particles of nature, which are electrically neutral and quite difficult to detect. Many characteristics of neutrinos are not yet known, despite the amount of experimental effort expended all over the world. Studies on neutrinos are also very important to gaining an understanding of the behavior of the universe which is closely connected with that of neutrinos.

To explore these physics, RCNS designed and constructed the world's largest 1000-ton liquid scintillator neutrino and anti-neutrino detector from 1998-2002, the KamLAND (Kamioka Liquid scintillator Anti-Neutrino Detector), in the Kamioka Mine in Hida City in Gifu Prefecture. The KamLAND experiment started in January 2002 and is being conducted through international collaboration with institutes from Japan, the United States, China and France. We observed for the first time the disappearance of reactor anti-neutrinos in 2002 and confirmed that this was caused by the neutrino oscillations in 2004. It also made possible, for the first time, the detection of terrestrial anti-neutrinos (geoneutrinos) in 2005, which originate deep inside the earth. At present, efforts are being made to further improve the sensitivity of the KamLAND detector to make possible the first real-time measurement of low-energy neutrinos from the sun (^{7}Be solar neutrinos), which clarifies the burning mechanism of stars. RCNS is going to promote neutrino science involving neutrino astrophysics and the newly opened field of neutrino geophysics with the upgraded KamLAND detector.

Please see the page of "the 21st century COE Programs –center of excellence–" for more information about results from a search for geoneutrinos with KamLAND.

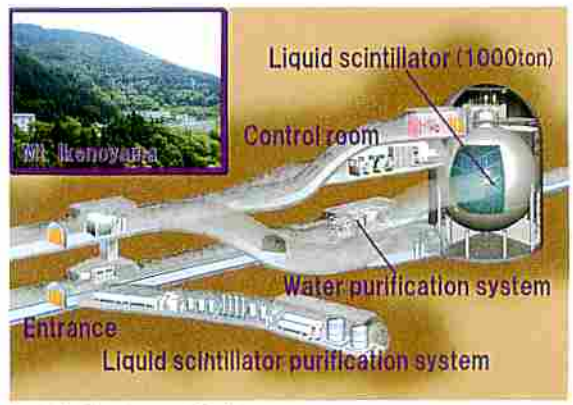
Organization





Neutrino Science with KamLAND

KamLAND International Collaboration Group



KamLAND Underground Facility

Contact

- Phone +81-22-795-6727
- Facsimile +81-22-795-6728
- Email rcns office@awa.tohoku.ac.jp
- URL http://www.awa.tohoku.ac.jp/

Planetary Plasma and Atmospheric Research Center (PPARC)

Introduction

Our principal aim at the Planetary Plasma and Atmospheric Research Center (PPARC) is to investigate the little known world of planets by sensing atmospheres surrounding planets and plasma extending beyond their atmospheres from the Earth using radio and optical techniques. Research on the physical processes governing various phenomena related to planets will be a major part of basic science well into the 21st century. Such studies will also shed light on an understanding of our own planet Earth.

The formation and environment of planets is studied by investigating the physics of phenomena on planetary atmospheres and plasma. This research is based on our own observations of planets employing radio and optical methods, analysis of planetary mission data, as well as modeling and simulation using these data.

Iitate Planetary Radio Telescope

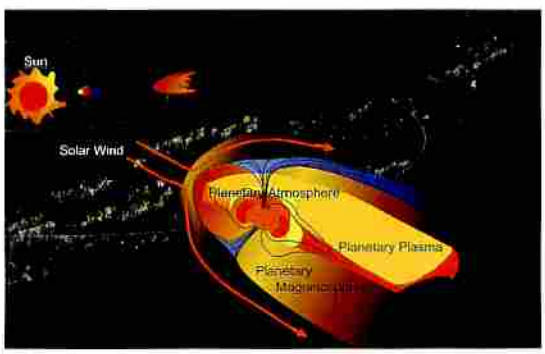
60-cm diameter Coude-Cassegrain Telescope

Sections

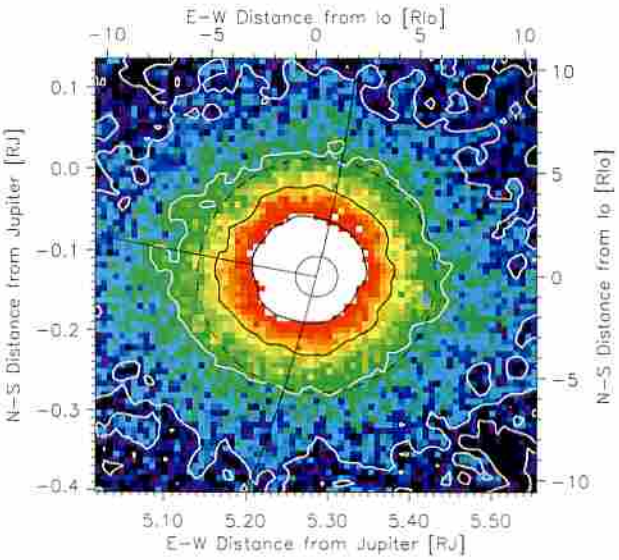
Planetary Radio wave Research
Planetary Spectroscopic research

Research Projects

1. Energetic particles in planetary magnetospheres
2. Planetary plasma and atmosphere
3. Planetary radio waves
4. Earth's magnetosphere, ionosphere,and atmosphere



Planetary plasma and atomophene in the solar system



Distribution of sodium atoms in the close proximity of Jovian satelite Io

Contact

- Phone +81-22-795-6367
- Facsimile +81-22-795-6406
- Email pparc-info@pparc.geophys.tohoku.ac.jp
- URL http://pparc.geophys.tohoku.ac.jp/

Directions

TOHOKU UNIVERSITY
Sendai, Japan

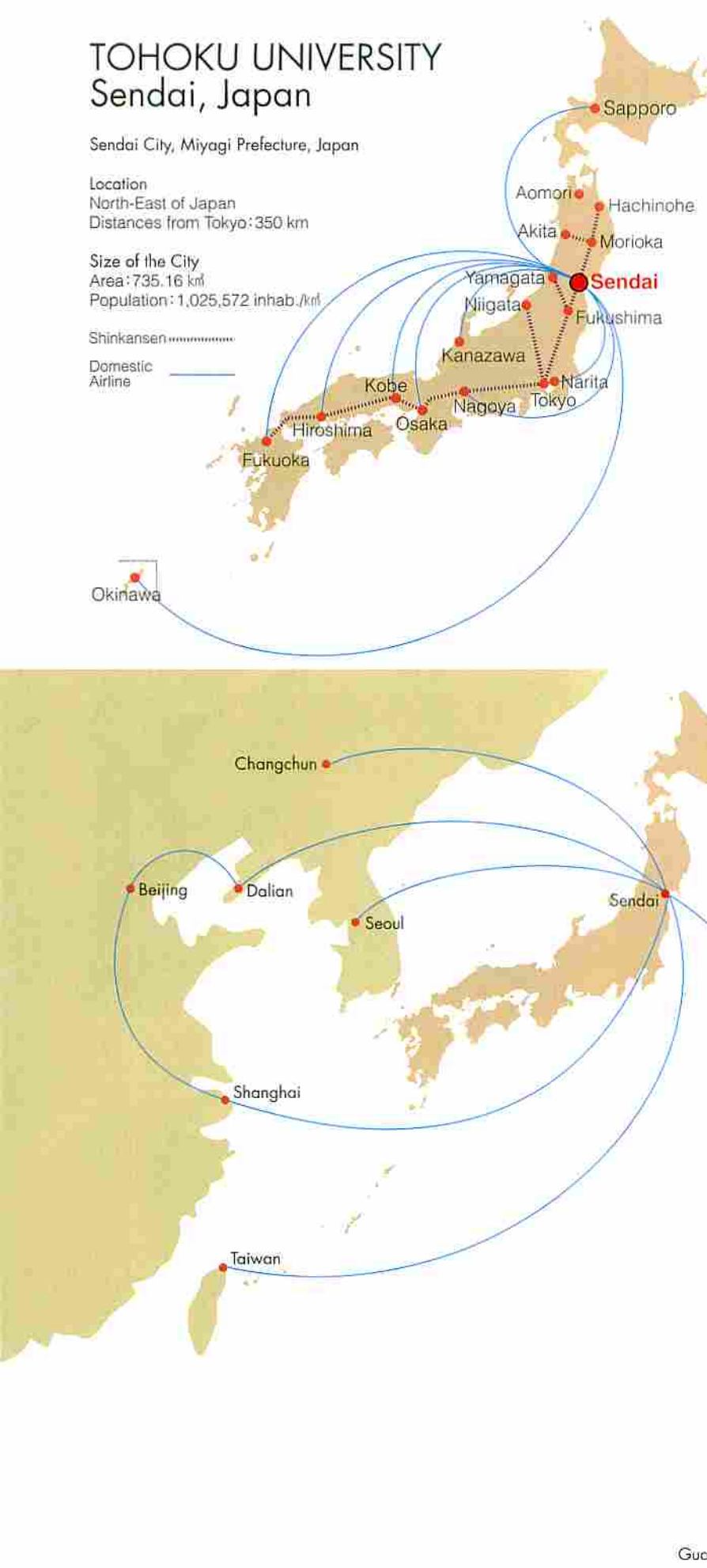
Sendai City, Miyagi Prefecture, Japan

Location
North-East of Japan
Distances from Tokyo: 350 km

Size of the City
Area: 735.16 ㎢
Population: 1,025,572 inhab./㎢

Shinkansen

Domestic Airline



Domestic Transportation from International Airport, Japan

Narita
You can transfer to a domestic flight to Sendai.
It is also possible to take the Narita Express (JR) to JR Tokyo Station, or the Keisei Sky Liner to JR Ueno Station, and transfer to the Tohoku Shinkansen (Super Express) for Sendai.
http://www.narita-airport.jp/en/

Nagoya (Central Japan International Airport "Centrair")
You can transfer to a domestic flight to Sendai.
http://www.centrair.jp/en/

Osaka (Kansai International Airport "Kankuu")
You can take the Airport Bus for Osaka International Airport (Itami Airport), and transfer to a domestic flight to Sendai.
http://www.kansai-airport.or.jp/english/

Fukuoka
You can transfer to a domestic flight to Sendai.

Sapporo
You can transfer to a domestic flight to Sendai.

Niigata
You can take the Airport Bus to JR Niigata Station, and transfer to the Joetsu Shinkansen (Super Express) to Omiya Station, and to the Tohoku Shinkansen for Sendai. It is also possible to take the local line from Niigata Station.

Kanazawa (Komatsu)
You can transfer to a domestic flight to Sendai.

Hiroshima
You can transfer to a domestic flight to Sendai.

Tokyo Station
You can take the Tohoku Shinkansen (Super Express) for Sendai.

East Japan Railway Company
http://www.jreast.co.jp/e/

Direct Access

Sendai Airport
•International
SEOUL, GUAM, BEIJING, SHANGHAI, DALIAN, CHANGCHUN, TAIPEI
•Domestic
SAPPORO, NARITA, NAGOYA, OSAKA (ITAMI), KOMATSU, KOBE, HIROSHIMA, FUKUOKA, NAHA

Sendai Airport is located in Iwanuma City and Natori City approximately 20 km southeast of the central part of Sendai City.
You can take the Airport Limousine Bus from the airport to JR Sendai Station.
Also the Airport relay bus and trains services are available. Transfer from the relay bus to trains at Tatekoshi Station.
"SENDAI AIRPORT LINE" (Sendai Airport to Sendai Station via Natori Station) is due to be completed in 2006.

http://www.pref.miyagi.jp/kutai/ENGLISH/top-english.htm/

Buses

from Sendai Station to the Graduate School of Science and Faculty of Science

From the bus terminal (Bus stop No. 9) at the JR Sendai Station West Exit, about a 25 minute ride on the "Aoba-dori Ichibancho Keiyu Dobutsukoen Junkan". Get off at the "Museum of Natural History" bus stop. About a 25 minute ride on the "Aoba-dori Ichibancho Keiyu Kogakubu/Miyakyodai-yuki". Get off at the"Johokagaku Kenkyuka-mae" bus stop and it is about 5 minutes on foot from the bus stop. The fare is 220 yen for both routes.

Taxis

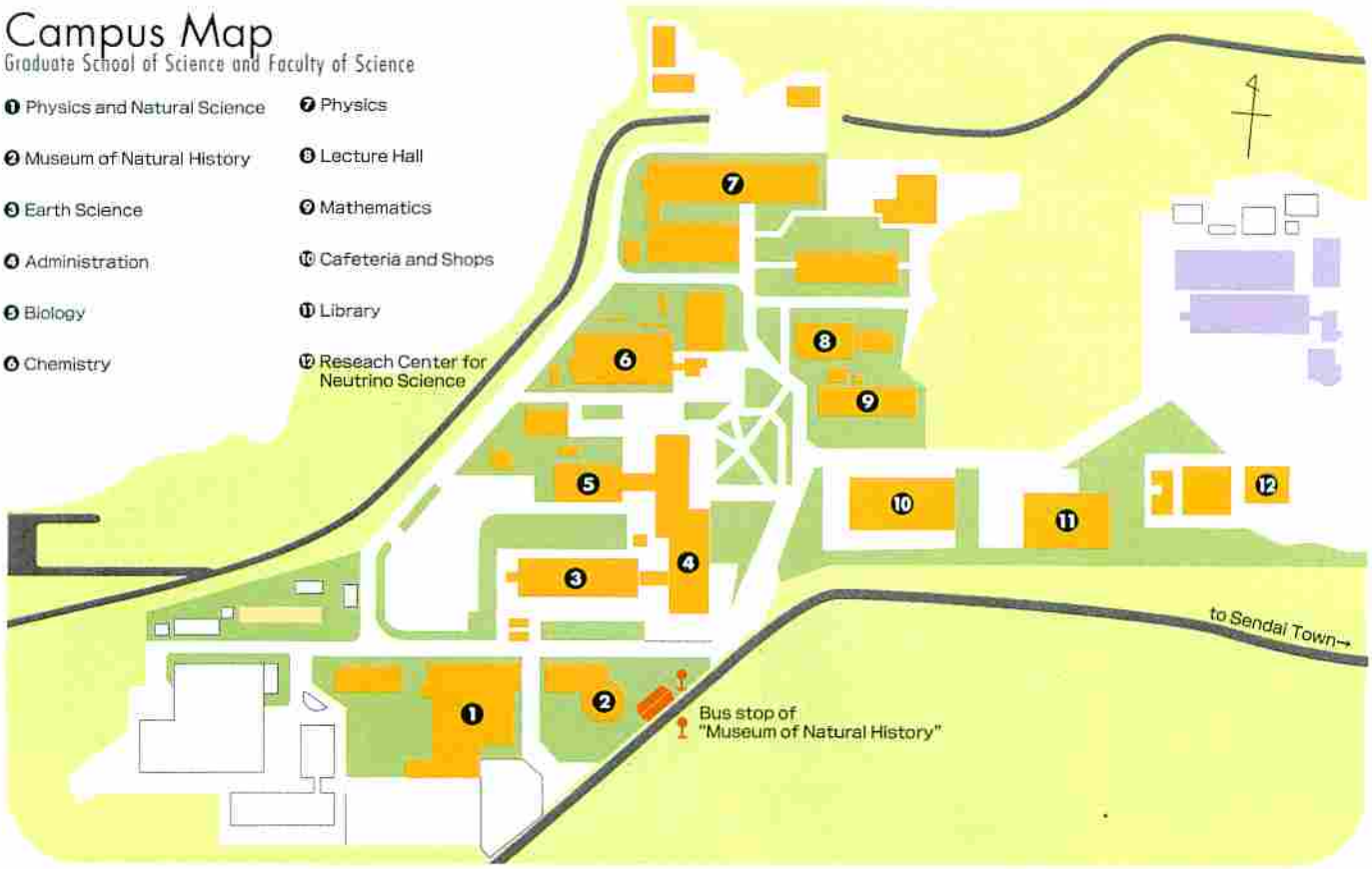
from Sendai Station to the Graduate School of Science and Faculty of Science

From the taxi stand in front of Sendai Airport, it takes about 45 minutes and costs about 6,500 yen. From the taxi stand at the JR Sendai Station West Exit, it takes about 15 minutes and costs about 1,600 yen.

Campus Map

Graduate School of Science and Faculty of Science

❶ Physics and Natural Science
❷ Museum of Natural History
❸ Earth Science
❹ Administration
❺ Biology
❻ Chemistry
❼ Physics
❽ Lecture Hall
❾ Mathematics
❿ Cafeteria and Shops
⓫ Library
⓬ Reseach Center for Neutrino Science



Sendai City

Central area of Sendai, viewed from Aobayama

The Graduate School of Science and the Faculty of Science of Tohoku University have a campus in Aobayama on the western side of the central urban area of Sendai City.

The modern history of Sendai City saw its start as the largest castle town in northern Japan when Date Masamune constructed a castle in Aobayama in 1601. With a population of one million, Sendai is the largest city in the Tohoku Region, whose land area is equal to one-fifth the national total, and grew as an academic and cultural city centered on Tohoku University and as an international city.

The city is surrounded by scenic sites, including Matsushima, an international sightseeing spot and one of the "Three Great Views of Japan", Mt. Zao, famous for spas and skiing, and Minami-Sanriku with a beautiful ria coast. In 1922, Albert Einstein visited Tohoku University and took a trip to Matsushima.

It is known that he said to an accompanying reporter about Matsushima, "Such beauty of nature can be seen neither in pictures by famous artists nor in sophisticated photos. This is the scenery that moves me the most in my visit to Japan ("Einstein Shock", Iwanami Shoten)".

You will enjoy various aspects of research life in Sendai where "Urban environment", "Natural environment" and "Cultural environment" are well harmonized.

Close to Matsushima that was highly praised by Einstein

The Starlight Pageant in December illuminates the winter night of Sendai

At the Tanabata Festival in August, the streets of central Sendai are colored with decorations on bamboo trees

Horse-riding statue of Date Masamune erected at the Sendai Castle Site

20-30 minute drive to a hot spa

20-30 minute drive to the beach

An hour drive to a ski area

Contact Information

Graduate School of Science and Faculty of Science
6-3, Aramaki Aoba, Aoba-ku, Sendai, Miyagi 980-8578, Japan
URL : *http://www.sci.tohoku.ac.jp/english/*

DiRECT (Division for International Research and Educational Cooperation Graduate School of Science)
6-3, Aramaki Aoba, Aoba-ku, Sendai, Miyagi 980-8578, Japan
Phone : *+81-22-795-5829* Facsimile : *+81-22-795-5831*
E-mail : *direct@sci.tohoku.ac.jp*
URL : *http://sciserv.sci.tohoku.ac.jp/direct/*

Application for Undergraduate Admission
6-3, Aramaki Aoba, Aoba-ku, Sendai, Miyagi 980-8578, Japan
Phone : *+81-22-795-6350* Facsimile : *+81-22-795-6345*
E-mail : *sci-kyom@bureau.tohoku.ac.jp*
URL : *http://www.tohoku.ac.jp/english/admissions/undergraduate.html/*

Application for Graduate Admission
6-3, Aramaki Aoba, Aoba-ku, Sendai, Miyagi 980-8578, Japan
Phone : *+81-22-795-6351* Facsimile : *+81-22-795-6345*
E-mail : *sci-in@bureau.tohoku.ac.jp*
URL : *http://sciserv.sci.tohoku.ac.jp/direct/new-comer.html/*

Helpful Web Sites

Graduate School of Science and Faculty of Science
▸ *http://www.sci.tohoku.ac.jp/english/*

Tohoku University
▸ *http://www.tohoku.ac.jp/*

Center for International Exchange, Tohoku University
▸ *http://insc.tohoku.ac.jp/index-j.html/*

Ministry of Education, Culture, Sports, Science and Technology
▸ *http://www.mext.go.jp/english/*

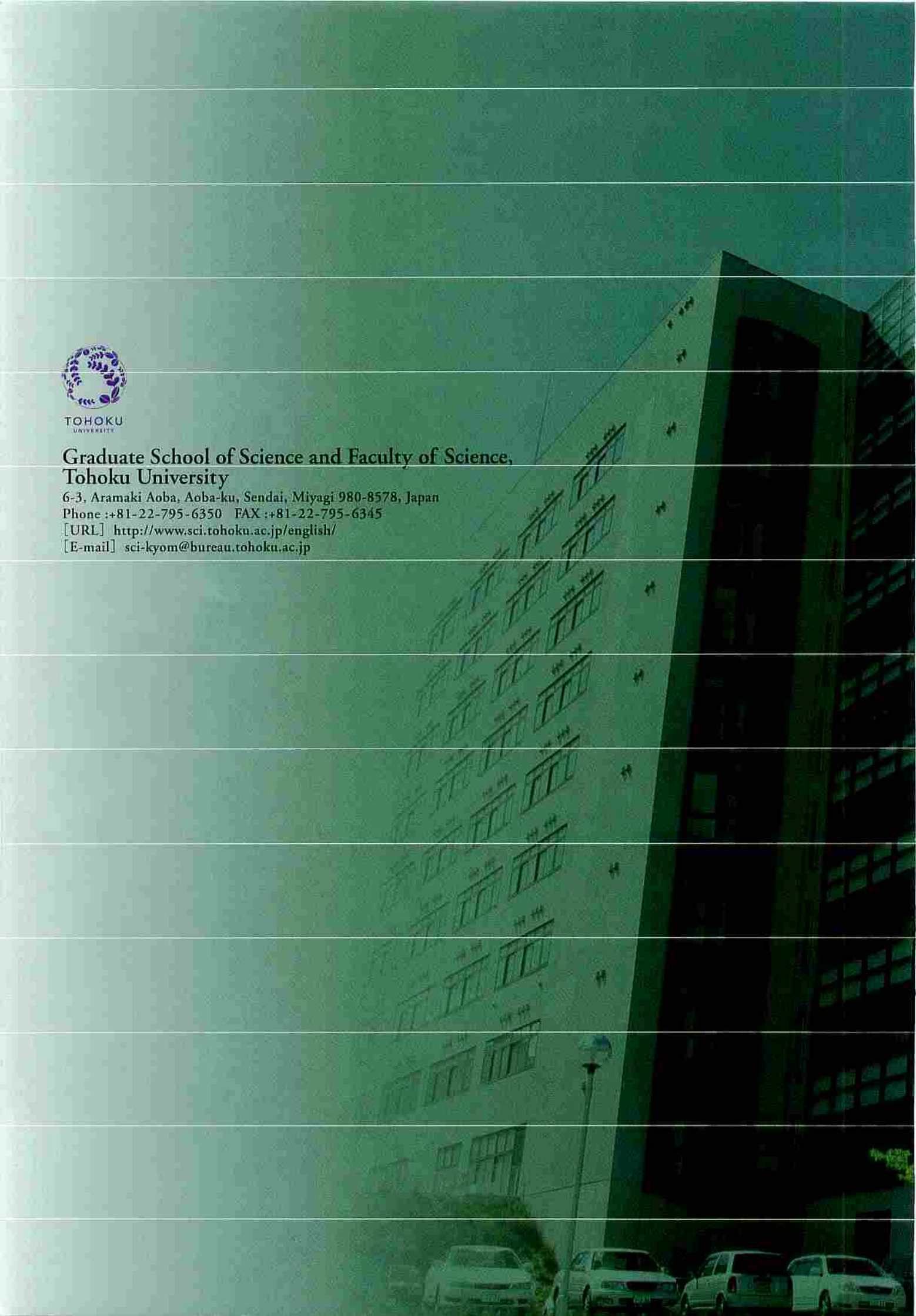
Japan Society for Promotion of Science (JSPS)
▸ *http://www.jsps.go.jp/english/*

Japan International Science and Technology (JISTEC)
▸ *http://www.jistec.or.jp/index_e.html/*

Japan Information Network
▸ *http://jin.jcic.or.jp/*

Miyagi Prefecture
▸ *http://www.pref.miyagi.jp/english/*

City of Sendai
▸ *http://www.city.sendai.jp/index-e.html/*



TOHOKU
UNIVERSITY

**Graduate School of Science and Faculty of Science,
Tohoku University**

6-3, Aramaki Aoba, Aoba-ku, Sendai, Miyagi 980-8578, Japan
Phone :+81-22-795-6350 FAX :+81-22-795-6345
[URL] http://www.sci.tohoku.ac.jp/english/
[E-mail] sci-kyom@bureau.tohoku.ac.jp