Hokkaido University

Faculty of Science

- Mathematics
- Physics
- Chemistry
- Biological Sciences
- Earth and Planetary Sciences

HOKKAIDO UNIVERSITY

Message from the Dean

Dr. AMITSUKA Hiroshi, Dean of the Faculty of Science

The Faculty of Science was originally established as the School of Science within Hokkaido Imperial University in 1930, and has a history of over 90 years. That school was the fourth to be founded within the university, following the Schools of Agriculture, Medicine, and Engineering. Establishing a school that was orientated toward basic science was strongly desired at that time, and the School of Science was expected to play a key role in supporting the active development of applied science, alongside the existing schools. The School of Science started with six departments: Mathematics, Physics, Chemistry, Geology/ Mineralogy, Botany, and Zoology. The building constructed for the school was the first modern reinforced concrete building in Sapporo at that time, and its striking architecture is still remarkable. The staircase area of the building has a dome-shaped ceiling with four traditional reliefs displaying "fruits," "sunflowers," "bats," and "owls," signifying "morning," "noon," "evening," and "night," respectively. These reliefs express the determination of the people at the time of the establishment to undertake unprecedented, cutting-edge research and high-standards education at any time, day or night.

That pioneering spirit of determination has been maintained throughout the history of the Faculty of Science, and has led to numerous significant research outputs. These include the first-ever artificial snow, created by Dr. Ukichiro Nakaya, and the development of the coupling reaction by Dr. Akira Suzuki, who was awarded the Nobel Prize in Chemistry in 2010. In 2018, a new innovative 10-year program, the "Institute for Chemical Reaction Design and Discovery (ICReDD)," was accepted as a World Premier International Research Center Initiative. The ICReDD is expected to revolutionize traditional approaches in developing chemical reactions through integrating the fields of computational science, information science, and experimental science.

Today, the Faculty of Science is one of the largest divisions in the university, with more than 300 faculty and staff members. It is composed of five departments: Mathematics, Physics, Chemistry, Biological Sciences, and Earth and Planetary Sciences. Affiliated institutes include the Institute of Seismology and Volcanology, the Genome Dynamics Research Center, and the Nuclear Reaction Data Centre. The faculty's research activities have been maintained at an advanced level, and the acquisition of competitive research funding has also been maintained at a high level. Since supporting basic science education throughout Hokkaido University is the faculty's responsibility, considerable efforts have been made to promote educational activities and, at the same time, to devise new teaching systems. These include establishing a Leading Program Promotion Office in 2014 to implement a reform plan, the "Ambitious Leaders' Program: Fostering Future Leaders to Open New Frontiers in Materials Science." An Active Learning Promotion Office was also established in 2015. Furthermore, in 2012, an Office for International Academic Support was established to support internationalization of the faculty and its related

schools. Their work includes providing daily assistance to students and researchers from overseas and conducting overseas public relations activities.

Research activities in the Faculty of Science are based on each researcher's scientific interests, which means that research subject areas are extremely diverse. This diversity is a significant strength of the faculty. With the increasing importance of the role of universities within ever-changing societies, and with the global community seeking means to address the challenges listed in the United Nations Sustainable Development Goals, our faculty needs to always be asking, "what can we do?" The diverse research conducted by the faculty is likely to contribute to resolving issues facing the world in various ways. Our faculty is determined to continue to move forward and contribute to society through promoting cutting-edge research activities and providing high-standards educational programs.

History

1930 School of Science is established with six departments: Mathematics, Physics, Chemistry, Geology and Mineralogy, Botany, Zoology.

1949 Departments of Botany and Zoology are combined as Department of Biology.

1953 Graduate School of Science (post-war educational system) is established with six departments: Mathematics, Physics, Chemistry, Geology and Mineralogy, Botany, and Zoology.
Department of Geophysics is added in the School of Science.

1959 Department of Polymer Science is established.

1963 Department of Chemistry II is formed.

1965 Liquid Helium Center is established.

1980 School of Science celebrates the 50th anniversary.

1981 High Resolution Nuclear Magnetic Resonance Laboratory is established.

1985 Laboratory for Energy Dispersive and Wave Length Dispersive X-ray Fluorescence Spectroscopy is established (renamed the Earth and Planetary Solid Material Analytical Laboratory in 2015).

1988 Laboratory for SQUID Magnetometer and Susceptometer is established.

1993 Departments of Biology and Polymer Science are reorganized into Department of Biological Sciences.

1994 Department of Geology & Mineralogy and Department of Geophysics are reorganized into Department of Earth Sciences.

1995 Departments of Chemistry and Chemistry II are reorganized as Department of Chemistry.

1998 Institute of Seismology and Volcanology is established by combining 4 observatories, Research Center for Earthquake Prediction, and Laboratory for Ocean Bottom Observatory.

2005 School of Science celebrates the 75th anniversary.

2006 Graduate School of Science is reorganized to "Graduate School of Science" and "Faculty of Science".
Faculty of Science consists of five Departments: Mathematics, Physics, Chemistry, Biological Sciences, and Natural History Sciences (renamed Earth & Planetary Sciences in 2015).

2007 Nuclear Reaction Data Centre is established.
Network Center for Molecular and System Life Sciences is established.
Observation and Data Centre for Cosmosciences is established.

2008 Genome Dynamics Research Center is established.
Center for Strategic Utilization of Elements is established.
Moving into the current block of buildings (Bldg 2-8).

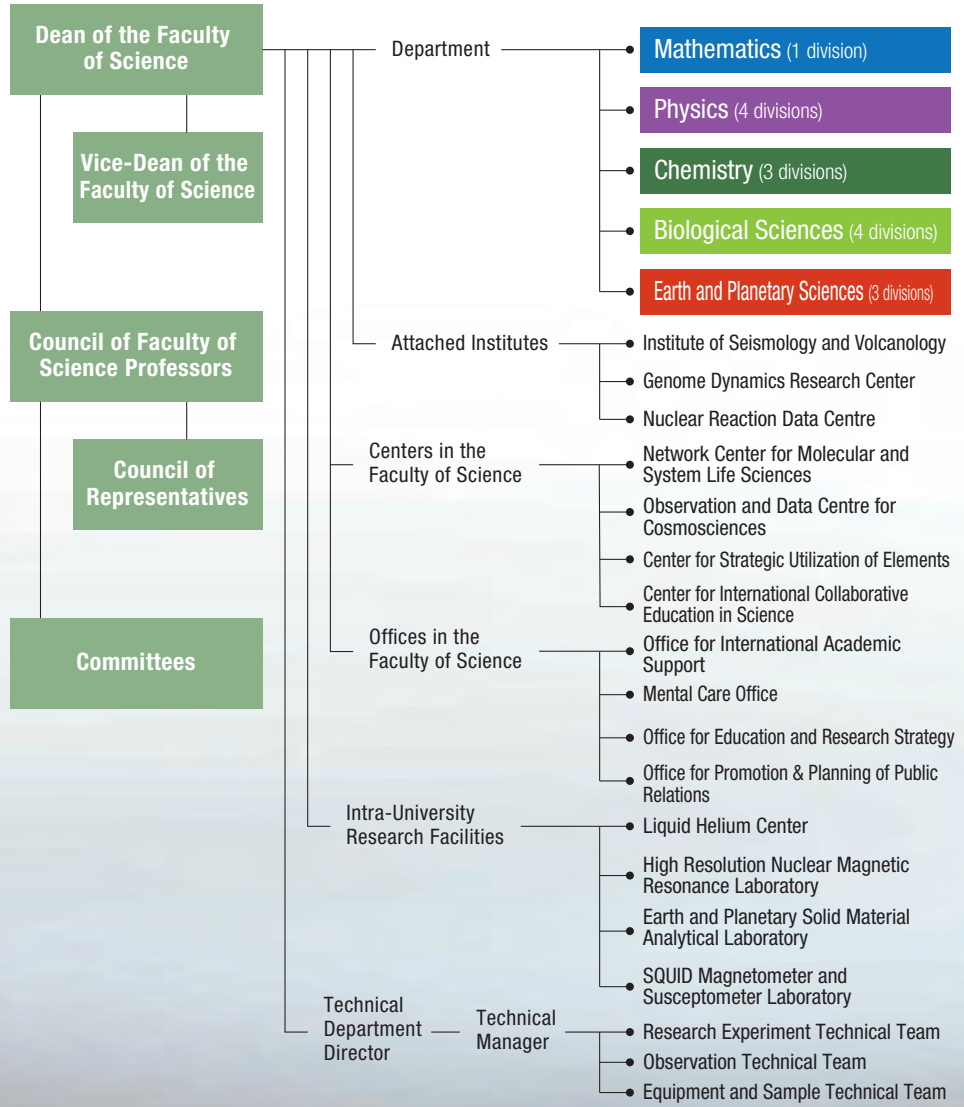
2010 Alumnus and former faculty member Dr. Akira Suzuki, who is also a professor emeritus at our university, is awarded the Nobel Prize in Chemistry.

2012 Office for International Academic Support is established.

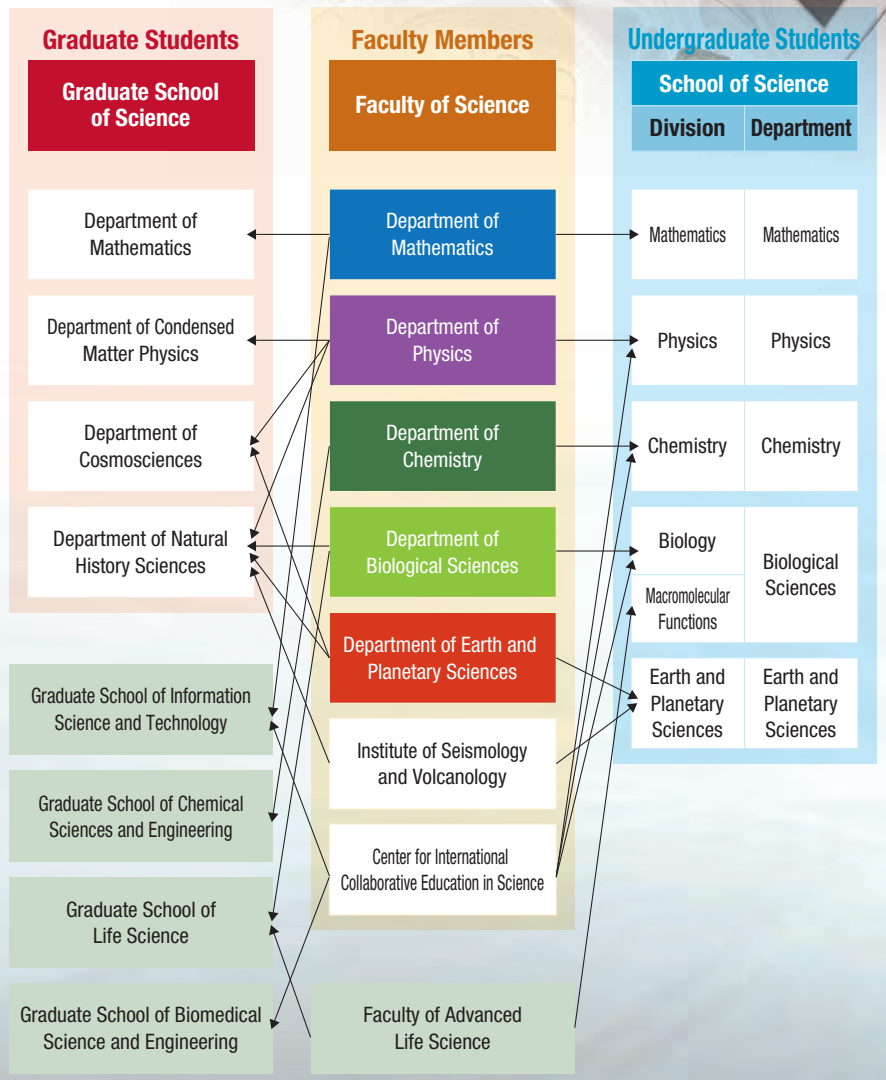
2016 Center for International Collaborative Education in Science is established.
Mental Care Office, Office for Research Strategy, and Office for Promotion & Planning of Public Relations are set up.

Organization

Faculty of Science



Relationship between the Faculty, Graduate School and School of Science



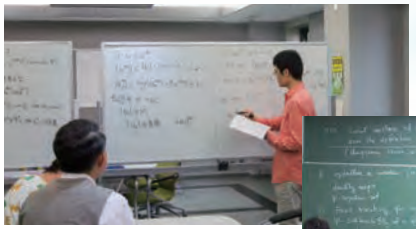
Department of Mathematics

https://www2.sci.hokudai.ac.jp/faculty/en/math

The Department of Mathematics, established in 1930, has approximately 40 academic staff, 150 undergraduate students (2nd–4th year), and 100 masters/doctoral graduate students. We host several international conferences with over 200 visitors every year. Our department covers a wide range of research areas — from theory-driven approaches that mainly seek to achieve theoretical sophistication to more empirically oriented approaches that employ computers for calculations on various phenomena. More specifically, our research fields include hyperplane arrangements, representation theory, differential geometry, singularity theory, partial differential equations, mathematical physics, chaos, probability theory, dynamical systems, and so on. We have published the Hokkaido Mathematical Journal since 1972 in collaboration with the Mathematics Library, which contains about 100,000 books and accepts about 350 titles of journals annually.

Our recent major achievements and participating programs are: (1) Japan Science and Technology Agency, Strategic Basic Research Programs (CREST), Research Area: Modeling Methods allied with Modern Mathematics, Project: Theory on mathematical modeling for spatio-temporal patterns arising in biology (Research Supervisor: Shin-Ichiro Ei), (2) Japan Science and Technology Agency, Strategic Basic Research Programs (CREST), Research Area: Technology for Computing Revolution for Society 5.0, Project: Optimization problems and their solutions with safe and secure quality validation based on mathematics (Research collaborator: Akira Sakai), (3) Promotion Office for Integrative Mathematics, (4) Hokkaido University Ambitious Leader's Program, (5) Ph.Discover (A project of Graduate school of Science, Hokkaido University).
In addition to our departmental staff, several members of the Research Institute for Electronic Science contribute to our diverse educational program.

Mathematics Library



Discussion

International conference

Specialized Fields and Laboratories

Algebra

- Algebraic analysis
- Algebraic geometry
- Arithmetic geometry
- Hyperplane arrangements
- Infinite analysis
- Representation theory
- Special functions
- Vertex algebras

Geometry

- Contact geometry of second order
- Differential geometry
- Dynamical systems
- Group cohomology
- Mirror symmetry
- Singularity theory
- Sub-Riemann geometry
- Topology

Analysis

- Algebraic analysis
- C*-algebras
- Geometric measure theory
- Geophysical equations
- Harmonic analysis
- Mathematical physics
- Nonlinear dispersive equations
- Potential theory
- Probability theory

Applied mathematics

- Asymptotic analysis
- Chaos
- Complex systems
- Dynamical systems
- Ergodic theory
- Ginzburg-Landau equation
- Probability theory
- Statistical Mechanics

Department of Physics

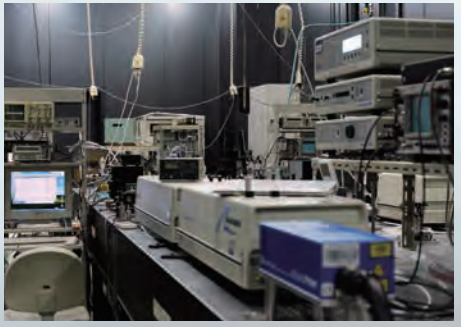
https://www2.sci.hokudai.ac.jp/faculty/en/phys

Physics is a discipline that studies the universal laws and principles that are followed by each and every entity in the natural world. The early 20th century saw the establishment of quantum theory, and modern physics has been having a tremendous impact on science and technology ever since. Studying physics leads us to understand the foundation of every branch of science and technology, which in turn, leads us to acquire tools and perspectives that allow us to flexibly navigate the rapidly changing world of science and technology.

Computer cluster for the large-scale numerical calculations (Theoretical Physics groups).

Experiments by using of low-temperature high-vacuum scanning tunneling microscope (STM) (Electric Properties of Solids Group).

The Department of Physics was established in 1930 and is one of the oldest departments in the Faculty of Science. In 1994, the History of Science course and the cooperative course in Condensed Matter Physics at the Research Institute for Electronic Science (RIES) were added to our department. Now about 40 staff members provide quality education and conduct cutting-edge research. Our challenging research covers natural phenomena on any spatiotemporal scale; from large-scale numerical simulations of the formation of stars and galaxies (Astrophysics), elucidation and manipulation of the various electronic properties in a material, including magnetism, dielectricity, and superconductivity (Condensed Matter Physics), the construction of new theory beyond the standard model (Elementary Particle Physics), and so on. In addition, the Theoretical Nuclear Physics group contributes to the construction and publication of a nuclear reaction database in the Hokkaido University Nuclear Reaction Data Centre, and stimulates the domestic and overseas research in the field.



Titanium:Sapphire laser system for the femtosecond pump-probe spectrometer (Condensed Matter Dynamics Group).

Specialized Fields and Laboratories

Theoretical Physics

- Theoretical Astrophysics
- Mathematical Physics
  (Magnetic and optical properties of low-dimensional electron systems)
- Statistical Physics
  (Phase transition on complex network systems, molecular dynamics on non-equilibrium systems, Superconductivity, Bose-Einstein condensation, and magnetism)
- Theoretical Nuclear Physics
- Theoretical Particle Physics and Cosmology

Experimental Physics

- Condensed Matter Dynamics
- Electric Properties of Solids
- J Material: Physics of Strongly Correlated Systems
- Nanostructure Physics (RIES)
- Electronic Properties of Low-dimensional Materials
- Observational Astronomy

History of Science

- Philosophy of Science
- Science and Technology Communication

Department of Chemistry

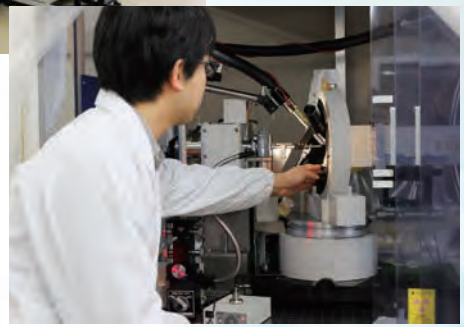
https://www2.sci.hokudai.ac.jp/faculty/en/chem

Chemistry is the exploration of matter; it involves the creation of molecules and materials, and investigation of their structures, properties, functions, and reactivity. Chemistry is everywhere: in space, on the earth, and in the human body. Corresponding to the wide range of topics in chemistry, the Department of Chemistry consists of 14 main laboratories representing all sub-disciplines (physical, inorganic & analytical, organic, and biological), including interdisciplinary areas of physics, catalysis, and life sciences. In addition, seven laboratories at Institute for Catalysis, Research Institute for Electronic Science, and Institute for Genetic Medicine at Hokkaido University, and four laboratories at the National Institute for Materials Science (NIMS) in Tsukuba, contribute cooperatively to the department.

The Department of Chemistry has provided excellent programs for undergraduates since 1930 and for graduate students since 1953. Emeritus Professor Akira Suzuki, a 2010 Nobel Laureate, studied in the department and received his Ph.D. degree in 1960. Dr. Mamoru Mohri, an astronaut, graduated from the department in 1970. Many other graduates are actively involved in cutting-edge research worldwide. In 2010, the integrated Graduate School of Chemical Sciences and Engineering was established to allow students to study chemistry in a broader context so as to flexibly respond to the needs of the times. All faculty members in chemistry participate in graduate training in cooperation with faculty members from Engineering. The Department of Chemistry also maintains active research programs to contribute to human society.

Emeritus Professor Akira Suzuki, a 2010 Nobel laureate in Chemistry, with students of Chemistry Department

Instruments for structure analysis



Single-crystal X-ray diffraction measurement

Specialized Fields and Laboratories

Physical Chemistry

- Physical Chemistry
- Quantum Chemistry
- Structural Chemistry
- Condensed Matter Chemistry
- Theoretical Chemistry
- Material Chemistry

Inorganic and Analytical Chemistry

- Coordination Chemistry
- Analytical Chemistry

Organic Chemistry

- Organic Chemistry I
- Organic Chemistry II
- Organometallic Chemistry
- Mechanistic Organic Chemistry

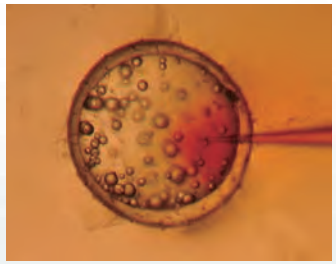
Biological Chemistry

- Biological Chemistry
- Bioorganic Chemistry

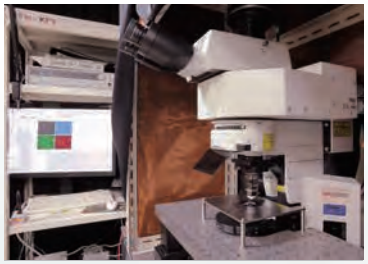
Department of Biological Sciences

https://www2.sci.hokudai.ac.jp/faculty/en/bio

Living organisms are dynamic systems in which a great variety of cells and molecules form complicated networks. In the Department of Biological Sciences of the Faculty of Science, we conduct basic research to understand how the diversity of living organisms originated, based on the structure and function of individual cells and their constituents. In particular, we focus on mechanisms that maintain homeostasis in basic cellular functions and organisms, as well as on principles involved in maintaining the continuity and diversity of life. Our research fields explore diverse topics at various levels in the biological hierarchy, from molecules and cells to systems and individual animals and plants. The department of Biological Sciences is organized into four research groups. The first is "Cell Structure and Function", which focuses on signaling mechanisms underlying higher-order cellular functions and on physiological mechanisms by which plants adapt to environmental stresses. The second is "Behavioral Neurobiology", which focuses on brain function in cognition and animal behavior. The third is "Reproductive and Developmental Biology", which focuses on the molecular, cellular, and physiological underpinnings of animal ontogeny and phylogeny. The fourth research group, "Biodiversity", tackles the evolutionary history of life, trying to establish classification schemes in various groups of organisms. It also addresses a wide variety of evolutionary issues including the mechanism of the formation of geographic variation, and the mechanism of the formation of new species, called speciation. With 33 faculty members as of 2021, the Department of Biological Sciences has one of the longest histories of any biology department in Japan, dating to establishment of the Departments of Zoology and Botany in 1930 and reorganized in its present form in 1993.



Microinjection into an egg of the medaka fish *Oryzias latipes*



Multiphoton laser-scanning microscope in shared equipment room

Shared laboratory for molecular biology has high-speed large-scale DNA sequencers and real-time PCRs.

Specialized Fields and Laboratories

Cell Structure and Function

- Molecular Genetics
- Plant Science
- Plant Developmental Physiology
- Development and Evolution of Plants
- Molecular Cell Biology

Behavioral Neurobiology

- Neuroethology
- Behavioral Physiology
- Cognitive Neuroscience
- System Neurobiology
- Molecular Neuroethology
- Behavioral Ecology

Reproductive and Developmental Biology

- Reproductive Biology
- Developmental Biology
- Comparative Endocrinology
- Molecular Endocrinology
- Molecular and Cellular Gamete Biology

Biodiversity

- Animal Taxonomy and Speciation
- Algal and Protist Taxonomy
- Genetic Diversity
- Population Ecology

Department of Earth and Planetary Sciences

https://www2.sci.hokudai.ac.jp/faculty/en/eps

Research groups in the Department of Earth and Planetary Sciences fall into three divisions. The "Division of Earth and Planetary Dynamics" studies mantle dynamics, earthquakes, volcanic activity, surface and ground water, and atmosphere-ocean circulation. The "Division of Earth and Planetary System Science" studies volcanoes, fossils, mineral microstructure, the isotopic composition of asteroids, the coordinated evolution of Earth's bio- and geospheres, and plate tectonics. The "Division of Cosmosciences" studies planetary atmospheric dynamics, Earth's atmosphere, and the evolution of the solar and planetary systems. The interests of the Department of Earth and Planetary Sciences span a size scale from molecules to the solar system, and a time scale from microseconds to billions of years. Because significant alterations in the Earth's abiotic environment are accompanied by, and often dictated by, changes originating in the biosphere, our department views the integration of geosciences and biodiversity studies as crucial to understanding the evolution of Earth and its life, and for assessing the possibility of life on other planets. Our departmental staff of about 40 faculty members conducts a broad range of cutting-edge experimental, observational, and theoretical research; collaborates with leading domestic and international researchers and organizations; and continually seeks to explore new scientific frontiers.

Isotope microscope used for the survey of the isotopic composition of asteroidal materials.

Picture of the field measurement showing the sampling of the hot volcanic gas.

Pirka telescope with an effective aperture of 1.6 m for planetary and astronomical observations.

Specialized Fields and Laboratories

Earth and Planetary Dynamics

- Physical Oceanography and Climate
- Meteorology
- Space Geodesy
- Seismology

Earth and Planetary System Science

- Petrology and Volcanology
- Paleobiology
- Geochemistry
- Earth Materials Science
- Earth System Evolution
- Geotectonics

Cosmosciences

- Astrophysics
- Planetary and Space Science

Institute of Seismology and Volcanology

https://www2.sci.hokudai.ac.jp/faculty/en/isv

The Institute of Seismology and Volcanology, established in 1998 as successor of several earthquake and volcano observation facilities since 1964, conducts basic researches on generation mechanisms of earthquakes, tsunamis, and volcanic eruptions to contribute to their forecasts and disaster mitigation. It consists of four main research sections: The Laboratory of Seismological Observation, The Laboratory of Ocean Bottom Seismology and Tsunami, The Laboratory of Volcano Physics, and The Laboratory of Subsurface Structure. The Institute is one of main institutes in Japan responsible for national research projects on Earthquake and Volcano Hazards Observation and Research Program (proposed by the Ministry of Education, Culture, Sports, Science and Technology). The Scientific Support Section of Hazard Mitigation for Earthquakes and Volcanoes has been in operation to accelerate our contribution through outreach and activities to raise hazard awareness in local communities and the general public.

Ocean bottom seismometers

Field experiment on active Meakan-dake volcano

Genome Dynamics Research Center

http://www.sci.hokudai.ac.jp/gdynamics/

The Center consists of three laboratories that provide various types of support for biological research by qualified faculty members and students at Hokkaido University. The Laboratory of Experimental Animals and Plants provides the facilities necessary for breeding and culturing a wide variety of animals and plants, and adequate experimental environments. The Laboratory of Animal Cytogenetics maintains and supplies various vertebrate cell lines, and supports molecular studies on chromosome structure by teaching the latest techniques. Facilities for cell culture are available for common use. The Laboratory of Molecular Genetics provides facilities necessary for research using recombinant DNA methodology, such as isolated greenhouses, a tissue culture room, and P1-level biological laboratories. In 2020 the Center is being used by 33 research groups at Hokkaido University.

Greenhouse for cultivating various plants

Facilities for breeding rodents with automated water supply

Nuclear Reaction Data Centre

https://www.jcprg.org

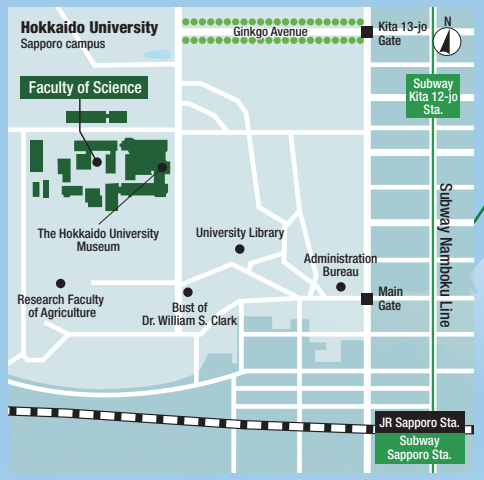
The Nuclear Reaction Data Centre was established in 2011 as the successor to the Japan Charged-Particle Nuclear Reaction Data Group (JCPRG) founded in 1974. Its objectives are: 1) Compilation of data obtained in Japan on charged-particle and photo-induced nuclear reactions, 2) Evaluation of reaction data for light nuclei, 3) Promotion of international collaborations, and 4) Training of graduate students. The Centre is a member of the International Network of Nuclear Reaction Data Centres (NRDC) under the auspices of the International Atomic Energy Agency (IAEA). The NRDC collaborates in compiling experimental nuclear reaction data and maintaining the compiled data in the EXFOR (EXchange FORmat) database. We have contributed about 10 percent of the data on charged-particle nuclear reactions in the EXFOR database.

Discussion among members

Contact

Office for International Academic Support
Faculty of Science, Hokkaido University

Kita 10 Nishi 8, Kita-ku Sapporo 060-0810 JAPAN
Tel +81-(0)11-706-2916 Fax +81-(0)11-706-2907
Email: international@sci.hokudai.ac.jp
https://www2.sci.hokudai.ac.jp/office/international/



Useful Links

Faculty of Science
https://www2.sci.hokudai.ac.jp/faculty/en

Facebook
https://www.facebook.com/OIAS.Sci

Hokkaido University
https://www.global.hokudai.ac.jp/

Related Graduate Schools

Graduate School of Science
https://www2.sci.hokudai.ac.jp/gs/en

Graduate School of Life Science
http://www.lfsci.hokudai.ac.jp/en/

Graduate School of Chemical Sciences and Engineering
https://www.cse.hokudai.ac.jp/english/

Graduate School of Biomedical Science and Engineering
https://www.med.hokudai.ac.jp/en/bme/

Graduate School of Information Science and Technology
https://www.ist.hokudai.ac.jp/eng/

MIX
Paper from responsible sources
FSC® C015418

Copyright©2021 Faculty of Science, Hokkaido University. All Rights Reserved.