Graduate School of Advanced Science and Engineering (Doctoral Course)
Division of Advanced Science and Engineering
Lists of Academic Supervisors

May 1, 2024

(Note) The following lists are current as of the above date, and include faculty members who may not be able to accept students due to retirement or other reasons at the time of admission.

Science Programs

Mathematics Program

Specialty	Research Fields	Academic Staff
Algebra	Number Theory, Algebraic Geometry, Arithmetic Geometry, Motives, Singularities, Group Theory, Representation Theory, Commutative Algebra, Coding Theory, Cryptography.	SHIMADA, Ichiro KIMURA, Shun-ichi TAKAHASHI, Nobuyoshi
Geometry and Topology	Differential Geometry, Topology, Manifolds, 3 and 4 Dimensional Mathematics, Knots, Hyperbolic Geometry, Homogeneous Spaces, Symmetric Spaces, Representation Theory of Lie Groups, Singularities.	ISHIHARA, Kai FUJIMORI, Shoichi OKUDA, Takayuki TERAGAITO, Masakazu*
Mathematical Analysis	Differential Equations, Nonlinear Analysis, Dynamical Systems, Potential Theory, Complex Analysis, Scattering Theory, Algebraic Analysis, Asymptotic Analysis, Resurgence Theory.	KAWASHITA, Mishio NAITO, Yuki TAKIMOTO, Kazuhiro HIRATA, Kentaro KAMIMOTO, Shingo SHIMOMURA, Tetsu IKEHATA, Ryo
Probability Theory and Mathematical Statistics	Probability Theory, Stochastic Processes, Financial and Insurance Mathematics, Random Fields, Theory for Multivariate Data Analysis and its Applications, Statistical Inference, Asymptotic Expansion for Statistical Distributions, Resampling Methods, Mathematical Statistics.	INOUE, Akihiko WAKAKI, Hirofumi YANAGIHARA, Hirokazu IMORI, Shinpei
Mathematical Sciences	Differential Geometry, Differential Equations, Bayesian Statistics, Knot Theory	MIZUMACHI, Tetsu HASHIMOTO, Shintaro SHIBUYA, Kazuhiro KOTORII, Yuka*

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International Program for Collaborative Sciences Enabling the Future

Physics Program

Specialty	Research Fields	Academic Staff
Theoretical Particle and Hadron Physics	Quest for fundamental law of elementary particle and hadron physics. Physics of mesons and baryons. Lattice QCD. Effective theory of QCD. QCD phase diagram, Phenomenological analyses on relativistic heavy ion collisions. Dynamical symmetry breaking. Origin of mass and CP violation.	NONAKA, Chiho* MOROZUMI, Takuya ISHIKAWA, Ken-ichi INAGAKI, Tomohiro
Astrophysics	Theoretical and observational research on astrophysics. The main research fields are as follows. Gravitational lensing, observational cosmology, dark matter, baryonic physics, galaxy clusters, black holes, neutron stars, pulsar magnetosphere, particle acceleration, gravitational waves, gravitational-wave cosmology, tests of gravity in extreme environments, and fundamental particle searches.	OKABE, Nobuhiro NISHIZAWA, Atsushi
Quark Physics	Experimental study of an exotic state of matter, quark-gluon-plasma, utilizing nuclear collisions at the energy frontier. Investigation of properties and space-time evolution of such a quark matter, which filled the universe in 10 micro-seconds after the Big-Bang. Search for dark matter/energy and new phenomena arising from ultra-intense fields. Computational magneto-hydrodynamics and interdisciplinary plasma physics. R&D of new particle detectors. High-performance computing and data analysis.	SHIGAKI, Kenta* YAMAGUCHI, Yorito HOMMA, kensuke
High-Energy Astrophysics	Study of high-energy astrophysical phenomena through cosmic X-ray and gamma-ray observations with Fermi GeV gamma-ray satellite, X-ray satellites, TeV gamma-ray telescopes, and so on. Astronomical objects of interest are neutron stars, black holes of various masses, supernova remnants, galaxies and clusters, and gamma-ray bursts. Together with Kanata telescope, multiwavelength and multimessenger observations are performed. Future X-ray and gamma-ray projects. Development of new radiation detectors is also an important research target.	FUKAZAWA, Yasushi MIZUNO, Tsunefumi TAKAHASHI, Hiromitsu
Optical and Infrared Astronomy	We study astrophysical phenomena, mainly based on optical and infrared observations, using our 1.5m 'Kanata' Telescope at the Higashi-Hiroshima Observatory, the James Webb Space Telescope, and other facilities. These data are further combined with multi-wavelength observations taken with the ALMA observatory and X-ray/gamma-ray satellites. We also promote research and development of new astronomical instruments, including future telescopes and satellites.	KAWABATA, Koji UEMURA, Makoto
High Energy Physics	Study of fundamental principles of nature in the following two fields. Experimental Particle Physics using High Energy Accelerators: Research in physics, detector and accelerator development, aiming to reveal how our universe began. Quantum Physics Deeper understanding quantum physics, as a language to describe microscopic worlds.	TAKAHASHI, Tohru
Structural Physics	Electron charge density study of ferroelectric and related materials by using synchrotron radiation. X-ray and neutron crystal structure analysis to study the phase-transition mechanism and relationship between crystal structure and physical properties.	KUROIWA, Yoshihiro MORIYOSHI, Chikako
Electronic Properties of Solids	Study of correlation between electronic states and physical properties in magnetic materials and/or dielectric materials by means of X-ray spectroscopy (XAS, MCD, XLD, PES, XES) and X-ray diffractometry using synchrotron radiation. Investigation of the physical properties under extreme conditions.	NAKAJIMA, Nobuo
Synchrotron Radiation Physics of Solids	Studying topologically non-trivial electronic band structures of Weyl semimetals, nodal-line semimetals and related spintronic materials by spin- and angle- resolved photoelectron spectroscopy utilizing synchrotron and laser radiation. Unraveling origins of superconductivity, metal-insulator transition and multipoles in strongly correlated systems.	KIMURA, Akio* KURODA, Kenta*
Molecular Photoscience	Atomic-level elucidation of functions, properties, and reaction dynamics of nanomaterials and bio molecules using advanced quantum beams such as synchrotron radiation, free electron lasers, and ultrafast pulsed lasers. Interdisciplinary physics with chemistry and biology based on the interaction between light and matter. Basic research on synthesis of new materials.	SEKITANI, Tetsuji WADA, Shin-ichi
Synchrotron Radiation Materials Science	Investigation of electronic and spin structures of materials by high-resolution photoemission spectroscopy, highly efficient spin- and angle-resolved photoemission spectroscopy, and soft X-ray magnetic circular dichroism using synchrotron radiation (SR) in the ultraviolet and soft X-ray region, study of biomolecule structures using vacuum-ultraviolet circular-dichroism spectroscopy, and the development of advanced SR instruments for materials science at Research Institute for Synchrotron Radiation Science (HiSOR).	NAMATAME, Hirofumi OKUDA, Taichi SHIMADA, Kenya IDETA, Shin-ichiro MATSUO, Koichi MIYAMOTO, Koji SATO, Hitoshi SAWADA, Masahiro

Specialty	Research Fields	Academic Staff
Physics of Synchrotron Radiation	Researches on particle accelerators, particularly synchrotron light sources. Beam physics studies on electron dynamics and electromagnetic radiation in synchrotrons. Researches and developments of accelerator technology for advanced light sources.	KATOH, Masahiro

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Program	Research Fields	Academic Staff
Transdisciplinary Science and Engineering Program	Non-Equilibrium Phenomena in Polymer Physics and Phase Transitions	TODA, Akihiko (Retirement at the end of March 2025)
	Static and dynamic structures and physical properties of structurally disordered matter	INUI, Masanori (Retirement at the end of March 2026)
	Quantum information theory concerning e.g. quantum entanglement and quantum communication	ISHIZAKA, Satoshi
	Foundation of quantum mechanics and quantum information sciences including quantum computer and quantum artificial intelligence	HATAKENAKA, Noriyuki (Retirement at the end of March 2025)
	Crystal growth and pattern formation of softmatter	TAGUCHI, Ken
	Physics of complex systems, such as active matter and non-equilibrium ordering	TANAKA, Shinpei
	Physics Education Research, Molecular Dynamics Simulation of Liquids	MUNEJIRI, Shuji
	Physics of Disordered Materials (liquids and glasses)	KAJIHARA, Yukio

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Earth and Planetary Science Program

Program	Research Fields	Academic Staff
[illegible]	Tectonics of East Asia, Continental evolution, Deformation microstructure, Microstructure of the Earth, Mineral physics, Water-rock interaction, Crystal chemistry	ANDO, Jun-ichi KATAYAMA, Ikuo OKAZAKI, Keishi DAS, Kaushik OKAWA, Makio
[illegible] Planeta[illegible]	Magma genesis, Astrobiology, Space exploration, Earth environmental change, Microbial mineralization, Planetary collision process	SHIBATA, Tomoyuki YABUTA, Hikaru* SHIRAISHI, Fumito MIYAHARA, Masaaki KOIKE, Mizuho
[illegible] Planetary [illegible]	Fault mechanics, Earthquake, Material transport, Mantle convection	INOUE, Toru SUDA, Naoki KAWAZOE, Takaaki NAKAKUKI, Tomoeki
Integrated Earth and Ocean Sciences	Geochemical cycles and environmental changes recorded in sedimentary rocks Microbiological and geochemical explorations of subseafloor biosphere Physico-chemical processes in earthquake fault zones Development of analytical techniques of isotopes and trace elements in core samples Diversity and ecology of microbes inhabiting the deep biosphere	ISHIKAWA, Tsuyoshi (Visiting Prof.) TOMIOKA, Naotaka (Visiting Prof.) HIROSE, Takehiro (Visiting Prof.) MORONO, Yuki (Visiting Prof.) HOSHINO, Tatsuhiko (Visiting Assoc.prof.) Nakada, Ryoichi

Chemistry Program

Specialty	Research Fields	Academic Staff
Structural Physical Chemistry	Studies on the structure and dynamics of molecular complexes and functional molecules by uses of nonlinear laser spectroscopy and ab initio molecular orbital calculations. Theoretical studies on the electronic structures and reactions of excited molecules.	INOKUCHI, Yoshiya TAKAHASHI, Osamu MURAMATSU, Satoru
Solid Material Chemistry	Synthesis, crystal structure, magnetic, optical, and conducting properties for molecule-based materials, studied by SQUID, magnetic resonance, MCD, and X-ray diffraction.	INOUE, Katsuya* NISHIHARA, Sadafumi LEONOV, Andrey *
Coordination Chemistry	Preparation, structures, and properties of transition metal complexes having phosphorus ligand(s) with novel functionality. Control of catalytic activity using External-stimuli responsive coordination compounds.	MIZUTA, Tsutomu KUME, Shoko
Analytical Chemistry	Studies on the physical and chemical responses or phenomena of single particles levitated in air by means of a laser trapping technique.	ISHIZAKA, Shoji MATSUBARA, Hiroki
Organic Stereochemistry	Study on the developments of supramolecular assembly and polymer generated from hetero- and homotopic monomers linked through multiple non-covalent forces, and their innovative functions.	HAINO, Takeharu* HIRAO, Takehiro
Photochemistry of Advanced Materials	Advanced nanomaterials synthesis based on physical chemistry method. Optoelectrical properties of nanostructured material. Development of basic structure for next-generation photovoltaic and LED. Optical properties of condensed phase.	SAITOW, Ken-ichi
Physical Chemistry of Kinetics	Experiments based on the selective detection of a single quantum state of atoms and molecules by laser spectroscopy. Studies on the kinetics and dynamics of the chemical reactions and energy transfer processes in atomic and molecular collisions.	KOHGUCHI, Hiroshi
Quantum Chemistry	Computational chemistry based on electronic structure theory. Theoretical development of relativistic quantum chemistry for heavy element molecules and its applications on various scientific fields.Studies on the electronic states and reactions of excited molecules induced by X-ray photons or electron impact. Solvation structure of solutes revealed by soft X-ray spectroscopy.	ABE, Minori OKADA, Kazumasa
Synthetic Organic Chemistry	New reactions-, new reagents-, and new catalysts-based synthetic organic chemistry, and creation of new functional molecules therefrom. Studies on the synthesis and reaction mechanism of organic compounds of main group elements. Chemistry of hypervalent molecules.	YOSHIDA, Hiroto NAKAMOTO, Masaaki
Organic Reaction Chemistry	Organic photochemistry, reactive intermediate chemistry, synthesis of biologically active compounds, artificial Photosynthesis, photochemistry of metal complexes.	ABE, Manabu ISHITANI, Osamu TAKAGI, Ryukichi
Radiation Reaction Chemistry	Chemistry related to radiation and radioactive materials. Environmental chemistry, chemistry of exotic atoms and development of a new analysis method using radiation.	NINOMIYA, Kazuhiko

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Engineering Programs & Informatics and Data Science Program

Applied Chemistry Program

Specialty	Research Fields	Academic Staff
Organic Supramolecular Chemistry	Education and research on development of synthetic reactions and supramolecular complexes applied for creating functional organic molecules in everyday life, medicinal field, and high technology.	IKEDA, Atsushi KAWASAKI, Riku
Polymer Chemistry	Education and research on polymer chemistry, especially, precision polymerization catalyzed by transition metal complex and development of new polymers from renewable biomass.	NAKAYAMA, Yuushou TANAKA, Ryo
-Conjugated Materials Chemistry	Education and research on novel organic functional and semiconducting -conjugated polymers, and their application to energy and/or electronic devices such as organic solar cells. Education and research on novel organic synthetic methodology by developing new reactions, reagents, and catalyst, and their application to syntheses of various organic functional materials and pharmaceuticals.	OSAKA, Itaru
Functional Dye Chemistry	Development of novel functional dye and polymer materials with epoch-making optoelectronic characteristics, fluorescence sensing ability and therapeutic activity. Education and research on new functions of organic/inorganic materials and their applications to novel electronic/optoelectronic devices	OOYAMA, Yousuke IMAE, Ichiro IMATO, Keiichi KOMAGUCHI, Kenji
Inorganic and Hybrid Materials Chemistry	Research and education on ceramics, with main interests on molecular design, synthesis, characterization, and applications of new inorganic or inorganic-organic hybrid materials having functional nano-structures.	INUMARU, Kei KATAGIRI, Kiyofumi TARUTANI, Naoki
Catalytic Materials Chemistry	Synthesis and characterization of novel functional metal oxide materials such as metal oxide clusters, zeolites, and related materials, and their application to catalysts and adsorbents in environmental and energy research fields.	SADAKANE, Masahiro TSUNOJI, Nao

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Program	Specialty	Research Fields	Academic Staff
Smart Innovation Program (Applied Chemistry)	Element-Based Organic Materials Chemistry	Education and research on element-based materials, in particular synthesis and applications of polymers with inorganic elements, and development of functional materials with epoch-making optoelectronic characteristics.	OHSHITA, Joji ADACHI, Yohei
	Computational Materials Science	Education and research on computational chemistry, in particular understanding of chemical and physical phenomena based on molecular simulation and applications using data science.	ISHIMOTO, Takayoshi

Chemical Engineering Program

Specialty

Electrical, Systems, and Control Engineering Program

Specialty	Research Fields	Academic Staff
Social Informatics	Research and simulation analysis on the fundamental technologies of artificial adaptive agent models. Analytical studies based on game theory regarding equilibrium and consensus among decision-makers such as individuals and organizations, and development of decision-making methods. Optimization of social systems (electric power systems) using optimization techniques such as mathematical optimization and evolutionary computation to design optimal next-generation social systems.	HAYASHIDA, Tomohiro SEKIZAKI, Shinya
Production Systems Engineering	Research on design, planning and control techniques of large-scale, complicated manufacturing systems and supply chains. Some research topics are the utilization of human capability as a fundamental element of the production system, the development of manufacturing systems which adapt to the change of manufacturing environment, the application of optimization and simulation techniques for planning facility, production-distribution-inventory systems, and service systems, and the development of scheduling techniques.	MORIKAWA, Katsumi NAGASAWA, Keisuke
Mathematics	Research on inverse problems and the eigenvalue problems of differential equations. Mathematical analysis of linear PDEs. Dynamical systems and ergodic theory. Research on nonlinear elliptic and parabolic differential equations, and applications to the dynamical system and phenomenological theory. Statistical physics of neural networks.	SHIBATA, Tetsutaro TSUGE, Naoki KAWASHITA, Wakako SANO, Megumi CHUNG, Yong Moo WAKASUGI, Yuta
Electric Power and Energy System	Research on large-scale, complex and nonlinear electric power systems, including problems of operation, planning, stability analysis, and control. Recent topics include the construction of smart microgrid using new type of converter under development (hardware) and its control technologies (software). Keywords: renewable energy, distributed power generation, battery, vehicle-to-grid, optimization technique, artificial intelligence (AI) application, control system design, analysis technology, reliable ICT application, algorithm development.	ZOKA, Yoshifumi SASAKI, Yutaka TAOKA, Satoshi
Biological Systems Engineering	The main subject of research is the measurement, analysis and modeling of biological functions with its engineering applications. The research area covers human motion analysis, bioelectric signal processing, welfare robotics, artificial life, soft computing, electric circuit design and medical electronics engineering, physical assist devices, haptics, virtual reality, human augmentation, and human interaction, etc.	TSUJI, Toshio KURITA, Yuichi SOH, Zu
Applications of Cybernetics	Research on the modeling and application of a complicated phenomenon. For example, measurement and diagnosis for the living body information and system integration, engineering application, etc.	KOMINE, Hidehiko MIYATA, Natsuki

Supervisor below in charge of plural programs takes charge of the program in the following table, including this program.

Program	Specialty	Research Fields	Academic Staff
Smart Innovation Program (Electrical, Systems, and Control Engineering)	Control Systems Engineering	Research and education on system control technology and digital signal processing. Specifically, adaptive & learning control system technology for industrial systems, Cyber-Physical Systems (CPS), Model Based Development (MBD) and digital signal processing for communication systems and image processing.	YAMAMOTO, Toru WAKITANI, Shin NAKAMOTO, Masayoshi
	Smart Robotics	Research on hyper-human robotics technology exceeding man's capability, and its real world applications. For example, high-speed robot vision, robot mechanism design, mobile robot, sensor-based manipulation, multimedia applications, industrial applications, medical applications, bio-	

Specialty	Research Fields	Academic Staff
Materials Forming Science and Engineering	Experimental investigation of elastic-plastic (or viscoplastic) behavior and fracture limit of metallic materials, Material modeling and material parameter identification based on theory of elasto-plasticity, Prediction of forming limit and springback of difficult-to-form sheet metals, Hot and warm incremental forming, Numerical analysis and optimization problems in metal forming.	HINO, Ryutaro
Materials Joining Science and Engineering	Development of high-quality / high-efficiency welding and joining processes using hot-wire method with several heat sources (laser, GMA and GTA); Evaluation of hot cracking susceptibility and elucidation of mechanism of hot cracking during welding using in-situ observation technique with high-speed cameras and multi-sensor camera; Prediction of hot cracking initiation and distortion during welding using computational simulation; Development of novel joints based on microstructure formation and strength analysis of welded joints; Development of automation and defect detection technologies combining various sensors and machine learning.	YAMAMOTO, Motomichi
Materials Engineering for Energy Conversion and Storage	Research and development of energy conversion materials which are in particular related to: Secondary battery materials (Li-Ion and Ni-MH); Fuel cell with non-conventional mechanisms, energy conversion systems (thermochemical hydrogen production and electrolysis of NH_3 and H_2O), and/or solid state hydrogen storage materials; Energy recovery from waste and biomass.	ICHIKAWA, Takayuki
Thermal Engineering	Production of hydrogen from biomass using supercritical water; Heat transfer and chemical reactions in supercritical water; Hydrothermal pretreatment of biomass; Chemical heat pump; Structural analysis of nanocrystal; Fundamental research of carbon nanotube.	MATSUMURA, Yukihiko
Fluid Engineering	Large-scale computer simulation of Magnetohydrodynamics for magnetic confinement fusion plasmas; Development of carbon-neutral energy using plasma; Development of new imaging diagnostics for turbulence and its applications; Numerical analysis and measurement to elucidate wall heat transfer mechanism in turbulent flow in pipes, and characteristics of gas-liquid two-phase flows such as liquid jets and fuel sprays for loss reduction technology; Development of new research areas on medical science and engineering using dynamical systems theory and data-driven science	SUZUKI, Yasuhiro OGATA, Yoichi
Combustion Engineering	Construction of reaction mechanisms for practical combustion; Improvement of IC engine combustion based on detailed kinetic analysis; Measurements of ignition properties of fuel components and mixtures; Improvement of combustion based on the ignition characteristics of fuels; Low NOx, low SPM tubular combustion; Micro combustor; Fire safety.	MIYOSHI, Akira SHIMOKURI, Daisuke
Reactive Gas Dynamics	Fundamental studies on high-speed reactive gas flows such as detonations or explosions; Development of new internal combustion engines or heat sources using high-speed combustion; Fundamental studies on laser ignition; Numerical studies on laser-plasma physics such as laser fusion or laser-plasma x-ray sources; Physics and chemistry of explosions in gas-phase or solid-gas-mixed-phase fluids.	ENDO, Takuma JOHZAKI, Tomoyuki KIM, Wookyung
Plasma Science		

Transportation and Environmental Systems Program

Specialty	Research Fields	Academic Staff
Structural Systems	Buckling and ultimate strength evaluations Fracture and fatigue strength evaluations Computational Mechanics, Applied Mechanics, Solid/Structural Analysis Research on a floating structure for offshore wind power generation Energy harvesting using mechanical vibration Nondestructive inspection, Numerical electromagnetic field analysis	TANAKA, Satoyuki
Structural Innovation	Research on novel material manufacturing technology and new structural design method for application to transportation equipment	KATAGIRI, Kazuaki
System Safety	Research on safety assessment and maintenance for structures and transportation equipment systems. Development of sensors for dynamic load and deformation measurement. Development of instrumentation system for structural safety management. Automatic control and planning of ship equipments and systems.	SHINTAKU, Eiji TANAKA, Yoshikazu
Transportation System Innovation	Research on planning and design methodology for transportation systems using ICT Design and planning of new transportation system using maritime logistics big data Development of efficient construction system using factory monitoring Ocean monitoring and observational physical oceanography Data assimilation and ocean environment prediction	HAMADA, Kunihiro TANIGUCHI, Naokazu
Marine Transportation System	Development of an environment friendly marine vehicle Research on prediction of performances of marine vehicle Research on marine navigation safety Research on a new energy transportation	SANO, Masaaki Yasukawa, Hironori (Collaborative Research Laboratory)
Fluid Dynamics for Transportation and Environmental Systems	Research on the reduction of wind resistance acting on a bridge of ship Research on seakeeping performance of a ship in nonlinear wave Research on aerodynamics of an automobile in the real world Assessment and prediction of ocean-atmosphere environment due to vehicle transportation Research on an advanced technology of electrical energy generated by renewable energy (wind, ocean power, vibration) Research on a technology of energy harvesting Research on CFD technology by using Particle Based Method	MUTSUDA, Hidemi NAKASHIMA, Takuji
Air Transportation and Ocean Systems	Research on the aerodynamic properties of WIG flying over the waves Research on the passive control of the wind turbine with elastic composit material Research on the human-powered aircraft Theoretical and experimental researches on Ship seakeeping Research on the remote sensing technology of marine environment	IWASHITA, Hidetsugu SAKUNO, Yuji

Civil and Environmental Engineering Program

Specialty	Research Fields	Academic Staff
Structural Materials and Concrete Structures	Education and research on the physicochemical characteristics of cementitious materials, the mechanical and durability performance evaluation of plain, reinforced and prestressed concretes, effective utilization of resources, environmental impact evaluation of concrete, and maintenance of concrete structual2 r(es)-1. (e)]TJETQq162.24 6 0 264.361 51.2 reW n]TJ0 Tc 0 Tw 90 005.0	

Specialty	Research Fields	Academic Staff
Data Analytics and Modeling	Statistical machine learning (including Bayesian modeling and deep learning) and its applications to large-scale, complex and/or dynamic data analysis and generation (especially focusing on natural languages, networks, financial data, brain data, and multimodal data).	EGUCHI, Koji ANDRADE, Daniel FUKUSHIMA, Makoto YU, Yi
Advanced Information Networks	Research on the technologies of the Internet architecture, network applications, decentralized computing, and information security, especially including mobility technology, virtualization / cloud infrastructure technology, IoT, operation management, distributed ledger technology, digital identity management, access control, formal methods, and distributed deep learning.	KONDO, Tohru
Complex Systems Science	Modelling, analysis, and control of complex systems including swarm systems, natural phenomena, cyber-physical systems, and social networks using the tools from machine learning, control theory, optimization, and self-organization.	OGURA, Masaki -p3yS/P #MC.363pyS/P #MC.

Smart Innovation Program

(Applied Chemistry)

Specialty	Research Fields	Academic Staff
Element-Based Organic Materials Chemistry	Education and research on element-based materials, in particular synthesis and applications of polymers with inorganic elements, and development of functional materials with epoch-making optoelectronic characteristics .	OHSHITA, Joji ADACHI, Yohei
Computational Materials Science	Education and research on computational chemistry, in particular understanding of chemical and physical phenomena based on molecular simulation and applications using data science.	ISHIMOTO, Takayoshi

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Program	Specialty	Research Fields	Academic Staff
Applied Chemistry Program	Organic Supramolecular Chemistry	Education and research on development of synthetic reactions and supamolecular complexes applied for creating functional organic molecules in everyday life, medicinal field, and high technology.	IKEDA, Atsushi KAWASAKI, Riku
	Polymer Chemistry	Education and research on polymer chemistry, especially, precision polymerization catalyzed by transition metal complex and development of new polymers from renewable biomass.	NAKAYAMA, Yuushou TANAKA, Ryo
	- Conjugated Materials Chemistry	Education and research on novel organic functional and semiconducting -conjugated polymers, and their application to energy and/or electronic devices such as organic solar cells. Education and research on novel organic synthetic methodology by developing new reactions, reagents, and catalyst, and their application to syntheses of various organic functional materials and pharmaceuticals.	OSAKA, Itaru
	Functional Dye Chemistry	Development of novel functional dye and polymer materials with epoch-making optoelectronic characteristics, fluorescence sensing ability and therapeutic activity. Education and research on new functions of organic/inorganic materials and their applications to novel electronic/optoelectronic devices	OOYAMA, Yousuke IMAE, Ichiro IMATO, Keiichi KOMAGUCHI, Kenji
	Inorganic and Hybrid Materials Chemistry	Research and education on ceramics, with main interests on molecular design, synthesis, characterization, and applications of new inorganic or inorganic-organic hybrid materials having functional nano-structures.	INUMARU, Kei KATAGIRI, Kiyofumi TARUTANI, Naoki
	Catalytic Materials Chemistry	Synthesis and characterization of novel functional metal oxide materials such as metal oxide clusters, zeolites, and related materials, and their application to catalysts and adsorbents in environmental and energy research fields.	SADAKANE, Masahiro TSUNOJI, Nao

Quantum Matter Program

Physics Field

Specialty	Research Fields	Academic Staff
Electron Theory of Solids	Mechanism of anisotropic superconductivity and interplay between magnetism and superconductivity in strongly correlated electron systems and quasi - lowdimensional systems. Superconductivity in high magnetic fields including the Fulde-Ferrell-Larkin-Ovchinnikov state. Magnetism in low and quasi-low dimensional systems.	SHIMAHARA, Hiroshi
	Theoretical studies on the 3d and 4f electrons and high-energy spectroscopies in transition-metal and rare-earth compounds.	TANAKA, Arata
Computational Physics	Development of the energy band theory beyond the density functional theory and its application to solids.	HIGUCHI, Katsuhiko
	Condensed matter theory and statistical physics. Theoretical studies on topological systems, Dirac semimetals, superconductivity, and magnetism including spin liquids.	TADA, Yasuhiro
Strongly Correlated Electron Physics	Experimental study on ordered structures and fluctuations of charge, spin, orbital, and higher multipole moments in strongly correlated electron systems by means of neutron and resonant x-ray scatterings. Also, by studying thermal and transport properties, we aim at total understanding from microscopic and macroscopic points of view.	MATSUMURA, Takeshi
	Experimental study on cross-correlation phenomena in quantum materials with broken symmetry. We aim to elucidate the origin of cross-correlation phenomena by measuring fundamental physical properties under multiple extreme conditions of electric field, magnetic field, and pressure.	AOYAMA, Takuya
Magnetism	Experimental research on magnetic property of rare-earth compounds and thermal property of clathrate compounds. Macroscopic measurements and neutron scattering experiments are performed to reveal origins of new phenomena.	ONIMARU, Takahiro
	Single crystal growth of new rare-earth compounds and measurements for magnetic/thermal properties at very-low temperature mainly below 1 K, to find exotic phase transition and anomalous metallic state.	SHIMURA, Yasuyuki
Low Temperature Physics	Exploration of novel materials such as superconductors and quantum magnets consisting of transition metal elements with strong electron correlations and heavy elements with strong relativistic effects, and search for exotic quantum states.	NOHARA, Minoru
	Experimental investigation of nano-scale physics. Quantum coherence, single electron phenomena and non-equilibrium transport are studied by fabricating extremely small structures and measuring low-temperature transport.	YAGI, Ryuta
	Experimental studies on the strongly correlated electron systems by means of ultrasonic spectroscopy. Our research focuses on novel physical properties originating from magnetism, multipoles, and a large-amplitude atomic oscillation under multiple extreme conditions.	ISHII, Isao

Supervisor below in charge of plural programs takes charge of the program in the following table, including Physics Field of this program.

Program	Research Fields	Academic Staff
Transdisciplinary Science and Engineering Program	Condensed matter physics under multiple extreme conditions (very high pressure, ultra-low temperature, strong magnetic field) by laser spectroscopy method	OGITA, Norio
	Condensed Matter Theory on Superconductivity and Superfluidity	HIGASHITANI, Seiji
	Lattice dynamics in condensed matter investigated by inelastic scattering of Quantum beam and first-principles calculation	HASEGAWA, Takumi
	Experimental-nanoscale physics on superconductors and related materials with scanning probe microscopy/spectroscopy	SUGIMOTO, Akira

Electronic Engineering Field

Specialty	Research Fields	Academic Staff
Mesoscopic Physics Theory	Theory of quantum electron transport in mesoscopic systems and lowdimensional electron systems.	TAKANE, Yositake
	Theoretical study of resonant optical response produced by surface plasmons in metallic nano-structures, and development of fast electromagnetic simulation softwares.	NISHIDA, Munehiro
Semiconductor Quantum Optics	Development of the devices for generation and detection of terahertz waves using ultrafast pulse lasers, and the devices for lightwave control using artificial material (meta-material).	KADOYA, Yutaka
	Theoretical research on quantum optics and quantum information; quantum computation and communication using highly non-classical states of light	Holger F. HOFMANN
	Crystal growth of semiconductor thin films and quantum structures, investigation of their optical characteristics, and development of novel optical devices.	TOMINAGA, Yoriko
Material Science of Nanotechnology	Experimental study of the mechanisms of self-assembled/self-organized structures consisting of organic molecules with scanning probe microscopes and their application for nanotechnology. Development of new analysis methods of organic molecules and/or bio-molecules and new application techniques of bio-molecules(motor protein, etc.) using micro/nano structures.	SUZUKI, Hitoshi
Semiconductor Electronics	Research on novel thin-film semiconductor processing techniques such as crystalline growth, low-temperature deposition of insulator films, and junction formation and their application to large-area electronics (solar cells, flat panel displays, etc.) and ULSI devices.	HIGASHI, Seiichiro
	Development of new thin-film structure formation technology and research of its application to quantum-effect devices.	HANAFUSA, Hiroaki
Electron Device Engineering	RF/microwave/millimeter-wave CMOS circuit design. Circuit theory. Microwave and millimeter-wave measurement. Device characterization and modeling.	AMAKAWA, Shuhei
Frontier Integrated Systems	Research on system architecture, circuit design, layout optimization, active/passive device modeling and measurement for ultrahigh-frequency millimeter-wave and terahertz wireless communication and sensors with nanometer CMOS integrated circuits.	FUJISHIMA, Minoru
	Analysis, synthesis and design of architecture and RF circuit in CMOS technology. High-speed transceivers for wireless and wired communications between LSI chips. Development of design method combining communication, mount and circuit technique.	SASAKI, Mamoru
	Low-power and low-noise circuit techniques for analog-digital merged system LSIs. Architecture and circuit technologies for Bio-Sensor LSI, which realize sensing a neural signal.	YOSHIDA, Takeshi
Nanodevice Engineering	Silicon-Carbide (SiC) harsh-environment electronics for space exploration, decommissioning of nuclear power stations and medical, SiC power semiconductor devices and silicon thin-film devices.	KUROKI, Shin-Ichiro
Nano-photon and quantum Engineering	Research on novel quantum physics in photon, spin and electrons as well as frontier device physics enabling low latency and low power consumption to realize next generation LSI enabling ultra-efficient information processing.	GOTOH, Hideki
Nanoprocess Engineering	Research on devise structures, advanced process technology, and evaluation system for advanced LSI, and research on new devise structures, process technology of wide bandgap semiconductor (GaN) for power devices and high-speed communication.	TERAMOTO, Akinobu
	Researches of ultra small-size or new functional devices (such as quantum device and single-electron memory) and the development of atomic- or nano-scale process and large-scale integration technologies to make LSI more large and fast.	NAKAJIMA, Anri
Intelligent Integrated Circuits Engineering	Research on wireless communication networks, wireless signal processing, wireless communication architecture & intelligent integrated circuits, and radio-wave propagation for wireless-environment cognitive IoT integrated system considering disaster resistance and medical applications.	KAMEDA, Suguru
	Architecture and circuit technologies for LSIs, which realize real-time recognition systems for flexible and intelligent information-processing based on reconfigurable logic-inmemory architecture approaches, and the systems development of medical / agricultural engineering applications.	KOIDE, Tetsushi
	Research on wireless communication networks, wireless signal processing, wireless communication architecture, and radio-wave propagation considering disaster resistance and space applications.	MIYAKE, Masataka
Biomagnetics	Research on optical and magnetic properties of biogenic crystals and living cells in tissue engineering. Electromagnetic manipulation of biological materials in bio-MEMS for biomedical science and biotechnology.	IWASAKA, Masakazu

Transdisciplinary Science and Engineering (Environmental and Natural Sciences Field)

Specialty	Research Fields	Academic Staff
Environmental Earth Sciences	Hydrologic transport of earth surface materials: hydrogeomorphology and biogeochemistry	ONODERA, Shin-ichi
	Thermodynamics of the global climate and fluid systems, dissipative structures of non-equilibrium systems	OZAWA, Hisashi
	Environment-geology-ecosystem interactions in terrestrial to coastal waters	SAITO, Mitsuyo
	Reaction and transport relevant to rock weathering	YOKOYAMA, Tadashi
Physics of Complex Matter	Static and dynamic structures and physical properties of structurally disordered matter	INUI, Masanori (Retirement at the end of March 2026)
	Non-Equilibrium Phenomena in Polymer Physics and Phase Transitions	TODA, Akihiko (Retirement at the end of March 2025)
	Crystal growth and pattern formation of softmatter	TAGUCHI, Ken
	Physics of complex systems, such as active matter and non-equilibrium ordering	TANAKA, Shinpei
	Physics Education Research, Molecular Dynamics Simulation of Liquids	MUNEJIRI, Shuji
	Physics of Disordered Materials (liquids and glasses)	KAJIHARA, Yukio
Physics of Correlated Matter	Quantum information theory concerning e.g. quantum entanglement and quantum communication	ISHIZAKA, Satoshi
	Foundation of quantum mechanics and quantum information sciences including quantum computer and quantum artificial intelligence	HATAKENAKA, Noriyuki (Retirement at the end of March 2025)
	Condensed matter physics under multiple extreme conditions (very high pressure, ultra-low temperature, strong magnetic field) by laser spectroscopy method	OGITA, Norio
	Condensed Matter Theory on Superconductivity and Superfluidity	HIGASHITANI, Seiji
	Lattice dynamics in condensed matter investigated by inelastic scattering of Quantum beam and first-principles calculation	HASEGAWA, Takumi
	Experimental-nanoscale physics on superconductors and related materials with scanning probe microscopy/spectroscopy	SUGIMOTO, Akira
Information and Media Sciences	Computational approach to strong coupling and gravitational systems, Computer based learning materials	INAGAKI, Tomohiro
	Research on Media Communication Service	KODAMA, Mei
	Cybersecurity, Confidential Computing	WATANABE, Hidenobu
	Studies on information system and information security education	IWASAWA, Kazuo

Professors who are in charge of plural programs including this program.

Supervisor below in charge of plural programs takes charge of the program in the following table, including Environmental and Natural Sciences Field of this program.

Graduate School / Program	Research Fields	Academic Staff
Graduate School of Advanced Science and Engineering / Mechanical Engineering Program	Research and Development of energy conversion materials	ICHIKAWA, Takayuki
	Research and development of biomass utilization technology	MATSUMURA, Yukihiko
Graduate School of Advanced Science and Engineering / Quantum Matter Program (Physics Field)	Research and development of hydrogen production, hydrogen storage, and material conversion	MIYAOKA, Hiroki
Graduate School of Integrated Sciences for Life	Studies on regulation of enzymes involved in cellular signaling	ISHIDA, Atsuhiko
	Conservation of organisms based on ecology	YAMADA, Toshihiro
	Studies on chemical interactions between plants and insects.	OMURA, Hisashi
	Thermodynamic studies on interfacial behavior of biorelated substances using model cell membranes, basic science related to drug delivery.	VILLENEUVE, Masumi
	Research of structural organic chemistry in life science.	NEHIRA, Tatsuo
	Environmental dynamics and analysis of trace compounds and reactive oxygen species in the atmosphere and hydrosphere.	TAKEDA, Kazuhiko
	Behavior and ecology of wildlife	NAKABAYASHI, Miyabi

Transdisciplinary Science and Engineering (Development Science Field)

Specialty	Research Fields	Academic Staff
Environmental Planning	Living environment planning in buildings and urban area: water environment, landscape and environmental psychology	NISHINA, Daisaku