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

Earth and Planetary Systems Science Program

Specialty	Research Fields	Academic Staff
Earth and Planetary Material Science	Tectonics of East Asia, Continental evolution, Deformation microstructure, Internal structure of the Earth, Mineral physics, Water-rock interaction, Crystal chemistry	ANDO, Jun-ichi KATAYAMA, Ikuo OKAZAKI, Keishi DAS, Kaushik OKAWA, Makio
Earth and Planetary Chemistry	Magma genesis, Astrobiology, Space exploration, Earth environmental change, Microbial mineralization, Planetary collision process	SHIBATA, Tomoyuki YABUTA, Hikaru* SHIRAISHI, Fumito MIYAHARA, Masaaki KOIKE, Mizuho
Earth and Planetary Physics	Slow earthquake, Material transport, Mantle convection, Deep magma genesis, Deep Earth water, Deep Earth Rheology, High pressure hydrous minerals	INOUE, Toru SUDA, Naoki KAWAZOE, Takaaki NAKAKUKI, Tomoeki
Integrated Earth and	Geochemical cycles and environmental changes recorded in sedimentary rocks Microbiological and geochemical explorations of subseafloor biosphere Physico-chemical processes in earthquake fault zones	

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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* LEONOV, Andrey *
Integrated Chemistry	Synthesis, architecture, and physical characteristics of functional molecules inspired by biological functions. Design and development of devices with integrated functional molecules.	NISHIHARA, Sadafumi
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 dy19Tm( )T47Tc -0.(c)10.3 319Tm(8(W8]TJET057Tc 0.23408T*(K)	

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.	OSAKA, Itaru (Concurrent post) NAKAYAMA, Yuushou TANAKA, Ryo
2UJDQLF&RQMXJDWHG Materials Chemistry	Education and research on novel organic functional and semiconducting 3RO\PHULF&RQMXJDWHG3RO\PHUV, 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-	

Chemical Engineering Program

Specialty	Research Fields	Academic Staff
Thermal-Fluid Engineering	Basic to practical level research on nanoparticle synthesis, development of nano / fine particle synthesis process, nanostructuring of fine particles, arrangement, fabrication of laminated film and application to functional materials	OGI, Takashi HIRANO, Tomoyuki
High-Pressure Fluid Property	Measurement and modeling of the equilibrium and transport properties for supercritical fluid + polymer systems. Development of innovative material processing technology for functional organic and inorganic materials utilizing particular characteristics of supercritical fluids.	OGI, Takashi (Concurrent post) USHIKI, Ikuo
Soft Materials Processing	Basic research to elucidate the relationship between engineering processing, hierarchical structuring, and functionalization of soft materials (polymers such as plastics and rubbers) through measurement and modeling of their physical properties, and applied research to create functional organic and inorganic materials using these materials.	NAKAI, Satoshi (Concurrent post) KIHARA, Shinichi
Separation Technology	Development and characterization of nano- or subnano-porous ceramic membranes, and their application to gas separation, pervaporation / vapor permeation, nanofiltration / reverse osmotic processes, and catalytic membrane reactors. Sol-gel and plasma-enhanced CVD for functionalized materials. Transport mechanism of gas/liquid molecules through microporous membranes. Evaluation of membrane-based separation processes.	KANEZASHI, Masakoto NAGASAWA, Hiroki
Fine Particle Technology	Development of novel high-performance classification system. Development of powder treatment process using microwave heating method. Improvement and life prediction of bag filter system. Analysis of particle dispersed system by DEM-DNS and DEM-CFD simulation. Evaluation of physical and chemical particle property. Application of zeta potential measuring device and vibration fluidized bed.	FUKUI, Kunihiro ISHIGAMI, Toru FUKASAWA, Tomonori
Interfacial Systems Process Engineering	Synthesis and fabrication of fine materials and micro-controlled surfaces by the generation and transport of gasborne matter; contamination phenomena induced by particulate matter and gaseous matter; development of synthetic process of organic-inorganic hybrid porous materials; investigation of mechanism of particle formation and assembly in small droplets.	SHIMADA, Manabu KUBO, Masaru
Sustainable Materials Process Engineering	Development of self-healing coating for industrial materials, printable electronics using metal complex (conductive, power storage, power generation materials). Synthesis of nanofibers, nanogel and biomaterials using self-organisation technology.	YABUKI, Akihiro
Green Process Engineering	Education and research on treatment of waste and wastewater, evaluation of environmental impacts of the human activities and its reduction by greenization of chemical processes, and ecological engineering for conservation and restoration of damaged ecosystems.	NISHIJIMA, Wataru NAKAI, Satoshi GOTOH, Takehiko UMEHARA, Akira

Mechanical Engineering Program

Specialty	Research Fields	Academic Staff
Machinery Dynamics	Analysis, design, control, and simulation of mechanical systems such as robotics and mechatronics systems, e.g., Force control and teleoperation for industrial robots; Safer control techniques for robots collaborating with humans; Teleoperation of bipedal robots; Control and motion planning for hydraulic excavators; Development of a mobile four arms robot; Estimation and compensation of periodic disturbances; and Analysis and control of human-robot interaction.	KIKUUWE, Ryo MURAMATSU, Hisayoshi
Mechanics of Materials	Experimental study on impact thermo-mechanical and fracture behavior of materials with phase transformation and characterization by observation of microstructure; Development of new members with high collision energy absorption by using material with high impact energy absorption; Development and modification of impact testing methods; Multi-scale analysis of steel with phase transformation based on the homogenization technique; Dislocation mechanics by the microforce concept and coupling with a transformation-crystal plasticity theory; Simulation of interface motion driven by phase transformation using microforce balance equation; Mesh free method such as GIMP for impact and phase transformation problems.	IWAMOTO, Takeshi
Control Engineering	Analysis and control of dynamical systems including robust control, model predictive control, optimal control, nonlinear control, and their applications to mechanical systems, biological networks, and privacy mechanism design.	WADA, Nobutaka KAWANO, Yu
Machine Intelligence and Systems A	Realization of machine intelligence. In particular, the collective intelligence generation, control and analysis based on the concept of decentralized autonomous systems by building swarm robotic systems or conducting computer simulations with emerging techniques in the field of biomimetics and computational intelligence.	OHKURA, Kazuhiro
Machine Intelligence and Systems B	Research on design, planning and control of manufacturing systems; Research on optimum/intelligent production planning and scheduling.	EGUCHI, Toru
Mechanical Design and Systems	Three-dimensional measurement of the motion of machine tools and its control; Kinematic modelling of machine tools and robots and error diagnosis; Three-dimensional geometric measurement; Monitoring and intelligent control of machining processes; Strength, failure analysis and design of gear drives; Simulation of gear vibration and noise; Development and design of a new-type gear with higher strength and performance than that of the Involute gear; Estimation and improvement of power transmission performance of gear and traction drives; Improvement in performance of gear pumps; Design and tribology of various machine elements.	IBARAKI, Soichi IKEJO, Kiyotaka
Machining and Machining System	The sensing technology and the components for machine tools; Machining for the difficult-to-cut materials; Development of the free-cutting steels and the new cutting tools; Laser assisted machining process; Laser processing of brittle materials.	YAMADA, Keiji TANAKA, Ryutaro
Materials Physics	Elucidation of physics phenomena in high-functional and high-performance metals, ceramics and metal matrix composites, and development of these materials: (1) Material process optimization with nano- and meso-scale texture control; (2) Evaluation of mechanical and functional properties in wide range from nanoscale to milliscale; (3) Observation and characterization of microstructure with optical, scanning electron and transmission electron microscopes; (4) Modeling with computer simulations (molecular dynamics method, finite element method, etc.).	SASAKI, Gen SUGIO, Kenjiro
Properties Control for Mechanical Materials	Analyses and micro-macro modeling for materials fabrication process, and development of materials property control by their techniques: (1) Casting using the material control technology, the alloying using the sintering method, and a diplo-phasing and compositing; (2) Thermal and mechanical conditions of the material engineering quality of the material by the analysis of a material process, research-and-development; (3) Nano-meso scale by the mechanical engineering techniques, such as control of the dynamic or control.	MATSUGI, Kazuhiro CHOI, Yongbum
Strength and Fracture of Mechanical Materials	The microscopy of the fatigue crack growth mechanism by using high-resolution Math m105105105a2yU	

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, Dai mle

Architecture Program

(Building Engineering Field)

Specialty	Research Fields	Academic Staff
Building Materials and Components	Study on large-scale wooden construction using wooden materials including CLT Research on development of wooden semi-rigid frame structure Evaluating method of residual seismic performance of existing wooden construction Long term performance evaluation of wooden buildings and materials	MORI, Takuro
Building Structures	Seismic design of steel structures Vibration control system of steel structures Beam-to-column connections and column-bases of steel structures Buckling analysis and design of steel frames Seismic retrofit of existing structures	TAGAWA, Hiroshi CHEN, Xingchen
Disaster Prevention Engineering	Earthquake strong motion prediction technology Ground motion evaluation Building damage estimation for scenario earthquakes Remote sensing for disaster response Spatial data analysis for disaster risk evaluation	MIURA, Hiroyuki
Earthquake and Structural Engineering	Seismic performance evaluation and repair/reinforcement technology for non-structural members Durability design of reinforced concrete members Advanced crack reduction technology for reinforced concrete members CO_2 fixation of reinforced concrete members Evaluation of building aesthetics and performance Control of indoor environment by interior materials	TERAMOTO, Atsushi

(Architecture Field)

Specialty	Research Fields	Academic Staff
Urban and Architectural Planning	Urban environmental planning (green, wind, water, climate, hazard, energy, and built environment). Compact city design with population decrease.	

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 structures.	KAWAI, Kenji OGAWA, Yuko
Structural Engineering	Education and research on evaluation of structural performance and durability of concrete structures, strength development and deterioration of cement-treated soils, and cementitious engineered barrier for nuclear waste management.	NAKARAI, Kenichiro
Geotechnical Engineering	Evaluation of mechanical property of soft ground, Ground improvement techniques, Engineering properties of cement treated clay and recycled geo-materials, Development of new construction technology for waste disposal facility in coastal areas, In-situ testing of weathered granite soil and the application on disaster prevention of natural slopes in heavy rainfall, Estimation and countermeasures of sand liquefaction by earthquakes, Evaluation of seismic site response of ground, Earthquake resistant design of geotechnical works, Maintenance and condition evaluation method for road pavement and geotechnical structures, Conservation of historic structures based on geotechnical engineering, Clarification and modeling of multiscale behavior of geomaterials and soil-structure interaction.	HATA, Toshiro KIDO, Ryunosuke
Infrastructure Management	Structural analysis and simulation, damage identification and deterioration diagnosis of infrastructures	KHAJI, Naser
Global Environment and Planning	Development of planning methodology, and analysis for following themes; recycling and low-carbon society, urban transportation system by making full use of an economical evaluation, a statistical model, and a mathematical planning, a travel behavior model, or network science. Researches on material flows for scarce metals, market share forecast on low emission vehicles, development of statistical model for "big-data", on consensus building by statistical approach for text data	TSUKAI, Makoto FUSE, Masaaki
Environmental Preservation Engineering	Biological wastewater treatment. Energy recovery from biomass by microbes. Nitrogen and Phosphorous removal. Microbial community analysis. Analysis and modelling of behavior of trace toxic chemicals in air and water environments. Application of membrane filtration technique on wastewater treatment.	KINDAICHI, Tomonori OZAKI, Noriatsu
Hydraulic Engineering	Flood forecast; interactions among flood flow, vegetation and morphology in rivers multi-scale phenomena of flow and sediment transport in a dynamic fluvial system sedimentation sorting and variation in porosity and sediment volume in rivers tsunami dynamics in rivers; multi-phase flows with sediment transport around river structures sediment-flood inundation and sediment capacity in rivers	UCHIDA, Tatsuhiko INOUE, Takuya
Coastal Engineering	Development of technology to improve environment in river bank Practical use of "sediment microbial fuel cells" more than solar batteries Research on groundwater and tidal flat environment in tidal estuaries	HIBINO, Tadashi

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	Transportation planning methods, evaluation of transport policies, and sustainable development and transport	FUJIWARA, Akimasa
	Smart urban infrastructure, transportation planning, urban planning, travel behavior analysis, travel survey design, transport network analysis, resilience research, risk analysis	CHIKARAISHI, Makoto
	í í	LEE, Han Soo

Informatics and Data Science Program

Specialty	Research Fields	Academic Staff
Intelligent Systems	Machine learning, High-performance computing, Parallel and distributed computing, Quantum computing, Embedded system	ITO, Yasuaki
Computer Systems	Research on novel computer architectures, systems, and computing techniques for machine learning and combinatorial optimization. In particular, we use GPUs, FPGAs, and quantum computers for accelerating machine learning and for solving combinational optimization problems.	NAKANO, Koji PARQUE, Victor
Distributed Systems	Theory and practice on parallel and distributed systems, such as secure and efficient resource sharing schemes, real-time file exploration in wide area networks, high-performance computing using PC clusters, contents delivery in service providing networks, and environment monitoring systems based on wireless sensor networks.	FUJITA, Satoshi
Visual Information Science	Computer graphics, visualization, image processing, image recognition and understanding, computer vision, machine learning, deep learning, brain-inspired computing and various applications of these technologies, such as biomedical imaging and image analysis, optical design, vision and language-based information fusion (computer vision and natural language processing), autonomous driving, video surveillance and human-computer interaction.	KANEDA, Kazufumi RAYTCHEV, Bisser HIGAKI, Toru GU, Yanlei
Learning Engineering	Research on technology-enhanced learning systems designed based on knowledge modeling, implemented with artificial intelligence, multimedia and web technologies, and then practiced from viewpoint of education and psychology.	HIRASHIMA, Tsukasa HAYASHI, Yuusuke
Foundation of Computer Science	Cryptography and information security. In particular, privacy-enhancing authentications and network services, and implementations based on elliptic curve cryptosystems. Mobile and ubiquitous computing. In particular, communication, activity recognition, and location sensing using wireless devices.	NAKANISHI, Toru KITASUKA, Teruaki
Dependable Systems	Reliability and Maintenance, Dependable computing, Fault tolerant computing, Computer security, Performance evaluation, Operations research, Software reliability engineering, Formal engineering methods for software development, Software testing and formal verification, Intelligent software engineering environment	DOHI, Tadashi OKAMURA, Hiroyuki LIU, Shaoying ZHENG, Junjun
Financial Data Science	We combine various models and techniques of quantitative finance with machine learning for achieving superior investment returns while taming the risk. We apply the state-space model and other methods to analyze financial time series. We also look into different correlation structures and perform feature importance analysis, examine optimal clustering, construct novel portfolios, estimate financial risk exposures, and propose new investment and trading strategies.	TING, Hian Ann
Social Computing	Algorithm for processing and utilizing “big data”. Data mining for SNS, Web, IoT, GPS, etc. Recommendation System, Personalization, Database marketing, Privacy-preserving information retrieval, Parallel and Distributed Algorithms, etc.	MORIMOTO, Yasuhiko KAMEI, Sayaka
Multivariate Analysis and Modeling	Theoretical and Applicational study of Multivariate Data Analysis. Research related to Psychometrics, Biostatistics and Medical Statistics.	MONDEN, Rei
Informatics and Mathematical Science	System theory and intelligent information processing, Stabilization and optimization for stochastic systems, Numerical analysis and optimal design for mechatronic systems. Stochastic processes, especially going around fractals. Spectral analysis of the generators associated with the stochastic processes on fractals.	MUKAIDANI, Hiroaki SHIMA, Tadashi
Intelligent Biosignal Informatics	Research on the measurement, analysis, and modeling of human biosignal information and its machine learning applications. Topics include biosignal processing for EMG, EEG, ECG etc., probabilistic modeling, machine learning, deep learning, human-machine interface, robotic prostheses, biomedical image analysis, motion analysis, etc.	FURUI, Akira
Intelligent Control Systems	We conduct research on intelligent control systems for realizing a super-smart society (Society 5.0), especially fundamental and theoretical research on machine learning, optimal control, multi-agent systems, cyber-physical systems, etc., as well as practical applications to practical systems such as power management, big data for medical care, smart mobility, etc.	NAGAHARA, Masaaki LI, Mengmou
Computational Complexity Theory	Computational complexity theory, hierarchies of complexity classes, combinational computational geometry, visibility problems and art gallery theorems, design and analysis of algorithms.	IWAMOTO, Chuzo

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
Bayesian Statistics and Inference	Research on Bayesian inference, with focus on hypothesis testing procedures. Also, research on item response theory models for data from educational or psychological backgrounds.	TENDEIRO, Jorge
Information Security	Research on the application of information security technologies to network systems and computer systems, the construction of management system and its operation to maintain information security, and the education for administrators and users to operate and use them properly.	NISHIMURA, Kouji
Leaning Analytics	Statistical growth model, Information system supporting education and learning	SUMIYA, Takahiro

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

Graduate School / Program	Research Fields	Academic Staff
Graduate School of Advanced Science and Engineering / Mathematics Program	Statistical Science: Theory for Multivariate Data Analysis and its Applications, Statistical Inference, Asymptotic Expansion for Statistical Distributions, Resampling Methods, Mathematical Statistics.	YANAGIHARA, Hirokazu
Graduate School of Advanced Science and Engineering / Transdisciplinary Science and Engineering Program	Research on Media Communication ServiceHO	KODAMA, Mei
		WATANABE, Hidenobu
	Nuclear Theory, Information System	IWASAWA, Kazuo
Graduate School of Humanities and Social Sciences / Economics Program	Econometrics (Time series econometrics, Spatial econometrics), Signal Processing on Graphs	YAMADA, Hiroshi
Graduate School of Humanities and Social Sciences / Psychology Program	Social psychological research on human behavior. Especially, research on inter-personal communication using indirect meanings.	HIRAKAWA, Makoto

(Electrical, Systems, and Control Engineering)

Specialty	Research Fields	Academic Staff
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 KINOSHITA, Takuya 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-applications, etc.	ISHII, Idaku TAKAKI, Takeshi

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
Electrical, Systems, and Control Engineering Program	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 YONG, Moo Chung 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

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
High Energy Physics	High Energy Physics and its application: Physics of Tera-scale by high energy electron-positron collider R&D of intense photon sources by the Laser-Compton scattering Experimental study of Light-by-Light scattering	TAKAHASHI, Tohru
Beam Physics	Study of charged-particle beams and non-neutral plasmas.	OKAMOTO, Hiromi
	Experimental research on trapped charged particles and related physics. Production of low energy particle beams and their application for atomic physics, plasma physics, and beam physics research.	HIGAKI, Hiroyuki
Accelerator Physics	Theoretical and experimental study for beam dynamics. Research and development of high energy accelerator and its applications for light source, Xray source. Research for high brightness (polarized) electron and (polarized) positron sources and study for photo-cathode and laser as key technologies of the high brightness particle sources.	KURIKI, Masao
Quantum Properties	Studies of the thermal, transport and magnetic properties of rare-earth and transition-metal compounds under high pressures. Main research subjects are pressure-induced quantum critical phenomena of heavy-fermion systems, anomalous magnetism in geometrically frustrated systems under pressure, and pressure dependence of the quasi-localized vibrational modes in clathrates.	UMEO, Kazunori

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

Specialty	Research Fields	Academic Staff
Environmental Earth Sciences	Hydrologic transport of earth surface materials: hydrogeomorphology and biogeochemistry	B ONODERA, Shin-ichi
	Thermodynamics of the global climate and fluid systems, dissipative structures of non-equilibrium systems	B OZAWA, Hisashi
	Environment-geology-ecosystem interactions in terrestrial to coastal waters	B SAITO, Mitsuyo
	Reaction and transport relevant to rock weathering	B YOKOYAMA, Tadashi
Physics of Complex Matter	Static and dynamic structures and physical properties of structurally disordered matter	B INUI, Masanori (Retirement at the end of March 2026)
	Non-Equilibrium Phenomena in Polymer Physics and Phase Transitions	B TODA, Akihiko (Retirement at the end of March 2025)
	Crystal growth and pattern formation of softmatter	B TAGUCHI, Ken
	Physics of complex systems, such as active matter and non-equilibrium ordering	B TANAKA, Shinpei
	Physics Education Research, Molecular Dynamics Simulation of Liquids	B MUNEJIRI, Shuji
	Physics of Disordered Materials (liquids and glasses)	d KAJIHARA, Yukio
Physics of Correlated Matter	Quantum information theory concerning e.g. quantum entanglement and quantum communication	B ISHIZAKA, Satoshi
	Foundation of quantum mechanics and quantum information sciences including quantum computer and quantum artificial intelligence	B 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	B OGITA, Norio
	Condensed Matter Theory on Superconductivity and Superfluidity	B HIGASHITANI, Seiji
	Lattice dynamics in condensed matter investigated by inelastic scattering of Quantum beam and first- on	

Specialty	Research Fields	Academic Staff
Environmental Planning	Living environment planning in buildings and urban area: water environment, landscape and environmental psychology	NISHINA, Daisaku
Transportation Engineering, Transportation Planning	Transportation planning methods, evaluation of transport policies, and sustainable development and transport	FUJIWARA, Akimasa
Urban and Data Science	Urban planning, smart mobility, travel behaviour, transport network analysis, data driven technology, mobility in built environment, spatial planning, urban environment analysis, decision making in smart energy, big data & machine learning for urban research	FENG, Tao
Environmental Health Science	Epidemiological study focusing on environmental health problems, Development of health care system based on spatial statistics	KASHIMA, Saori
Sustainable Architecture	Building and urban environmental science for achieving sustainable development in developing world	KUBOTA, Tetsu
Urban Environmental Science	Urban Climate Change Mitigation and Adaptation; Nature-based Solutions; Green Infrastructure; Urban Microclimate, Urban Resilience; Sustainable Urban Forms; Assessment Tools.	SHARIFI, Ayyoob
Risk Management Technology	Smart urban infrastructure, transportation planning, urban planning, travel behavior analysis, travel survey design, transport network analysis, resilience research, risk analysis	CHIKARAISHI, Makoto
Biomass Energy Technology, Botany Resources for the Future	Development of biomass energy technologies and application to developing countries Agricultural ecology and development of sustainable agricultural technologies	XUAN, Tran Dang
Ecosystem Conservation and Management Science	Research and education on ecology and ecosystem management	HOSAKA, Tetsuro
Energy Science and Technology	Renewable energy evaluation and management in developing countries, Numerical models for coastal hazards, Disaster prevention, Mitigation, Evaluation of climate changes on natural hazards and renewable energy environment.	LEE, Han Soo
Environmental Genomics and Ecology, Environmental Microbiology	Our research focuses on understanding how microorganisms interact with each other, with their symbiotic hosts and with the environment, both experimentally and through big data analysis. Topics includes the relationship between climate change and microbes, genomic dynamics of pathogenic microbes in habitats, and pathogenic microbes and antibiotic resistance in air and water environments.	MARUYAMA, Fumito
Conservation of Biological Resources	Research and education on vegetation and landscape ecology of SATOYAMA ecosystems with a wide range of conservation issues. -Geographic distribution patterns of rural landscapes -Biodiversity conservation in SATOYAMA	WATANABE, Sonoko