

SOPHIA UNIVERSITY
FACULTY OF SCIENCE AND TECHNOLOGY

**FACULTY MEMBERS AND
THEIR FIELDS OF RESEARCH**

April, 2013 | March, 2014

SOPHIA UNIVERSITY

7-1 Kioi-cho, Chiyoda-ku, Tokyo, 102-8554, Japan

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DEPARTMENT OF
MATERIALS AND LIFE SCIENCES

AZUMA, Yoshiro (Professor)
Research field:

MASUYAMA, Yoshiro (Professor)

Research field: Synthetic Organic Chemistry, Organometallic Chemistry

Main theme:

- í Homologation with homogeneous rhodium, iridium, and palladium complex catalysts
- í Transformation with homogeneous rhodium, iridium, and palladium complex catalysts
- í Heterogeneous catalysis of hydroxyapatite-supported rhodium, iridium, and palladium

NAGAO, Hirotaka (Professor)

Research field: Coordination Chemistry, Bioinorganic Chemistry

Main theme:

- í Activation and conversion of nitrogen-containing compounds by transition metal complex
- í Synthesis of novel transition metal complexes
- í Regulation of geometry and reactivity around metal centers

NANBU, Shinkoh (Professor)

Research field: Theoretical Chemistry

Main theme:

- í Theory-Aided Molecular Design
- í Quantum Reaction Dynamics

OI, Takao (Professor)

Research field: Isotope Science and Technology

Main theme:

- í Isotope separation by chemical methods
- í Preparation and characterization of isotope-specific inorganic materials
- í Isotope effects studied by molecular orbital calculations

OKADA, Kunihiro (Associate Professor)

Research field: Atomic and Molecular Physics, Quantum Electronics

Main theme:

- í Gas-phase ion-molecule reactions at very low temperatures
- í Production of ion Coulomb crystals and cold molecular ions
- í Laser and microwave spectroscopy of trapped unstable nuclear ions

RIKUKAWA, Masahiro (Professor)

Research field: Polymer Chemistry, Nano Science

Main theme:

- í Proton conducting polymer electrolytes and fuel cell applications
- í Synthesis and applications to medical materials of biodegradable polymers
- í Synthesis and applications to solar cells and EL devices of conducting polymers

SAITO, Tamao (Associate Professor)

Research field: Environmental Molecular Biology, Biochemistry

Main theme:

- í Analysis of small molecules (especially polyketides) for communication and ecology
- í Functional analysis of novel polyketide synthases found in the cellular slime mould
- í Pattern formation of the cellular slime mould as a model system

SUGIYAMA, Toru (Associate Professor)

Research field: Organic Photochemistry, Organometallic Chemistry

Main theme:

- í Thermal and photochemical formation of sulfur-containing compounds
- í Formation and characterization of the metal sulfur bond
- í Chemistry of molybdenum complexes

SUZUKI, Noriyuki (Associate Professor)

Research field: Synthetic Organic Chemistry, Organometallic Chemistry

Main theme:

- í Synthesis of five-membered metallacyclic alkynes and allenes, and study of their reactivity
- í Development of organic reactions using organozirconium compounds

TAKAHASHI, Kazuo (Associate Professor)

Research field: Physical Chemistry, Chemical Kinetics, Combustion Chemistry

Main theme:

- í High-pressure autoignitions of gasoline components for HCCI engines
- í Combustion chemistry of biomass fuels
- í Computational chemistry using *ab initio* MO and DFT methods

TAKEOKA, Yuko (Associate Professor)

Research field: Polymer Chemistry

Main theme:

- í Development of organic-inorganic hybrid
- í Electrical and optical properties of polymer materials
- í Synthesis and applications to medical materials of biodegradable polymers

TAMIYA, Toru (Professor)

Research field: Biochemistry, Molecular Biology

Main theme:

- í Regulation mechanism of snake toxin gene expression
- í Molecular evolution and diversification of snake toxin genes

TANAKA, Kunihiro (Associate Professor)

Research field: Applied Physical Chemistry, Plasma Chemistry

Main theme:

- í Surface treatment and thin film deposition by atmospheric pressure glow plasma discharge
- í Plasma diagnostic of atmospheric pressure glow plasma

UCHIDA, Hiroshi (Associate Professor)

Research field: Material Science (Inorganic), Chemical Processing

Main theme:

- í Thin film processing using metal-organic precursors
- í Pb-free dielectric/ferroelectric materials with large polarization properties
- í Material synthesis using supercritical fluid

USUKI, Toyonobu (Assistant Professor)

Research field: Natural Product Chemistry, Organic Chemistry

Main theme:

- í Bioorganic study of plant natural products
- í Chemistry of enediynes antitumor antibiotic calicheamicin
- í Structural elucidation of elastin peptides

YASUMASU, Shigeki (Professor)

Research field: Developmental Biology

Main theme:

- í Differentiation of fish hatching gland cells
- í Molecular evolution of hatching enzyme gene
- í Mechanism of egg envelope digestion by hatching enzyme

DEPARTMENT OF ENGINEERING AND APPLIED SCIENCES

EMA, Kazuhiro (Professor)

Research field: Optical Physics, Optical Properties of Solids, Photonics
Main theme:

- í Excitonic optical properties of semiconductors, organic materials, and inorganic-organic hybrid materials
- í Ultrafast dynamics of excited states in solids
- í Optical properties of semiconductor nanostructures
- í Generation and control of coherent phonons in wide-gap semiconductors
- í Ultrafast optical pulse control and its application for optical communications

GOTO, Takayuki (Professor)

Research field: Low Temperature Condensed State Physics

This laboratory studies magnetic and superconducting properties of strongly-correlated electron systems at low temperatures by microscopic probes of nuclear magnetic resonance (NMR) and muon spin relaxation (# SR)

Main theme:

- í The ground state and various quantum phase transitions in quantum spin systems
- í The effect of the incoherent local structure on the superconductivity in high-Tc superconductors
- í Superconducting properties including the novel vortex state in organic complexes

HIRANO, Tetsufumi (Associate Professor)

Research field: Hadron physics (theory)

Main theme:

- í Quark gluon plasma
- í High energy nuclear collision

- í Relativistic hydrodynamics

HISAMORI, Noriyuki (Associate professor)

Research field: Biomaterial Science, Material Science and Engineering
Main theme:

- í Bio-functional materials for advanced medical technology
- í Bioactive metals: Preparation and properties
- í Design of bioactive bone substitutes based on bio-mineralization process

ICHIYANAGI, Mitsuhsa (Assistant Professor)

Research field: Thermal Engineering, Heat and Mass Transfer

Main theme:

- í Investigation of micro-and nano-scale transport phenomena
- í Experimental analysis of interfacial phenomena in multiphase flow
- í Evaluation of heat transfer characteristics in next-generation semiconductor devices
- í Development of laser-based measurement technique

KIKUCHI Akihiko (Associate Professor)

Research field: Semiconductor Engineering, Optoelectronics, Nano Technology

Main theme:

- í Inorganic/organic hybrid devices(light emitting diode, laser diode, solar-cell, etc.)
- í Growth and characterization of III-nitride semiconductor nano-crystal and epitaxial film
- í Development of nano-structural optoelectronic semiconductor devices
- í Development of novel semiconductor materials and devices

KISHINO, Katsumi (Professor)

Research field: Optoelectronics, Nano-technology, Wide-gap

Semiconductors

Main theme:

- í Green light semiconductor lasers
- í Wide-gap semiconductors and related optical devices
- í Semiconductor nano-structure and nano-devices

KUNUGITA, Hideyuki (Assistant Professor)

Research field: Optical Physics, Optical Properties of Solids

Main theme:

- í Ultrafast spectroscopy
- í Excitonic optical properties of solids
- í Generation and control of coherent phonons in wide-gap semiconductors
- í Carrier dynamics in photocatalytic materials

KUROE, Haruhiko (Associate Professor)

Research field: Solid-State Physics, Magnetism

Main theme:

- í Raman scattering in magnetic materials under multi-extreme condition
- í Magnetic and electric measurements in magnetic materials

KUWAHARA, Hideki (Professor)

Research field: Materials Science, Solid State Physics

Main theme:

- í Exploration for novel spintronic (spin-based electronic) and multiferroic materials, e.g., giant magnetoresistive and gigantic magnetoelectric oxides
- í External field control of electronic phases in strongly correlated materials: Magnetic (Electric) field control of electric-polarization or resistivity (magnetization) for next-generation high-density memories
- í Design and synthesis for *A*-site ordered perovskite-type oxides with high phase-transition temperatures for future electronic devices
- í Transport (resistivity, Hall effect, thermopower, specific heat, *etc.*) and magnetic properties near the Mott insulator-metal phase boundary in

band-width and/or band-filling controlled systems with strong electron correlation

MIYATAKE, Masafumi (Associate Professor)

Research field: Electrical Energy Systems and Applications

Main theme:

- í Energy-saving design and operation of rail and road transportation systems
- í Energy management and control of rail and road vehicles
- í Applications of renewable energy sources and storage devices

MIZUGAI, Yoshihiro (Lecturer)

Research field: Applied Optics, Simulation Physics

Main theme:

- í Interaction between materials and lasers
- í Simulations of ionizing clusters by a laser field
- í Soliton propagation in nonlinear materials

MUTOH, Yasuhiko (Professor)

Research field: Control Engineering

Main theme:

- í Nonlinear Control
- í Adaptive Control
- í Multivariable Control Systems, etc.

NAGASHIMA, Toshio (Professor)

Research field: Computational Mechanics, Structural Engineering

Main theme:

- í Meshfree method
- í Extended FEM
- í Crack propagation simulation

NAKAMURA, Kazuya (Associate Professor)

Research field: Applied Superconductivity, Electric Power Application

Main theme:

- í Fusion magnet technology
- í Accelerator magnet technology
- í Advanced cryogenic materials for magnets

NAKAOKA, Toshihiro (Associate Professor)

Research field: Nano Electronics, Semiconductor Physics

Main theme:

- í Quantum optoelectronic devices
- í Single electron / photon devices
- í Transport phenomena and optical spectroscopy in semiconductor nanostructures

NOMURA, Ichirou (Associate Professor)

Research field: Semiconductor engineering, Optoelectronics

Main theme:

- í Semiconductor materials and devices
- í II-VI compound semiconductors and their applications
- í Visible light emitting diodes and laser diodes

OHTSUKI, Tomi (Professor)

Research field: Solid State Physics (theory)

Main theme:

- í Anderson localization
- í Quantum Hall and quantum spin Hall effects
- í Quantum network model
- í Light propagation in non-uniform media

For detail: <http://www.ph.sophia.ac.jp/~tomi/english.html>

SAKAMA, Hiroshi (Professor)

Research field: Applied Physics, Surface Science.

Main theme:

- í Thin films: Nucleation and growth mechanism. Epitaxy. Structure and chemical composition, Sputtering, Pulsed-laser deposition
- í Transition metal oxide thin films: Growth, micro-fabrication and physical property measurement. Charge and spin order
- í Surface: Structure and physical properties of solid surfaces, Phase transitions, Electron diffraction
- í Photocatalyst: Reaction mechanism, Electronic structure of photocatalyst

SAKAMOTO, Haruhisa (Associate Professor)

Research field: Precision machining, Micro machining

Main theme:

- í Development of advanced machining technology for high-quality surface generation
- í Environmental impact reduction in precision machining
- í Development and improvement of laser micro-machining technology for three-dimensional mechanical parts

SHEN, Tielong (Professor)

Research field: Control Theory and Applications

Main theme:

- í Robust control of nonlinear systems
- í Mechanical system control
- í Modeling and control of automotive systems

SHIMIZU, Shinji (Professor)

Research field: Machine tool technology, Mechanical design

Main theme:

- í Evaluation of performance of machine tools and precision machines
- í Development and evaluation of tool interface for ultra high-speed spindle
- í Evaluation and improvement of contact characteristics of joint in machine tools and precision machines
- í Evaluation of thermal characteristics of machine tools and their improvement

SHIMOMURA, Kazuhiko (Professor)

Research field: Optoelectronics, Photonic Devices, Nano Structure, Semiconductor Crystal Growth

Main theme:

- í Photonic Integrated Circuits: Integration of various functional photonic devices
- í Optical devices for photonic systems, such as optical switch and modulator, arrayed waveguide grating
- í Quantum-dots structure for laser, SOA, switch, and nonlinear photonic devices
- í Optical interconnection technology
- í Selective area growth using Metal-Organic Vapor Phase Epitaxy for the control of in-plane bandgap of epitaxial layers and integration of photonic devices

SUEMASU, Hiroshi (Professor)

Research fields: Structural Mechanics, Engineering of Composite Materials

Main theme:

- í Structural and fracture mechanical study of damaged composite structures and structural elements
- í Testing methods of composite materials
- í Fracture mechanical study on adhesive structures such as joints and repairs

SUZUKI, Hiroshi (Assistant Professor)

Research field: Materials Science

Main theme:

- í Modeling and simulation of deformation, fracture and diffusion kinetics of materials
- í Effect of hydrogen on behavior of metallic materials

SUZUKI, Takashi (Assistant Professor)

Research field: Internal combustion engine, Heat transfer

Main theme:

- í Heat flow of SI engine for control
- í Energy flow analysis of hybrid engine system

TAKAI, Kenichi (Professor)

Research field: Materials Science, Hydrogen Technology

Main theme:

- í Hydrogen degradation mechanism of bcc, fcc and hcp metals
- í Hydrogen trapping characteristic of metals measured by TDS
- í Infrastructural material development for hydrogen energy society
- í Metallic separator materials for fuel cell
- í Hydrogen storage metals for fuel cell vehicle

TAKAO, Tomoaki (Professor)

Research field: Electric Energy, Applied Superconductivity

Main theme:

- í AC loss in superconducting magnet
- í YBCO and Bi-2223 tapes
- í Advanced cryogenic materials for magnets
- í Motor for ship propulsion
- í Magnetic levitation system
- í Some technologies related to superconductivity

TAKAYANAGI, Kazuo (Professor)

Research field: Quantum Many-Body Problems, Condensed Matter Physics, Nuclear Physics

Main theme:

- í Short range correlation and its realization as an effective interaction in electron systems and in nuclei
- í Long range correlation, collective excitation and its softening, and quantum phase transitions

TERUMICHI, Yoshiaki (Professor)

Research field: Multibody Dynamics

Main theme:

- í Motion analysis of high speed train
- í Contact mechanics between rail and wheel
- í Pattern formation phenomena due to machine vibration
- í Motion and control of tethered system

TSUKIJI, Tetsuhiro (Professor)

Research field: Fluid Engineering

Main theme:

- í Development of micro motor and pump using functional fluids
- í Flow analyses in hydraulic control valves and pump
- í Flow analyses around a bluff body and a jet flow using CFD
- í Flow measurement around a body in a wind tunnel
- í Flow-induced vibration
- í Device Development using pneumatic technology

YAGAI, Tsuyoshi (Associate Professor)

Research field: Superconducting Power Application

Main theme:

- í Design DC micro grid with renewable energy resources
- í Development of DC power supply system for IT devices
- í Development of new energy resource use
- í Stability analysis of CIC conductor for large scale magnet

DEPARTMENT OF INFORMATION AND COMMUNICATION SCIENCES

ARAI, Takayuki (Professor)

Research field: Speech Communication

Main theme:

- í Education in acoustics, acoustic phonetics, and speech analysis
- í Speech science (incl. production), hearing science (incl. perception)
- í Speech signal processing for people with communication disorders

BANDAI, Masaki (Associate Professor)

Research field: Computer Networks

Main theme:

- í Network systems (wireless networks, ad hoc networks and sensor networks)
- í Network protocols (medium access control, routing, transport protocols)
- í Network applications

FUJII, Mamiko (Associate Professor)

Research field: Bio-medical Optics, Bio-medical Engineering

Main theme:

- í Application of bio-medical optics: Development for depth-selective Diffuse Optical Topography
- í Fundamental study of bio-medical optics: Theoretical and experimental study of tissue characterization
- í Biomedical Instrumentation: Application of electrical impedance

GOMI, Yasushi (Associate Professor)

Research field: Algebra

Main theme:

- í Representation theory of algebraic groups and Hecke algebras

GONSALVES, Tad (Associate Professor)

Research field: Computational Intelligence, Computer Simulation, Knowledge Engineering

Main theme:

- í Simulation Optimization Meta-heuristics
- í Knowledge Management & Design of Expert Systems
- í Ontology and Semantic Web

GOTO, Satoshi (Lecturer)

Research field: Operator Algebras and Mathematical Physics

Main theme:

- í The Jones index theory of subfactors in the theory of operator algebras
- í Algebraic/combinatorial aspects of subfactor theory (graphs, fusion algebras etc.) and its relation to other fields in mathematics and mathematical physics such as quantum groups, solvable lattice models, topological quantum field theory (3-dimensional topology) and rational conformal field theory

HIRATA, Hitoshi (Lecturer)

Research field: Analysis, Applied Analysis

Main theme:

- í Nonlinear Schroedinger Equations
- í Nonlinear Waves
- í Biological Mathematics

IROHARA, Takashi (Professor)

Research field: Manufacturing Systems Engineering

Main theme:

- í Facility layout and material handling
- í Production scheduling and its optimization
- í Logistics problem and its optimization

ISHIDA, Masashi (Associate Professor)

Research Field: Geometry

Main theme:

- í Einstein metrics on 4-manifolds
- í Ricci flow on 4-manifolds
- í Seiberg-Witten invariants

ITO, Kiyoshi (Professor)

Research field: Software and Systems Engineering, Knowledge

Engineering

Main theme:

- í Methodology and tool for software and systems engineering
- í Evaluation system for systems improvement
- í Domain analysis and modeling

KATO, Takeshi (Associate Professor)

Research field: Mathematical Statistics

Main theme:

- í Time series analysis
- í Application of wavelet analysis to mathematical statistics and probability theory
- í Asymptotic theory in statistical inference

KAWABATA, Ryo (Associate Professor)

Research field: Software Engineering

Main theme:

- í Knowledge Base for Systems Analysis
- í Reusing Diagrams for Systems Specification

KAWANAKA, Akira (Professor)

Research field: Signal Processing, Image Information Processing

Main theme:

- í Multidimensional signal processing
- í Data compression for still pictures, moving pictures, and texture information

for CG

- í Representation and modeling of three-dimensional objects for realistic image synthesis

MIYAMOTO, Yuichiro (Associate Professor)

Research field: Combinatorial Optimization, Mathematical Programming

Main theme:

- í Approximation algorithms
- í Graph coloring problem and perfect graphs
- í Network design and network flows

NAKASHIMA, Toshiki (Professor)

Research field: Quantum Groups, Representation Theory

Main theme:

- í Crystal Bases and Geometric Crystals
- í Quantum groups at roots of unity
- í q-boson Kashiwara algebras

SASAKAWA, Nobuyuki (Professor)

Research field: Pharmacology, Neuroscience

Main theme:

- í Spatial and temporal regulation of neurotransmitter release by physiologically active substances
- í Functional roles of inositol pentakis- and hexakisphosphates in neuronal cells

SHIBUYA, Tomoharu (Associate Professor)

Research field: Coding Theory, Communication Theory, Information Theory

Main theme:

- We study various coding techniques for realizing reliable digital communication. This includes an analysis of behavior of the iterative decoding algorithm, design of codes suitable for the iterative decoding algorithm, estimation of parameters of linear codes, and so on.

SUMI, Chikayoshi (Associate Professor)

Research field: Biomedical Engineering, Measurement System Engineering, Visualization

Main theme:

- í Techniques of diagnosis/therapy/culture for human diseases and various functional disorders (bioelectromagnetics, biomechanics, biothermodynamics, nanomedicine, etc.)
- í Techniques of nondestructive evaluations of structures/materials for environment
- í Reconstructions using functional, stochastics, optimization (signal, image, function, etc.)

TAHARA, Hidetoshi (Professor)

Research field: Mathematical Analysis

Main theme:

- í Differential equations in the complex domain
- í Complex analysis

TAKAOKA, Eiko (Associate Professor)

Research Field: Database, Web Application Development, Programming Language Education

Main theme:

- í Development of the weather visualization system and analysis of local weather data
- í Application of micrometeorological data analysis to education
- í Touch-typing training method
- í Scalable video streaming for computer education
- í Development of the template for computer programming education
- í Development of support system for community-based volunteer activities

TAMURA, Yasuhisa (Associate Professor)

Research Field: Learning Technology

Main theme:

- í CSCL support with use of Natural language processing

- í Tablet PC / e-textbook utilization of e-Learning

- í Material and learner information repository analysis and reuse

TANAKA, Mamoru (Professor)

Research field: Circuits and Systems, Neural Networks

Main theme:

- í Analysis of large scale Cellular Neural >Letworks
- í Architectures of new LSI computers
- í Analysis and synthesis of data mining by Cellular Neural Networks

TANAKA, Shoji (Professor)

Research Field: Brain Science and Psychiatry Informatics

Main theme:

- í Neuroscience - Circuit dynamics for brain cognitive functions, through mathematical analyses and computer simulations
- í Psychiatry - Circuit theory of cognitive dysfunctions in schizophrenia and other psychiatric diseases
- í Neuropsychopharmacology - Modeling and simulations towards the development of new drugs for mental illness

TSUJI, Hajime (Professor)

Research field: Algebraic Geometry, Several Complex Variables

Main theme:

- í Abundance of canonical line bundles
- í Study of pluricanonical systems
- í Convexity and semipositivity of family of projective varieties

TSUNOGAI, Hiroshi (Associate Professor)

Research field: Mathematics, Number Theory

Main theme:

- í Constructive Galois theory, Noether's Problem and its variants
- í Galois representation attached to arithmetic fundamental groups
- í Moduli spaces of projective lines with marked points

TSUZUKI, Masao (Associate Professor)

Research field: Number Theory

Main Theme:

- í Modular forms and related L-functions
- í Selberg zeta functions and trace formulas

WAHO, Takao (Professor)

Research field: Analog Circuit Design, Semiconductor Devices

Main theme:

- í Design of low-power and high-speed analog-to-digital converters
- í Circuit applications of emerging devices
- í Signal processing based on multiple-valued logic

YAMANAKA, Takao (Associate Professor)

Research field: Intelligent Sensors, Neuromorphic Engineering

Main theme:

- í Odor sensing systems (Machine olfaction)
- í Hardware implementation of neural-network models
- í Applications of pattern recognition

YAIRI, Ikuko (Associate Professor)

Research field: Informatics, Media and Communication Science and

Technology

Main theme:

Applied research:

- í Barrier-free ubiquitous mobility support system
- í Geographic information system for disabled pedestrian navigation
- í Universal-designed interactive map contents and interfaces, etc.

Basic research:

- í Spatial and graphic information representation method with sound and touch without vision
- í Interactive interface design for the aged, the disabled and children
- í Community support for offering spatial information, etc.

