Degree Programs in Pure and Applied Sciences
Graduate School of Science and Technology

Master's Program in Mathematics

Field of Research	Faculty	Detailed Description of Research Field
Algebra	ITO Atsushi	Algebraic geometry, in particular, positivity of line bundles, toric geometry.
	SAGAKI Daisuke	Combinatorial representation theory of Lie algebras and quantum groups.
	CARNAHAN Scott	Moonshine, Automorphic forms, Algebraic geometry, Vertex algebras, Conformal fields
	KANEKO Hajime	Analytic number theory, uniform distribution theory and transcendental number theory
	KIMURA Ken-ichiro	Algebraic geometry and number theory: Study on K-groups and Chow groups.
	MIHARA Tomoki	Non-Archimedean analysis, integer-valued functional analysis, derived rigid geometry
Geometry	ONO Hajime	Differential Geometry, in particular the existence problem of canonical Riemannian metrics. Kähler manifolds, Sasaki manifolds
	ISHII Atsushi	Low dimensional topology, Knot theory
	TANGE Motoo	Handle decomposition and differential structure of 4-manifold, Dehn surgery
	NAGANO Koichi	Global Riemannian geometry, Geometry of metric spaces
	HIRAYAMA Michihiro	Dynamical systems, Ergodic theory
	YAMAMOTO Hikaru	Differential geometry. In particular, special geometry and geometric flow.
	AIYAMA Reiko	Differential geometry for surfaces and submanifolds.
Analysis	TAKEYAMA Yoshihiro	Special functions and their applications to mathematical physics and number theory
	HAMANA Yuji	Theory of stochastic processes, Stochastic analysis
	FUKUSHIMA Ryoki	Probability theory. In particular problems related to random media
	KINOSHITA Tamotsu	Hyperbolic systems, Wavelet.
	KUWABARA Toshiro	Representation theory of noncommutative algebras and vertex algebras via microlocal analysis.

Field of Research	Faculty	Detailed Description of Research Field
	MATSUURA Kouhei	Symmetric Markov processes, Dirichlet forms, Analysis related to diffusion processes with boundary conditions
Mathematics of Information	AOSHIMA Makoto	Statistical science, Large complex data, High-dimensional statistical analysis, Asymptotic theory
	YATA Kazuyoshi	High-dimensional statistics, Asymptotic theory, Machine learning, Sequential analysis
	OIKAWA Issei	Numerical analysis, Finite element methods, Discontinuous Galerkin methods
	SHIOYA Masahiro	Axiomatic set theory, in particular, infinitary combinatorics and large cardinals.
	TERUI Akira	Algorithms and applications in Computer Algebra, Symbolic Computation and Symbolic-Numeric Computation.
	TAKEUCHI Kota	Mathematical logic, Model Theory, in particular Stability Theory.
	〔OHYAUCHI Nao〕	Study of statistical non-regular theory of estimation by Bayesian approach.

(Note)

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- Applicants are requested to discuss their research plan, prior to application, with the faculty member by whom they would like to be supervised.

For inquiries about the entrance examination, please contact

Prof. Yuji Hamana, Chair, Master's Program in Mathematics

Email：hamana#@#math.tsukuba.ac.jp (Remove "#")

Telephone: +81-29-853-4371

Website of Master's Program in Mathematics： https://program.math.tsukuba.ac.jp

Master's Program in Physics

Field of Research		Faculty	Detailed Description of Research Field
Particle physics	Theory	KURAMASHI Yoshinobu YAMAZAKI Takeshi 〔AKIYAMA Shinichiro〕 〔ASANO Yuhma〕 〔MOHRI Kenji〕 〔OHNO Hiroshi〕	(1) Research on nonperturbative aspects of This field does not recruit students for the January to February Selection Process. the standard model including string theory, tensor renormalization group , utilizing machine learning) (2) Theoretical studies related to string theory and quantum field theory (nonperturbative formulation of string theory such as string field theory and the matrix model, noncommutative geometry, gauge/gravity correspondence)
	Experiment	TAKEUCHI Yuji 〔SATO Koji〕 〔IIDA Takashi〕 〔HIROSE Shigeki〕	(1) Studies of elementary particles at hadron-hadron colliding beam experiments (Higgs particle physics, top quark properties, electroweak interactions, bottom quark physics, quantum chromodynamics and strong interactions, and searches for new particles such as supersymmetry) (2) Physics of neutrinos (Searches for neutrino decays and the determination of their masses using the cosmic neutrino background, Probing the Majorana nature of the neutrinos via double-beta decays) (3) Development of new particle detectors for the LHC accelerator luminosity upgrade, linear electron-positron colliders, and other future experiments.
Astrophysics	Theory	OHSUGA Ken YOSHIKAWA Kohji 〔WAGNER Alexander〕 〔FUKUSHIMA Hajime〕	(1) Black Holes This field does not recruit students for the January to February Selection Process. (4) Stars & Star Clusters (5) Astrobiology (6) Computational Medicine Theoretical researches on these issues by using simulations with supercomputers and by analytic methodology.
	Observation	KUNO Nario HASHIMOTO Takuya 〔HONDA Shunsuke〕 〔NISHIMURA Yuri〕	Observational study of our Galaxy, galaxies, active galactic nuclei, distant universe, et al., and development of radio telescopes and detectors. Projects of submillimeter and terahertz telescopes which will be installed in the Antarctic plateau are advancing, in addition to observing with existing telescopes such as the Nobeyama 45-m telescope and ALMA.

Field of Research		Faculty	Detailed Description of Research Field
Nuclear physics	Theory	NAKATSUKASA Takashi SHIMIZU Noritaka HINOHARA Nobuo 〔MIYAGI Takayuki〕	(1) Theoretical research on quantum many-body systems with the strong interaction (2) Microscopic structure of unstable nuclei and nuclear reaction for element synthesis in the universe (3) Microscopic study on structure and phenomena of neutron stars (4) Large-scale nuclear structure calculation for interdisciplinary applications
	Experiment	OZAWA Akira ESUMI Shinichi CHUJO Tatsuya SASA Kimikazu NIIDA Takafumi MORIGUCHI Tetsuaki 〔NONAKA Toshihiro〕 〔SEKIHATA Daiki〕	(1) Experimental Study of Nuclear physics using relativistic heavy ion collider (Quark Gluon Plasma, Big Bang Cosmology, Reaction mechanism of high energy nuclear collision) (2) Evolution of Nucleosynthesis using RI beam (Nucleosynthesis, Unstable nuclei, Precise mass spectroscopy of rare nuclei) (3) Accelerator Mass Spectrometry (AMS) of cosmogenic nuclides(Global environmental changes, Age dating, Cosmic-ray intensity variation and Ultrasensitive detection method for radionuclides), Environmental radiation and Radiation physics (4) R&D of new experimental devices (Accelerator, detector, new application of accelerator beam)
Condensed matter physics	Theory	OTANI Minoru OKADA Susumu HATSUGAI Yasuhiro TANIGUCHI Nobuhiko MIZOGUCHI Tomonari 〔YOSHIDA Kyo〕 〔MARUYAMA Mina〕 〔GAO Yanlin〕 〔HAGIWARA Satoshi〕 〔SONE Kazuki〕	(1) Computational material sciences: Using the first principles techniques based on the quantum mechanics, we study physical and chemical properties of nanoscale materials, ranging from the semiconductor to biomaterials. (2) Quantum transport: Theory of quantum transport in nano-structures made of various semiconductors. Non-equilibrium dynamics and quantum coherence in compound quantum system. (3) Quantum theory of matter: Theoretical/numerical studies of quantum phases of matter (theory of bulk-edge correspondence, graphene, quantum (spin) Hall systems, strongly correlated systems, exotic superconductors, quantum spins, Berry phases, topological insulators, etc.) (4) Nano Quantum Physics: Quantum properties and quantum transport phenomena in semiconductor nanostructures; Quantum field theories of nonequilibrium steady states; Quantum field

Field of Research		Faculty	Detailed Description of Research Field
			theories of low dimensional systems, random systems or chaotic systems.
	Experiment	KANDA Akinobu NISHIBORI Eiji MORITOMO Yutaka IKEZAWA Michio NOMURA Shintaro MORISHITA Masashi 〔KUBO Atsushi〕 〔KOBAYASHI Wataru〕 〔TOMIMOTO Shinichi〕 〔NIWA Hideharu〕	(1) Low temperature physics (Kanda, Morishita) Mesoscopic electron transport in nanoscale systems: quantum effects in graphene and other atomic layer 2D materials, observation and manipulation of quantum states in mesoscopic superconductors. Low dimensional quantum properties in quantum fluids and quantum solids (helium) which appear with structural control. (2) Energy materials science (Y. Moritomo, W. Kobayashi, H. Niwa) Research of the energy materials and devices, such as, tertiary battery (energy harvesting), secondary battery, perovskite solar cell, thermoelectrics, and so on with use of Synchrotron-radiation X-ray (SPring-8, PF) and nano probes (NIMS). (3) Structural Materials Science (Nishibori): Structural materials science using advanced x-ray region photon sources. Ultra-high resolution charge density study; In-situ observation of nano-particle synthesis; structural studies of thermoelectrics, battery materials, molecular functional materials. International research collaboration using research unit project. Advanced Structural research using X-ray free electron laser. (4) Nanophotonics (Ikezawa, Kubo, Tomimoto): [Semiconductor Optics] We investigate optical properties, spin characteristics and quantum optics in low dimensional semiconductor nanostructures such as quantum wells, quantum dots and defects using various spectroscopy, including femto/pico-second laser spectroscopy. [Surface Dynamics] Studies on dynamics of charge carriers, collective excitations such as surface plasmons, and wave packets excited on solid surfaces, hetero-interfaces, and nanostructures. Developments of novel ultrafast time-resolved microscopy methods. (5) Optical nanoscience (Nomura): Studies on optical and spin properties of semiconductor nanostructures by advanced optical techniques. Studies on quantum spin systems in diamond NV centers, electron systems such as in

Field of Research		Faculty	Detailed Description of Research Field
			heterostructures, and atomic layered compounds.
Biophysics	Theory	SHIGETA Yasuteru SHOJI Mitsuo SAITO Nen	(1) Molecular simulation (SHIGETA, SHOJI) Simulation researches on biological macromolecules (proteins, nucleic acids and sugars) and supercomplexes. Development of computational methods to reveal the structure-function relationship, enzymatic catalytic reaction and origin of life. (2) Cell, tissue, or population-level simulation (SAITO): Mathematical modeling of biological systems and study on active matter physics, combined with machine learning techniques, toward understanding cell/tissue/organism-level biological phenomena from a physics-based perspective.
Plasma Physics	Experiment	SAKAMOTO Mizuki MINAMI Ryutaro YOSHIKAWA Masayuki 〔KOHAGURA Junko〕 〔HIRATA Mafumi〕 〔NUMAKURA Tomoharu〕 〔HWANGBO Dogyun〕	(1) Study on plasma transport and confinement by magnetic and electric fields, and divertor simulation study using a tandem mirror device. (2) Study on plasma heating and electric field formation by using microwave and radio frequency wave, and control of heat and particle transport in core and boundary plasmas. (3) Plasma diagnostics with X ray, infrared, microwave, particle beam, visible light, laser, etc. Using these diagnostics, especially, study on relation between plasma transport and instability and fluctuation. (4) Theoretical analysis and computer simulation related to above experiments and its application to plasma thruster. (5) Study on plasma-material interaction.

【Cooperative Graduate School System】

Field of Research	Faculty	Detailed Description of Research Field
Advanced Interdisciplinary Physics	GUBLER Philipp (JAEA) NISHIMURA Shunji (RIKEN)	Theoretical studies on origin of mass and structure of hadrons, relativistic simulation for high-energy nuclear reactions and analysis of experimental data (Gubler) Study of nuclear astrophysics using new accelerator and new experimental techniques (Nuclear Structure, Nuclear Cosmology, Neutron-Rich Nuclei) (Nishimura)

Field of Research	Faculty	Detailed Description of Research Field
Nuclear Fusion and Plasma Physics	SAKAMOTO Yoshiteru NAKANO Tomohide (QST)	(1) Study on integrated scenario of a large nuclear fusion device. (2) Study on core-boundary plasma physics for a large nuclear fusion device. (3) Study on plasma control scenario for a nuclear fusion reactor.
Frontier Materials Science	YAMAMOTO Tsuyoshi (NEC) Work location is AIST	Research on superconducting devices for quantum information processing application. Circuit-based quantum electronics is explored with technologies such as nano-fabrication and microwave engineering.
	YUGE Ryota (NEC) Work location is AIST	Research on devices with carbon nanotubes and carbon nanobrushes. They contain the material preparation, characterization, and sensing and energy device applications.
	SASAKI Ken-ichi (NTT)	We study the electronic properties of graphene, graphite, and carbon nanotube using the method of condensed matter physics. We aim for theoretical proposal of new and versatile ideas.
	SHINYA Akihiko (NTT)	Research on ultra-compact and ultra-low power photonic devices and circuits, novel photonic phenomena in nanostructures.
	OGURI Katsuya (NTT)	Research on ultrafast optical physics, in particular, attosecond physics. We are investigating lightwave-matter interaction dynamics on extreme short time scale by developing various attosecond time-resolved spectroscopic techniques.

(Note)

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(1) Please refer to the website below. Applicants should have a thorough discussion with a professor of their research field about your research plan two weeks before the examination.
Inquiries about the entrance examination should be sent to:

Prof. Akira Ozawa, Chair, Master's Program in Physics
Email：ozawa#@#tac.tsukuba.ac.jp (Remove "#" before sending an email)
Telephone: +81-29-853-4277
Website of Master's Program in Physics： https://grad.physics.tsukuba.ac.jp/

(2) Even though you passing the examination, the field of research of your choice might not the one you choose. A notification regarding the field of research you pass will be sent from Physics major followed by the university sending the letter of acceptance.

(Remarks) The faculty members in the list of the “Advanced Interdisciplinary Physics” research field by cooperative graduate school system offer their instruction by joint cooperative graduate school system. If you wish to apply for this method of instruction, contact the person above prior to the application.

(JAEA)＝Japan Atomic Energy Agency
(AIST)＝The National Institute of Advanced Industrial Science and Technology
(RIKEN)＝Institute of Physical and Chemical Research
(QST)＝National Institutes for Quantum and Radiological Science and Technology
(NEC)＝NEC Corporation
(NTT)＝NTT Basic Research Laboratories

Master's Program in Chemistry

Field of Research	Faculty	Detailed Description of Research Field
Inorganic and Analytical Chemistry	KOJIMA Takahiko 〔ISHIZUKA Tomoya〕 〔KOTANI Hiroaki〕	Synthesis of transition-metal complexes and their reactivity in various redox and catalytic reactions; Development of photo- and redox-functionality of non-planar and fused porphyrins.
	NIHEI Masayuki 〔SHIGA Takuya〕 〔MIHARA Nozomi〕	Chemistry of multi-nuclear metal clusters with controlled structures and electronic states; Creation of ultra-small metal/metal oxide nano-particles.
	SAKAGUCHI Aya 〔YAMASAKI Shinya〕 〔SHIGEKAWA Yudai〕	Studies on naturally-occurring/anthropogenic radionuclides in the environment; Study on radioactive wastes for their volume reduction； Studies on the chemical and nuclear properties of actinide and superheavy elements.
	NAGATOMO Shigenori	Studies on diffusion behavior of heme proteins in microparticle and functions and structures of heme proteins using spectroscopic and crystallographic analysis.
Physical Chemistry	ISHIBASHI Taka-aki 〔SATO Tomoo〕 〔MOMOTAKE Atsuya〕 〔SHIBATA Keisei〕	Studies on interfaces and condensed phases by linear and nonlinear molecular spectroscopy, and chemical reactions by time-resolved IR spectroscopy (Ishibashi, Shibata); Studies on photofunctions and photochemical properties of newly fabricated molecular assemblies and inorganic particles in mesoscopic scale (Sato); Development of useful molecules for photodynamic therapy and elucidation of reaction mechanisms, and development of nucleic acid adjuvants. (Momotake)
	ENAMI Shinichi 〔NISHIMURA Yoshinobu〕 〔NUMADATE Naoki〕	Atmospheric heterogeneous chemistry, biosurface chemistry, interfacial photoreactions, interface chemistry and physics (Enami, Numadate); Synthesis of emissive compounds and kinetic analyses of formation and deactivation processes of the emissive state by TCSPC (Nishimura).
	YAGI Kiyoshi 〔MATSUI Toru〕 〔OKAZAWA Kazuki〕 〔OKITA Kazuya〕	Studies on developments of QM/MM methods combining quantum chemistry and molecular dynamics, molecular design integrating computational and informational chemistry, and their applications to biomolecular and photochemical reactions, and functional polymer designs.
	YAMAMURA Yasuhisa	Structure and property of soft molecular systems, and dynamics and phase transitions in them.

Field of Research	Faculty	Detailed Description of Research Field
Organic Chemistry	SASAMORI Takahiro 〔SUGAMATA Koh〕 〔MASADA Koichiro〕	Studies on synthesis of novel main-group-element compounds with unusual chemical bonds and elucidation of their chemical and physical properties. Creation of the novel species of main-group-element compounds in pursuit of unique organic reactions and functions utilizing main group elements.
	YOSHIDA Masahito	Bioorganic studies on bioactive natural products and related analogs based on isolation and total synthesis.
	NAKAMURA Takashi	Precise construction of functional molecules based on supramolecular chemistry, and exploration of their properties such as molecular recognition and selective reaction. Studies on supramolecular metal complexes utilizing organic ligands and metal ions.
Interdisciplinary Chemistry	IWASAKI Kenji 〔ADACHI Naruhiko〕 〔HARADA Ayaka〕 〔KATO Kazashi〕 〔FUJIKI Ryo〕	Study of proteins in soft-tissue sarcoma, chromatin remodeling factors and a photosensing flavoprotein. Structural biology and chemistry using single-particle cryo-EM and its development.
	KUTSUMURA Noriki 〔SAITOH Tsuyoshi〕 〔SUGAI Tomoya〕	Design and synthesis of protein kinase ligands regulating sleep/wakefulness, Synthesis of biologically active nitrogen–containing heterocycles, Studies on chemoselective reaction useful for drug discovery.

【Cooperative Graduate School System】

Field of Research	Faculty	Detailed Description of Research Field
High-pressure Organic Chemistry	KAWANAMI Hajime （ ＡＩＳＴ）	Studies in Organic Chemistry with High-pressure and Supercritical Fluids includes High-pressure Hydrogen Production, Carbon Dioxide Utilization Chemistry, Biomass Conversion, etc.
Organic Electronics Chemistry	YOSHIDA Yuji （ ＡＩＳＴ）	Research on structural properties and photo-electrical properties of thin films based on polymers, molecular compounds and organic-inorganic hybrid materials, and chemistry on organic electronics such as organic photovoltaic cells (solar cells).
Catalytic Organic Chemistry	TANIGUCHI Tsuyoshi （ ＡＩＳＴ）	Research on the development of catalytic reactions for challenging molecular transformations and polymer synthesis
Photofunctional Materials Chemistry	NORIKANE Yasuo （ ＡＩＳＴ）	Photofunctional organic molecules especially showing photo-induced solid-liquid phase transitions and lightdriven mechanical motion.

Field of Research	Faculty	Detailed Description of Research Field
Functional Polymer Gel Chemistry	HARA Yusuke （ ＡＩＳＴ）	Research and development of functional polymers and polymer gels for application to soft actuators, soft robots, micro fluidic devices.
Organic Reaction Chemistry	MINAMI Yasunori （ ＡＩＳＴ）	Research and development of organic reactions and catalysts for precise organic transformations of stable chemicals including polymers
Molecular Transformation Chemistry	UEDA Yoshihiro （ ＡＩＳＴ）	Development of synthetic methods that enable naturally abundant resources to be transformed precisely and greenly into high-value substances.
Biomolecular Chemistry	NISHIHARA Ryo （ ＡＩＳＴ）	Study on the discovery and development of functional biomolecules for bioanalytical applications

（Note）

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Inquiries about the entrance examination should be sent to:

Prof. Takahiro Sasamori, Chair, Master's Program in Chemistry/
Prof. Aya Sakaguchi, Member of the Academic Committee Master's Program in Chemistry
Telephone: +81-29-853-4412・8789
Website of Master's Program in Chemistry: https://program.chem.tsukuba.ac.jp/?lang=en

（AIST）＝The National Institute of Advanced Industrial Science and Technology

Master's Program in Engineering Sciences
Subprogram in Applied Physics

Field of Research	Faculty	Detailed Description of Research Field
Nano instrumentation Physics	SEKIGUCHI Takashi	Basics and application of scanning electron microscope (SEM). Electron and material interactions and physics of secondary and reflective electrons. New measurement method by the electron beam.
	SOHDA Yasunari	Basic and application of scanning electron microscope (SEM). Electron optics and measurement of electron beam. Enhancement of SEM system and proposal of new system.
	FUJITA Jun-ichi	Research on the development of nitrogen-doped high-performance carbon nanotubes and development of femtosecond ultrafast electron microscopy visualization technology
	KOBAYASHI Nobuhiko	Condensed matter theory. Computational materials science. Density functional theory for nonequilibrium systems. Theory of charge, heat and spin transport in nanoscale systems.
	YAMADA Yoichi	Surface and molecular sciences on the structure-property relationships of the self-organized organic semiconductors.
	FUJIMORI Toshihiko	Nanocarbon materials: Controlled synthesis, development of their assembly techniques and functionalization.
	TAKEUCHI Osamu	Development of new microscopy techniques by combining nanometer-resolving scanning probe microscopy and optical measurement techniques, in order to reveal nanometer-scale optoelectronic processes in solar cells, light emitting diodes, and spintronics devices and to improve their device performance
	YOSHIDA Shoji	Our research target is to understand and develop nanoscale science and technologies of such as surface science, molecular physics, and new functional materials and devices. To realize these studies, we develop new microscopy techniques based on scanning probe microscopy and advanced laser technologies, which, for example, enable ultimate spatial and temporal resolutions, simultaneously.

	MAKIMURA Tetsuya	Nano- and Micro-machining and materials synthesis using laser produced plasma EUV light and laser light.
	OIGAWA Haruhiro	Experimental study on nano physics and spectroscopy
	ARASHIDA Yusuke	Femtosecond atomic-scale imaging of electronic states in semiconductors and molecules using broadband pulsed laser technology.
	MOGI Hiroyuki	Development of new microscopy techniques based on scanning probe microscopy and advanced quantum optical technologies, and their application for research in nanoscale science and technology.
Optical and Quantum Engineering	HASE Muneaki	Ultrafast laser spectroscopy on semiconductors and dielectric materials using femtosecond laser and application to optical devise and controlling phase transitions
	HADA Masaki	Femtosecond time-resolved electron diffraction measurements: filming “molecular movies” of photo-reactive or responsive materials, Terahertz-wave engineering.
Bio-medical engineering	SHIRAKI Kentaro	Technology of protein folding and application of biomaterials
	YASUNO Yoshiaki	Fundamental, instrumentation, application research on optical tomographic imaging for medical and lifescience applications. It includes optical coherence tomography and quantitative three-dimensional functional microscopy.
	TERADA Yasuhiko	Development of new imaging methods based on NMR and MRI
Quantum Beam and Plasma Engineering	TOMITA Shigeo	Experimental studies on advanced atomic physics and atomospheric science using charged particle beams from accelerators
	EZUMI Naomichi	Study of plasma-gas interaction and plasma-wall

		interaction in boundary plasmas (edge-divertor plasmas) of magnetically confined nuclear fusion utilizing an open magnetic field structure of the largest tandem mirror plasma device GAMMA 10/PDX. To control the high heat flux boundary plasma, we are investigating the plasma behavior using advanced plasma measurement systems.
	SEKIBA Daiichiro	Structure and electronic state study of hydrogen storage metals and metalloprotein by high energy ion beam and synchrotron radiation.
	TOGO Satoshi	Numerical simulation of heat and particle transport in magnetic confinement fusion using the open-end magnetic field configuration of mirror plasma and development of control methods
Advanced device Engineering	SUEMASU Takashi	Exploration of novel materials for thin-film solar cells and thermoelectric materials composed of abundant elements. Ultrafast magnetization control in compensated ferrimagnets and microwave oscillation via spin currents.
	TOKO Kaoru	Research on materials and processes for highly functional thin films for flexible energy devices
	HASUNUMA Ryu	Development of highly reliable gate dielectric films on Si and SiC substrates.
	UMEDA Takahide	Electron-spin-resonance (ESR)-based characterization on nano-electronics devices and power-electronics devices
Nano Functional Materials Engineering	SAKURAI Takeaki	Development of highly efficient organic and inorganic thin-film solar cells. Characterization of defects in power semiconductor devices.
	ITO Yoshikazu	Synthesis, characterizations and fabrication of 3D Materials using graphene and two dimensional materials for studies of fundamental physics and developments of carbon neutral technology
	ISLAM Muhammad Monirul	Growth and characterization of thin-film semiconductors for application in energy devices, such as solar cells and photocatalyst. Study of

		nanostructured semiconductors for battery application.
	SELVAKUMAR Sellayan	Defect studies on Fe based alloys and nanostructured materials by positron annihilation spectroscopy.
Power electronics and wide-bandgap semiconductor technology	YANO Hiroshi	Research on ultra-low-loss SiC power semiconductor devices, particularly improvement in SiC-MOS device performance and understanding of its interface physics, toward power electronics innovations.
	ISOBE Takanori	Study on circuit topologies and control for efficiency and power density improvement in power converters, and its emerging applications
	OKUMURA Hironori	Crystal growth of wide bandgap semiconductors and development of their optical and electrical devices
Spintronics and magnetics	MITSUMATA Chiharu	A study of Materials Informatics using Explainable Machine Learning to analyze the mechanism of magnetic property in magnetic materials. Development of representations that use free energy to build models in data space and connect observed physical phenomena.
	OHNO Yuzo	Research on electronic, optical, and spin properties of semiconductor nanostructures, and spin injection and control which are the basis of spin lasers for ultra-high-speed and low-power consumption technologies
	YANAGIHARA Hideto	Thin film growth of advanced magnetic oxides for spintronics devices
	SHARMIN Sonia	Using machine learning to analyze light emission spectra during sputtering

(Materials Science and Engineering Class)

Materials Science and Engineering Class is designed as a Master's course jointly operated by National Institute for Materials Science and Degree Programs in Pure and Applied Sciences, corresponding to Doctoral Program in Engineering Sciences, Subprogram in Materials Science and Engineering.
For details regarding this class, see here: https://www.nims.go.jp/tsukuba/en/

Field of Research	Faculty	Detailed Description of Research Field
Optoelectronic Nanomaterials Engineering	MITANI Seiji	Development of magnetic materials and nanostructures by atomic scale control based on state-of-the-art thin film growth techniques. Searching and understanding new functionalities in spin transport and their application to spintronic devices.イ
	TAKANO Yoshihiko	We are focusing on the physical properties of high-Tc superconductor, diamond superconductor, Fe-based superconductor and carbon nanotube. Development of novel devices, including optical and field effect devices, using superconductors and nano-technologies are targets.
	FUKATA Naoki	The basic and applied research of next generation semiconductor transistor materials and new environment and energy related materials, which are characterized by high s peed and low power consumption by compounding semiconductor nanomaterials of different dimensions and mate rial types, is comprehensively carried out.
	YAMAGUCHI Takahide	Research on fundamental properties and device applications of diamond as an electronic material for power electronics, quantum information processing, and sensing. Development of quantum devices based on heterostructures consisting of diamond and two-dimensional materials such as graphene and h-BN.
	YOSHIKAWA Genki	Research and development of olfactory sensors, the last frontier of the five senses. Based on various basic sciences such as structural mechanics, materials science, fluid mechanics, system engineering, and informatics, we will conduct comprehensive research and development of novel hardware and software with unprecedented performance, aiming for social implementation through industry-academia-government collaboration.
	ISHII Satoshi	Studies on developing novel photonic nanostructures for extraordinary optical properties and photoelectric/photothermal conversions. Includes both numerical and experimental works to develop, for examples, optical metamaterials and photonic nanostructures to harvest sunlight as well as solar heat.
	SAKURABA Yuya	Focusing on special transport and thermoelectric effects derived from magnetism and spin, we studied new magnetic thin film materials and multilayer nanostructures. In addition to the fundamental research, we are also conducting research for practical devices such as next-generation data storage, ultra-sensitive magnetic sensors, and novel thermoelectric power generation applications.
	IIMURA Soshi	The electronic, optical, and chemical functions of materials are determined by the response of electrons to external stimuli such as electricity, light, and contact with chemical substances. Focusing on the interactions between electron orbitals in materials, we will pioneer new materials consisting solely of ubiquitous elements based on our original design guidelines

		and contribute to the realization of a sustainable society.

【Cooperative Graduate School System】

Field of Research	Faculty	Detailed Description of Research Field
Power electronics and wide-bandgap semiconductor technology	MAKINO Toshiharu (AIST)	Diamond growth, and electronic device fabrication using unique properties.
	KOJIMA Kazutoshi (AIST)	Research and development on wide gap semiconductor epitaxial growth technique such as SiC and its characterization. Development of power device with new structure by using epitaxial growth technique.
Spintronics and magnetics	YUASA Shinji (AIST)	Research and development of magnetic tunnel junctions, magnetoresistive random access memory MRAM and other spintronic devices.
Bio・medical engineering	HIRANO Atsushi (AIST)	We explore the interaction mechanisms between nanomaterials and biomolecules to understand the biological behavior of nanoparticles and develop novel composites. While our primary focus lies on nanocarbons and proteins as targets, we also extend our exploration to a diverse range of materials.

(Note)

◆Applicants should have a thorough discussion with a professor of their research field about your research plan in advance.

Inquiries about the entrance examination should be sent to:

Prof. OHNO Yuzo, Chair, Subprogram in Applied Physics

Email：ono.yuzo.gb#@#u.tsukuba.ac.jp (Remove "#" before sending an email)

Telephone: +81-29-853-4966

For more information, please refer to the following websites:

Website of the Degree Programs in Pure and Applied Sciences: http://www.pas.tsukuba.ac.jp/

Website of Master's Program in Engineering Sciences Subprogram in Applied Physics：
https://applphys.bk.tsukuba.ac.jp/

(AIST)＝The National Institute of Advanced Industrial Science and Technology

Master's Program in Engineering Sciences
Subprogram in Materials Science

Field of Research	Faculty	Detailed Description of Research Field
Quantum Physics of Solid State	KURODA Shinji	Experimental studies on spin-related phenomena in the solid state. We develop novel materials exhibiting spin properties, such as magnetic semiconductors, topological insulators and their nanostructures, and clarify the spin-related properties aiming at the application to spin-based electronic devices
	MARUMOTO Kazuhiro	Development and characterization of semiconductor materials, and their application to semiconductor devices such as solar cells, light-emitting devices, transistors, etc. using functional materials such as organic materials, perovskite materials, low-dimensional materials, etc.
	FUJIOKA Jun	Research on electronic, optical and thermal property in strongly correlated electron material and topological quantum material. Searching new quantum phenomena and functions by using state-of the art material synthesis technique, spectroscopy and fundamental characterization.
	KASHIWAGI Takanari	Development of terahertz-waves emitters, detectors and applications based on single crystals of high temperature superconductors. Study of material characteristics of single crystals of high-temperature superconductors.
	KANAZAWA Ken	We focus on magnetic semiconductors as promising materials for spintronic devices. To realize novel semiconductors with room-temperature ferromagnetism, we fabricate samples by precise crystal growth methods such as molecular beam epitaxy.
	MORI Tatsuya	Fundamental research and application development on universal excitations appearing in disordered systems. We aim to understand the dynamics of glasses and proteins using terahertz spectroscopy and molecular dynamics simulation, and to develop novel applications of terahertz light.
Theoretical Quantum Physics	ISHII Hiroyuki	Theoretical research to predict electronic states, crystal structures, and quantum transport properties for development of new functional materials such as organic semiconductors and inorganic thin films.

Field of Research	Faculty	Detailed Description of Research Field
	KOIZUMI Hiroyasu	Theoretical study of superconductivity in strongly-correlated materials and topological materials, and their application to fault-tolerant quantum computers.
	SUZUKI Shugo	First-principles study of structural and electronic properties of materials
	MAESHIMA Nobuya	Theoretical study of photo-induced phenomena in strongly correlated electron systems and topological materials
Materials Physics and Engineering	KIZUKA Tokushi	Development of heat resistance materials and carbon fiber-reinforced composites for aircrafts and jet engines, nanowires, nanocontacts devices, and mechanical and friction nanostructures for nanodevices by electron microscopy.
	KIM Hee Young	Development and characterization of novel functional alloys and biomaterials including biomedical superelastic alloy, high temperature shape memory alloy, high entropy alloy and gum metal
	TOKORO Hiroko	Development of novel materials with advanced light-responsive functionalities, accompanying changes of optical, magnetic, and electric properties. Metal complexes and metal oxides are the main target materials
	SUZUKI Yoshikazu	Development of new inorganic materials for energy and environmental applications such as supercapacitors and environmental purification filters
	TANIMOTO Hisanori	Research on characteristic properties and application of nanostructured materials (amorphous alloys and metallic nanoparticles etc.) and high-entropy alloys.
	TAKAHASHI Miwako	Phase transitions and structural fluctuations in magnetic alloys and compounds studied by diffraction techniques using quantum beams (neutron beams and X-rays)
Materials Chemistry and Biotechnology	KANBARA Takaki	Development and characterization of novel functional polymers and organometallic compounds directed toward organic devices and catalysts
	KONDO Takahiro	Creating new materials contributing to the carbon neutrality, surface physics and chemistry at atomic scale, surface reaction dynamics, and creating new materials composed of boron.

Field of Research	Faculty	Detailed Description of Research Field
	TSUJIMURA Seiya	Electrochemistry of redox enzymes and its application to biosensors and biofuel cells
	YAMAMOTO Yohei	Self-assembly of π-conjugated molecules, polymers, and biomolecules to construct electronic, optical, and energy conversion devices.
	OISHI Motoi	Development and design of novel point of care testing (POCT) devices and nano-machines based on DNA nano-system.
	KUWABARA Junpei	Development of new molecular catalysts, facile synthetic methodology for conjugated molecules, and luminescent metal complexes.
	GOTO Hiromasa	Synthesis and properties of low-molecular mass compounds and polymeric materials having magnetism, electrical conductivity, photo-isomerization, optical rotation, and circular dichroism
	YAMAGISHI Hiroshi	We design, synthesize, and assemble organic molecules and their devices as a bridge across artificial and living matters.
	KODA Yuta	Precision design of polymer-based biomaterials for the medical treatments of intractable diseases

(Materials Science and Engineering Class)

Materials Science and Engineering Class is designed as a Master's course jointly operated by National Institute for Materials Science and Degree Programs in Pure and Applied Sciences, corresponding to Doctoral Program in Engineering Sciences, Subprogram in Materials Science and Engineering.
For details regarding this class, see here: https://www.nims.go.jp/tsukuba/en/

Field of Research	Faculty	Detailed Description of Research Field
Nanostructural Engineering	EBARA Mitsuhiro	Our research group is interested in developing smart biotechnologies using stimuli-responsive polymers. These smart biomaterials are designed to act as an "on-off" switch for drug delivery technologies, gene therapy, affinity separations, chromatography, diagnostics.
	KAWAKAMI Kohsaku	Development of pharmaceutical/cosmetic materials are of our research interests, where self-assembly phenomena of organic molecules are utilized to add novel functions. Also focused is regulation of non-equilibrium behaviors of soft materials, which is important for maximizing function of drug products.

Field of Research	Faculty	Detailed Description of Research Field
	SASAKI Taisuke	The research focus involves elucidating connections between processing, structure, and properties in various metallic alloys, including, but are not limited to, light alloys, permanent magnets, and steels. We utilize a variety of state-of-the-art analytical microscopes, such as electron microscopes and 3D atom probe, that characterize materials from the atomic to micron length scales to achieve these outcomes.
	SHIBATA Akinobu	Main our research target is structural metallic materials (particularly, steel). We are investigating microstructure evolution by phase transformation, relationship between deformation / fracture behavior (mainly brittle fracture, such as hydrogen embrittlement) and microstructure. We try to propose novel alloy design and microstructure design concepts for developing advanced steels from theoretical background.
	TAGUCHI Tetsushi	Basic research on polymer-based medical materials for minimally invasive treatment and tissue regeneration. By synthesizing polymeric materials that change from sol to gel in the in vivo environment and combining these materials with cells and drugs, we will develop tissue adhesive materials, anti-adhesive materials, injectable materials for localized cancer treatment, and other applications.
	CHEN Guoping	Preparation of biocompatible and biofunctional polymer biomaterials with controlled porous and surface structures using biodegradable polymers and bioactive factors, and their application for tissue engineering.
	NAITO Masanobu	We aim to research and develop circular materials, such as upcycling materials, self-healing materials, adhesives, coatings, through data-driven research using state-of-the-art autonomous smart lab and materials informatics.
	MORI Takao	We focus on developing highly functional energy environment materials, such as, thermoelectric and battery materials, through atomic network control, synthesis of new materials, nano/microstructure control of materials with strong structure-property relationships from their topology.

Field of Research	Faculty	Detailed Description of Research Field
	HASHIMOTO Ayako	Development and applications of transmission electron microscopy techniques and systems. We especially focus on in-situ observations of environmental and energy materials such as photovoltaic materials, fuel cells, rechargeable batteries and so on.
	WATANABE Ikumu	We have developed a computer aided engineering framework to accelerate material research and development, based on multi-scale and multi-discipline modeling to characterize material behaviors and properties. We focus on especially structural materials for automotive and aviation industries.
	KAWAI Shigeki	Single molecular chemistry with high-resolution atomic force microscopy/scanning tunneling microscopy. Development of local probe chemistry. Functionalized nano-carbon materials synthesized by on-surface chemical reaction.
	SODEYAMA Keitaro	The working mechanism of energy-related materials such as lithium-ion batteries will be clarified by first-principles molecular dynamics simulations using a supercomputer. We also use the machine learning techniques to find new feasible materials with experimentalists.
	SAKAUSHI Ken	We conduct our research to solve modern energy issues through unveiling basic principles and synthesis of materials of electrochemistry towards fuel-cells and rechargeable batteries. We put special emphasis on researches in collaboration with experiments, theoretical calculations, and data science, focusing on the following two points: (1) uncovering reaction mechanisms by using model electrodes, and (2) design and synthesis of novel electrode materials.
	TAKAI Atsuro	We develop innovative organic materials through unique molecular design and chemical reactions. In particular, we focus on understanding the dynamic phenomena that link the nano- and macro-worlds, which are characteristic of life activities.

【Cooperative Graduate School System】

Field of Research	Faculty	Detailed Description of Research Field
Materials Chemistry and Biotechnology	CHOI Jun-Chul (AIST)	We aim at the development of high efficiency catalyst for green synthetic processes and material design of highly dispersed metal catalyst.
	KURITA Ryoji (AIST)	We conduct R&D from basic research to device development as regard a novel biomolecule analysis, and contribute to the development of next-generation medical and life science.

(Note)

◆ Applicants should have a thorough discussion with a professor of their research field about your research plan in advance.

Inquiries about the entrance examination should be sent to:

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Related Websites (http://www.pas.tsukuba.ac.jp/ / http://www.ims.tsukuba.ac.jp/ / http://www.tsukuba.ac.jp/)

(AIST)＝The National Institute of Advanced Industrial Science and Technology