UTSIP Kashiwa 2022

Program A

Host Laboratory List

Division of Transdisciplinary Sciences

1. Advanced Materials Science (AdvMS)
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3. Complexity Science and Engineering (CSE)

Division of Biosciences

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11. Graduate Program in Sustainability Science - Global Leadership Initiative (GPSS)

Division of Transdisciplinary Sciences

Department of Advanced Materials Science

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
KIMURA (Tsuyoshi) Laboratory	Prof. KIMURA Tsuyoshi	The research subject of our laboratory belongs to the field of "Materials Physics" which deals with the understanding of materials' properties based on quantum mechanics, the exploration for state-of-arts functional materials based on synthetic chemistry, and the development of cutting-edge measurement systems of materials properties. Especially, we explore multi-functional electronic materials in which various electric and magnetic properties are entangled and induce unexpected materials functionalities. For this purpose, we design and synthesize various transition-metal compounds, and carry out measurements of their electric and magnetic properties under various environmental conditions in terms of temperature, pressure, and electric and magnetic fields. "Multiferroics" are one of such functional materials and are defined as materials in which multiple order parameters such as ferromagnetic, ferroelectric, and ferroelasitic orders coexist and couple each other. We aim to explore new types of mutiferroic couplings and orders such as ferroaxial, magnetic toroidal, magnetic quadrupole, and chiral orders, which lead to unconventional control of electronic properties in materials.	Physics and chemistry, Multi-functional materials, Crystal growth, Electronic properties, Magnetic and electric fields	In this summer program, you will learn how to investigate multi-functional electronic materials such as multiferroics in which their electronic properties respond to both magnetic and electric fields. Electronic properties of materials are strongly dominated by their constituent elements and crystal structures. Thus, you will begin with the synthesis of the materials from chemicals, and have an experience of crystal growth. The obtained specimens will be characterized by structural analyses such as an x-ray diffraction measurement which reveals the crystal structures of the specimens. Subsequently, you will characterize their magnetic, mechanical, and electric properties under various environmental conditions such as low temperatures and high magnetic and electric fields. By comparing the results of several compounds, you will find the required conditions to achieve materials with (multi-)functional properties.

Division of Transdisciplinary Sciences

Department of Advanced Energy

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Yasushi Ono Laboratory	Prof. ONO Yasushi Dr. TANABE Hiroshi	Our main research fields are Plasma Physics and Engineering, especially development of fusion energy, alternative energy sources, space and solar plasmas and plasma applications. The present fusion research already realized fusion power output larger than the input power as an exhaustless energy without any global warming gas. Its key question is whether we can develop cost-effective /high-beta confinement using economic high-power heating, where the beta is the plasma thermal pressure P confined by the unit magnetic field: beta=P/(B^2/2μ_0) ~ fusion output power / coil cost. We have developed a number of new ideas for (1) high-power heating: merging/ reconnection heating and (2) ultra-high-beta confinements: second-stable Spherical Tokamak (ST) , using the TS-3, TS-4, TS-6, UTST and MAST, ST-40 devices (based on UK-Japan collaboration). Since the magnetic field-line reconnections (mergng of two ST plasma) converts about half of poloidal (reconnnecting) magnetic energy into plasma kinetic/ thermal energy, our TS-3 and ST-40 experiments documented significant ion heating over 2.3keV, respectively. We found the new scaling law of reconnection heating energy proportional to square of reconnecting magnetic fiels B_rec, indicating that the high-B_rec ST merging will heat ions to the burning plasma regime without using any additional heating facility line neutral beam injection (NBI). This fact leads us to new high-magnetic field ST merging/ reconnection experiments TS-6 with B_rec > 0.3-0.5T for ion heating >1keV. We are now organizing the international world-wide reconnection collaboration program CMSO for physics, application of merging and reconnection and also for international and interdisciplinary plasma education of young scientists among MRX (Princeton U.), MST (Wisconsin Univ.), MAST (Culham lab.) and ST-40 (Tokamak Energy). ■ Web：http://tanuki.t.u-tokyo.ac.jp/	Plasma Experiment; Fusion Energy; Laboratory Astrophysics; Spherical Tokamak (ST); Magnetic Self-Organization	We, international plasma research groups composed of Univ. Tokyo, Princeton Univ, NIFS, JAXA etc. are planning annual interdisciplinary schools and workshops of plasma astrophysics in 2022 using bidirectional exchanges of research staffs, graduate and undergraduate students. This new approach focuses on interrelationship of laboratory plasma experiments, space/ astrophysical plasma observations and numerical/ theoretical plasma studies and their applications based on the international and interdisciplinary collaborations. Our annual school and workshop will be held in Tokyo area for graduate and undergraduate students. Mutual visits of faculty members and graduate and undergraduate students will be encouraged and realized. Our initiative will provide a new interdisciplinary and balanced education of plasma astrophysics in both the undergraduate and the graduate schools. This program involves laboratory experiments, space observations and numerical / theoretical studies of plasma astrophysics. Our activities will generate a joint consortium of departments of advanced energy, space-astrophysical science, physics and electrical engineering. We believe that our annual school and workshop will provide new opportunities of international and interdisciplinary lectures, discussions and experiments to all plasma-course students.

Division of Transdisciplinary Sciences

Department of Complexity Science and Engineering

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Ejiri-Tsuji Laboratory	Assoc. Prof. EJIRI Akira	In Ejiri-Tsujii laboratory, fusion-oriented high-temperature plasma research is performed. The main research topic is the start-up and sustainment of a spherical tokamak configuration using RF wave power. This is an important issue to realize an economical reactor producing energy from the nuclear fusion reaction of deuterium and tritium. Besides the issue, we also study various MHD instabilities and wave induced nonlinear phenomena in plasma. We have a spherical tokamak device (TST-2) in our laboratory located at the Kashiwa campus, and we are running it by ourself. The major radius of the plasma is 0.36 m, and the maximum electron temperature is about 400 eV, and the density is up to about 2x10^19 m^-3, and the discharge duration is less than about 0.1 sec. In order to study the above topics, someone is developing an RF devices including RF antennas, while others are developing measurement systems or simulation codes. Please visit our website http://fusion.k.u-tokyo.ac.jp/index-e.html for more information, and visit https://www.youtube.com/channel/UCKTRHAVdVptxZFo2AasGeJg/ to feel the atmosphere.	plasma physics, nuclear fusion, tokamak, visible light detection, plasma production	Since high temperature plasmas are far from thermal equilibrium and have spatial inhomogeneity and temporal evolutions, it is quite important to get information on the plasma as much as possible. However, plasmas are too hot to insert sensors into the plasma, and remote measurements are necessary. Optical measurements are one such method. During UTSIP, our laboratory provides an opportunity to construct a very wide dynamic range visible light detection system, which consists of several detectors (i.e., photomultipliers, photodiodes) with different sensitivities and several collection optics. By using it you can observe the growth of a plasma from a very low density state to a standard high density state. The target density range is 10^10 m^-3 to 10^18 m^-3. This measurement is quite useful to understand the physics of plasma production process by inductive electric field, which is a standard plasma production process in tokamak devices.

Division of Biosciences

Department of Integrated Biosciences

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Laboratory of Signal Transduction	Prof.OHYA Yoshikazu Assoc. Prof. SUZUKI Kuninori	The budding yeast Saccharomyces cerevisiae is a very attractive model organism for studying the fundamental theories and concepts of eukaryotic cells. We applied the power of yeast genetics to understand many aspects of yeast cells. Our current research is mainly focused on (1) system biology based on cell imaging, (2) function of cell wall and cell wall integrity checkpoint, and (3) autophagy. (1) To understand biological system as the network of logical and informational process, one of the invaluable tools is genetics. Global analysis of the mutant phenotypes can provide relationships between knockout of the gene and function in the network. We developed CalMorph image analysis system useful to examine high-dimensional quantitative phenotypes under the fluorescent microscope. This method can be applied to identifying intracellular drug target, monitoring fermentation process during culture and studying biological diversity. Our ultimate goal is to place all yeast genes and their corresponding products on a functional signaling network based on phenotyping. (2) The cell wall is an essential cellular component in yeast. The cell wall is dynamic, because it undergoes remodeling during the cell cycle. We demonstrated that small rho type GTPase Rho1 is regulated by the progression of the cell cycle. We also found that there is a new cell cycle checkpoint mechanism called “cell wall integrity checkpoint” which functions to control cell cycle progression in response to cell wall perturbation. We are now studying such signaling mechanism as well as biosynthesis of the cell wall in yeast. (3) Autophagy is a major pathway of bulk degradation of cytoplasmic materials. In yeast, autophagy has been studied as a cellular response for survival during nutrient-limited conditions. During autophagy, cytoplasmic components are enclosed in a membrane compartment, called an autophagosome. We are now studying the mechanisms of autophagosome formation and its degradation. Moreover, we have a particular interest in physiological significance of autophagy.	Budding yeast Saccharomyces cerevisiae; systems biology; imaging; cell cycle; autophagy	(1) Live imaging and biochemical analysis of autophagosome formation and its degradation (2) Cell biological analysis of membrane sources of autophagosomes (3) Chemical genetic analysis of yeast autophagy (4) Multivariate analysis of high-dimensional morphometric data to our understanding of the pharmacology of antifungal drugs. (5) High-Content, image-based profiling to identify drug target. (6) High-dimensional quantitative phenotyping of yeast haploinsufficient genes (7) Single-cell phenomics with morphological data to reveal biodiversity and intraspecies variation in yeast. (8) Genetic study of multiple functional domains of the yeast 1,3-β-glucan synthase subunit by quantitative phenotypic analysis of temperature-sensitive mutants. (9) Phenotypic robustness contributed by the cell wall by protecting the intracellular functional network from environmental conditions. (10) Application of image-based monitoring system for green algal Haematococcus pluvialis (Chlorophyceae) cells during culture
Laboratory of Evolutionary Anthropology	Assoc. Prof. NAKAYAMA Kazuhiro	We all suffer from diseases. In particular, noncommunicable diseases related to modern lifestyles, such as metabolic syndrome, affect many people. The susceptibility to lifestyle-related diseases is related to the genetic variants inherited from our ancestors. What was the significance of the disease-prone/resistant variants before the modern lifestyle prevailed? Our primary interest is in the relationship between obesity and adaptation to starvation and cold. We are seeking evidence that environmental adaptations in our ancestors were involved in shaping the susceptibility of modern humans to disease. To achieve this goal, we are developing research that combines a variety of methods, including phenotyping experiments on human subjects, statistical analysis using genome-wide DNA variation data, and population genetic analysis to detect traces of natural selection.	Evolution of modern humans, genome variation, adaptation, lifestyle related diseases	We plan to conduct molecular anthropological experiments on the simple measurement of brown adipose tissue function in humans. Students will learn the basic methodology of a human association study, including DNA extraction from human specimens, small-scale genotyping methods for single nucleotide polymorphisms (Taq-Man real-time PCR, for instance), genotype-phenotype statistical analyses, and measurements of cold-adaptive thermogenesis using a thermal camera. If time permits, students may be able to learn evolutionary genetic studies using genome-wide SNP genotype data. Additionally, students will join the journal club co-hosted with Prof. Shoji Kawamura, Laboratory of Evolutionary Anthropology, GSFS.

Division of Biosciences

Department of Computational Biology and Medical Sciences

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Frith Laboratory	Prof. FRITH Martin	Our ultimate aim is to decipher the functional and historical information in genome sequences. We do this using probability models (such as hidden Markov models) and computational methods (such as enhanced suffix arrays and dynamic programming). A major approach is to compare and align related sequences to each other, to see how they have evolved. One recent focus is characterization of genome rearrangements in evolution and disease. Another long-term interest is promoter sequences and DNA motifs that regulate gene expression. Further interests are everything “weird”: malaria genomes (80% A+T), frameshifts, unexplained evolutionary conservation, trans-splicing, etc.	Genome; evolution; orthology; probability-based	Students are encouraged to pursue their own ideas on analyzing genetic sequences. There are broadly two types of project: biological investigation, and method development. Examples of biological investigation: survey the evolution of gene structure by gain or loss of splice sites, frameshifting, gene fusion or fission, etc; compare the evolution of mitochondrial versus plastid genomes; compare genome evolution to major body-form evolution (e.g. snakes, whales). Examples of method development: make a sensitive probabilistic model for finding distantly-related DNA sequences; devise a beautiful way to visualize complex sequence rearrangements; develop a way to extract specific rearrangement events from pair-wise alignments of long sequences (e.g. long DNA reads or whole genomes).

Division of Environmental Studies

Department of Ocean Technology, Policy and Environment

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Ocean Industrial Science and Technology Lab (Wada Lab)	Assoc. Prof. WADA Ryota	"System Innovation and Social Implementation for Ocean Development" Commercialization, together with further technology development, is inevitable to secure sustainable ocean development with scale. Our lab aims to accelerate innovation by managing the complexity of ocean development systems under socio-technical uncertainty through systems approach. One key strategy is systems innovation by integrating cutting-edge technologies from different fields and applying them to ocean development. We focus on the fusion of ocean engineering, our core competence, and new technologies, such as data science and sensing systems, for its sound application in the harsh ocean environment. Specific research topics are Offshore CCS with CO2 shipping, ultra-deepwater drilling, bayesian grey-box modeling, offshore system design, offshore logistics design, dynamics of subsea line structures, subsea engineering, and metocean research. *CCS: CO2 Capture and Storage	Offshore development; CCUS (Carbon dioxide Capture & Storage); Co-creation; Stakeholder engagement	We run projects related to social implementation of ocean development, especially new technologies such as Methane hydrates, CCS, offshore wind and Northern Sea Route utilization. Our key strategy is to engage various stakeholders in the process of concept exploration by workshops utilizing interactive concept evaluation models. An ideal activity will be upgrading the model based on your topic of interest (with literature survey) and interacting with stakeholders to see how the topic is received by them.
Applied Physical Oceanography Laboratory	Prof. WASEDA Takuji	The following research activities are on-going: i) waves in the ice-covered sea; ii) Stereo- and radar-imaging of ocean waves and ice. In the first project, we will conduct experiments in a small wave-ice tank. In the second project, a field observation is conducted using stereo photogrammetry and radar imaging from a ship to reconstruct surface wave and ice geometry and distribution. The activities in our group encompasses theoretical, observational and numerical studies of ocean waves, currents and wind to understand the basic physics. And eventually, the knowledge will be applied to support ocean developments such as the Northern Sea Route, safe navigation and operation at sea, and marine renewable energy.	Ocean waves, sea ice, marine wind, marine renewable energy, stereo photogrammetry, radar	The student will engage him/herself in a self-motivated research project that includes but is not restricted to the research topics listed above. The research may involve analyses of observation data and model outputs. Those motivated can challenge in programming the numerical model and analysis program as well. The research will be guided by postdoctoral researchers, graduate students, Lecturer Kodaira and Prof. Waseda. Regular meetings will be held in English. The past UTSIP students undertook the following research topics: developing phase resolved nonlinear wave model based on High-Order Spectral Method; diagnosis of East China Sea density structure; Synthetic Aperture Radar image analysis for ocean waves; validation of model wave power considering the performance of Wave Energy Converter; optimization of sail assisted ship navigation; freak wave occurrence near Japan; wind and waves in the north Atlantic. The student with prior programming knowledge with Matlab, Python, C, Fortran 90, GrADS, etc. may have an advantage undertaking the project, but, the senior students will guide those who do not have any experience. The research topics can be determined upon discussion with Prof. Waseda prior to the visit to Japan via e-mail exchange. We are happy to host those who are interested not only in research but also in learning about Japanese culture.

Division of Environmental Studies

Department of Environment Systems

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Energy and Environment Laboratory	Lecturer AICHI Masaatsu	Current approaches to energy supply and consumption face problems such as climate changes and dwindling resources. The development of key technologies for saving energy, switching to renewable energy resources, and appropriate waste disposal is required. Our goal is to perform research that will contribute to the development of these technologies, especially by taking advantage of the characteristics of subsurface formations. For example, we study ways of developing a sustainable energy system, especially through hydrogeological and thermo-poro-mechanical modeling of geothermal heat pumps, geothermal power plants, and the geological sequestration of carbon dioxide. On the other hand, we also start to study how to adapt to global warming. Combining mitigation and adaptation is an attractive choice but it is not simple because one countermeasure possibly causes another environmental effect. For example, though the groundwater becomes a more important water resource under changing climate, the overexploitation of groundwater possibly causes another environmental problem such as land subsidence, sea water intrusion in coastal areas, and so on. We try to predict and prepare for this kind of domino-like propagation to other environmental problems in advance.	Groundwater resource; land subsidence; numerical modeling; uncertainty analysis	Land subsidence simulation with unertainty analysis Land subsidence caused by groundwater abstraction has been one of the severe environmental problems. By strictly regulating the groundwater abstraction, the land subsidence in several cities in Japan stopped today. On the other hand, groundwater becomes a more important water resource under changing climate. In addition, groundwater is considered to be an important water resource after an earthquake or flood disaster. Furthermore, the high groundwater pressure is harmful for the subsurface infrastructures. Then, the possibility to restart groundwater abstraction is becoming a matter of debate. However, it is essential to avoid the restart of land subsidence problems. Theoretically, it can be achieved by controlling the groundwater level such that the effective stress does not exceed the preconsolidation stress of subsurface formations. However, it is very difficult to find practically because of the heterogeneity in subsurface formations and the complex history of hydraulic head change in the clayey layer. The model usually contains large uncertainty. In this program, we try to numerically simulate the evolution of the preconsolidation stress under the historical groundwater abstraction and find a critical groundwater level in the future groundwater usage with uncertainty analysis.
Akizuki Laboratory	Lecturer AKIZUKI Makoto	"Supercritical fluid" refers to a fluid in which the material's critical points of temperature and pressure are being exceeded. Dramatic physical changes are possible depending on the operating conditions of the material. In particular, the ionic content and dielectric constant of supercritical water changes extensively based on temperature and/or pressure. As a result of this, it becomes possible to select a reaction based on one's objective: from an ionic atmosphere suitable for acid/base reactions, to one implementing the dissolving of organics, which is equivalent to a non-polar solvent. Taking advantage of these properties, it is expected that this new, inexpensive, environmentally-friendly reaction medium will replace conventional organic solvents. Our laboratory has many research goals, covering a broad range of topics: Degradation of harmful waste products using the oxidation reaction in supercritical water, organic synthesis using solid catalysts, and synthesis of inorganic materials such as nanoparticles. In regards to all of these fields, by designing, analyzing, and controlling reactions based on a study of chemical reaction rate and reaction engineering, we are advancing extensive research, from fundamental research related to the chemical reaction of supercritical fluids, to the cultivation of new engineering application technologies.	Supercritical Water; Reaction Engineering; Organic Synthesis; Tunable Solvent; Catalysis	Supercritical water is a promising reaction medium for organic reactions because its solvent properties can be varied with the temperature and the pressure, and these properties affect reaction kinetics and mechanisms. The aim of this study is to propose a methodology which enables to control the reaction rate and the selectivity of organic synthesis reactions only with the change of temperature and pressure of supercritical water.

Oshima Laboratory	Prof. OSHIMA Yoshito	In university experimental research, carrying out research safely without losing research creativity and activities is a difficult proposition because research promotion and its risks are inextricably linked. When considering the safety of an academic laboratory, it is important to view the laboratory as a system that consists of human behavior, the transportation of things, and the condition of the experimental research field, and to analyze the system by acquiring data through scientific methods from actual experimental research sites. Examples of data include flow line of an experimenter's movement, tracking the usage of chemical reagent bottles, and distribution of chemicals induced by indoor airflow. Collected data are then integrated and analyzed by a deep learning method to investigate the system configuration of laboratory, which enables us to objectively and quantitatively understand the conditions of experimental research sites and the characteristics of experimental research. "Laboratology" is a new concept area that is being proposed for future research. Laboratory safety must be discussed more scientifically and quantitatively, and this concept will undoubtedly contribute to comprehending characteristics of the research activity more precisely and help facilitate discussion on risk assessment of laboratory experiments.	Laboratory safety; Visualization; airflow analysis; PIV; CFD	In university chemical laboratories, many different types of chemicals are used for various purposes. Laboratories are workplaces in which complex airflows are formed because many experimenters work simultaneously and arbitrarily and the laboratory layout also frequently varies according to one's experimental purposes and plans. Such complex airflows can inadvertently cause experimenters to become exposed to chemicals in laboratories. To prevent experimenters from being exposed to hazardous chemicals, the dynamics of the airflow in the laboratory need to be precisely analyzed. In this program, you will conduct airflow analyses in university laboratory by Particle Image Velocimetry (PIV) analysis and Computational Fluid Dynamics (CFD) simulation. PIV is an optical method of flow visualization used to obtain the velocity of fluids. The fluid is seeded with tracer particles which are assumed to faithfully follow the flow dynamics. CFD is a system that uses numerical analysis to analyze and work out complications concerning fluid flow with the aid of computer-based simulation. Using these techniques, you will investigate the air environment in laboratory in view of outlet/inlet ventilation layout and experimenter movement. You will also clarify the impact on airflow by laboratory layout and walking experimenters by using a scale model, PIV, and CFD.
Geosphere Environment Systems Laboratory	Prof. TOKUNAGA Tomochika	Underground geosphere environment has been extensively used to support highly developed human society; e.g., extraction of energy resources and groundwater, waste disposal, construction of tunnels and underground spaces. Because of these activities, environmental problems which affect the sustainability of our society have emerged. The target of our laboratory is to understand and predict the change of geosphere environment caused by human activities, and to develop necessary engineering measures to attain sustainable use of geosphere environment. Current research topics include, studying and evaluating geosphere environmental changes caused by energy resources development and proposing necessary technological measures for sustainable resources development, securing stable and safe freshwater resources and development of efficient management schemes, and modeling long-term fluid flow and material transport processes through geosphere and its application to waste disposal and energy resources exploration.	Groundwater; coastal zone; seawater intrusion; modeling; field survey	Fresh groundwater in shallow unconfined aquifers is an important water resource for many coastal zones worldwide which, however, is threatened by seawater intrusion. The occurrence of seawater intrusion is controlled by both anthropogenic activities and natural factors. Anthropogenic activities such as land reclamation, abstraction of freshwater and other natural resources, construction of structures such as riverbanks and ditches, and alternation of land surface conditions, could disturb freshwater-seawater interactions from the natural conditions. To what extent seawater intrusion occurs is also dependent on natural factors such as aquifer properties, tidal river dynamics, and meteorological conditions. In this study, computer-based techniques such as numerical modeling combined with field-based geophysical exploration techniques such as 1D and 2D resistivity surveys will be applied to understand seawater intrusion situations both from conceptual cases and realistic sites. Students will learn fundamental knowledge of coastal hydrological processes and gain the ability to analyze environmental issues through hands-on practice of using advanced modeling tools as well as participating field investigation. Also, students will have chances to get involved in other research activities in this laboratory, such as GIS-based mapping, water sampling, and water quality analysis.

Division of Environmental Studies

Department of Human and Engineered Environmental Studies

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Simulation of Complex Systems Laboratory	Prof. CHEN Yu	In our lab, fields of research range from social-economic, complex fluid, to biological systems. There are three research directions: (1) Multi-agent cooperative evolutionary games for modeling and simulations of financial markets; (2) Discrete kinetic models for the simulation of complex fluids; (3) Cellular automata and heterogeneous stochastic agent models for the simulation of aging and cancers.	Complex Systems, Agent-based modeling, Financial Markets, Soft-condensed Matters, Cancer	In the program, a small project will be assigned to the visiting student, basically relating to model construction and computer simulations. The specific complex system for study depends on student's interest. It could be a financial market, a solution including colloid, or a growing tumorous tissue. Apart from the research activity, visits of related labs in other university, and/or scenic sites surrounding Tokyo, etc. are also being scheduled.

Division of Environmental Studies

Department of Socio-Cultural Environmental Studies

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Jun SASAKI (Estuarine & Coastal Environment) Laboratory	Prof. SASAKI Jun	We focus on estuarine and coastal environmental studies in the field of civil, coastal, and hydro-environmental engineering: (1) numerical modeling and application of physical and biogeochemical processes in urban bays and mangrove, (2) environmental restoration in urban bays; (3) mitigation of and adaptation to climate change, including blue carbon; (4) Coastal disaster mitigation; (5) sustainability of community and livelihood in coastal areas in developing countries. Tokyo Bay, at short distance from our campus, is one of our main study fields. The bay has suffered from decline in fishery and water quality, including hypoxia and anoxia, for long time. We have been considering strategies for environmental restoration, rehabilitation and mitigation in the bay supported by scientific evidence. Disaster mitigation against storm surges and tsunamis is also our research targets, including development and application of prediction systems for coastal hazards using open source numerical models. Studies on coastal zone management for sustainability in developing countries, especially in mangrove coastal areas influenced by climate change and associated sea level rise, are also our main focus.	Coastal engineering; numerical simulation; water quality and ecosystems; blue carbon; storm surges	Students will firstly learn physical and biogeochemical processes in estuarine and coastal waters, which may include some of coastal circulation, water quality and ecosystems, and sedimentary processes. Secondly students will choose one of the related problems and learn its mechanism by applying a numerical model. Students will also learn skills in pre-processing and post-processing for numerical computation using Python tools and/or Matlab. Students may select one of the open source models coded in Fortran, including FVCOM (unstructured-grid Finite Volume Community Ocean Model), ROMS (Regional Ocean Modeling System), and TEEM (Tokyo Bay Estuarine Ecosystem Model deeloped in the lab). Students will plot results, interpret them, and present their works and outcomes at the lab's progress report seminar. Students interested in estuarine and coastal engineering as well as numerical computation are welcome. Students are expected to have basic IT skills such as programming in Python and Linux.

Division of Environmental Studies

Department of International Studies

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
Honda Laboratory	Prof. HONDA Riki	Our society is exposed to various types of risks including natural disasters. Preparation for such risks is essential, but no countermeasure can provide perfect protection against severe disasters. In the presence of various threats such as climate change, huge earthquakes and tsunamis, society needs to be endowed with capability of adaptation and resilience. In our group, mechanism of collective behavior observed in the society coping with the situation with severe uncertainty is discussed from the viewpoints of social networks, game theory, adaptive systems theory, etc. Innovative mathematical approach for uncertainty management, such as financial problems is also in our scope. Development and management of infrastructure systems, advanced design methods, asset management and international technology transfer are also of our interest.	Infrastructure, natural disaster, community resilience	Statistical Analysis of Community Behavior: It is essential for disaster management, to be accepted by concerned people with affirmative attitude. In order to discuss how such attitude is developed and what kind of factors affect, various cases are discussed from various viewpoints. The mission of the intern will be analysis and numerical simulation of statistical analysis over the collected survey data.

Division of Environmental Studies

Graduate Program in Sustainability Science – Global Leadership Initiative

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
No laboratories in Program A				