UTSIP Kashiwa 2022

Program B

Host Laboratory List

Division of Transdisciplinary Sciences

1. Advanced Energy (AdvEng)

Division of Biosciences

2. Integrated Biosciences (IB)

Division of Environmental Studies

3. Ocean Technology, Policy, and Environment (OTPE)
4. Environment Systems (EnvSys)
5. Human and Engineered Environmental Studies (HEES)
6. Graduate Program in Sustainability Science - Global Leadership Initiative (GPSS)

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 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 Plant Functional Analyses	Assoc. Prof. OHTANI Misato	Plants develop and grow in ways that are completely different to us animals. They are born without deciding the number of organs they will make during their lives, and they develop and grow to suit the environment where they take root. In addition, they continue living by regenerating lost organs through their advanced organ regeneration abilities, while some of their cells choose death for the benefit of other cells. Our aim is to obtain molecular information on how plants sense and react to environmental conditions, and how control flexibly cell proliferation and differentiation, for an active control of their life system. For this purpose, we focus on “dynamics of RNA metabolism” and “dynamics of cell wall polymer”, which are key regulatory elements of gene expression and cell function in plants. Furthermore, we aim to develop new technologies that can contribute to a sustainable society, by maximizing plant functions and/or creating new functions by artificial modification of these molecular factors.	plant cells dofferentiation, xylem vessel cells, secondary cell wall, transcriptional activity	Xylem vessels are one of essential tissues of vascular plants for their survival. Moreover, the accumulated secondary cell walls in xylem cells are considered to be a promising renewable bioresource, as “woody biomass”. Our goal is to understand the mechanism of xylem vessel cell differentiation in order to improve the utilization of woody biomass, for the construction of a sustainable society. Student will participate the project “elucidation of molecular mechanisms of xylem vessel cell differentiation”, to learn molecular biological techniques using our original induction system VND7-VP16-GR for xylem vessel cell differentiation, as shown below. 1. Sowing and growing plants by aseptic manipulation 2. Induction of xylem vessel cell differentiation 3. Microscopic observation of plant cells 3. Examination of transcriptional activity by transient expression system
Molecular Recognition Laboratory	Prof. NAGATA Shinji	My research interest is to investigate the interaction between matabolisms and behavior observed in insects. We are particularly interested in feeding behavioral strategies such as carnivorous, herbivorous, and omnivorous characteristics. To explore the mechanisms of host preference and feeding motivation observed in insects, we focus on the endocrine control in the nervous system and metabolic mechanisms. In the lights of biology, biochemistry, molecular biology, and chemical biology, we run our projects to address the insect's innate behavioral motivation.	Insect; Behavior; RNA interference; metabolism; GC-MS; cricket	【Experimental projects】Using crickets Gryllus bimaculatus (the two-spotted cricket), program students will experience the functional assay of feeding behavior. Program students will also experience transcriptional knockdown techniques of RNA interference targetting several genes, which are related to endocrine factors, metabolilc enzymes and signaling molecules, for example. Finally, program students must evaluate if those target molecules can influence innate feeding behavior and/or metabolisms in crickets. 【Experience during UTSIP activity】RT-PCR, quantitative RT-PCR, GC-MS, MALDI-TOF MS, and general techniques of molecular biology and chemical biology, and behavioral analyses using crickets.

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
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.

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

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
Onuki Laboratory	Assoc. Prof. ONUKI Motoharu	Our laboratory belongs to an interdepartmental master/Ph.D. program on sustainability science: “GPSS-GLI”. Students select their own research topic related with sustainability by themselves and conduct research by interacting many faculties and students with different academic background in our group. Currently, we are conducting following research: “disaster recovery and resilience”, “environmental pollution and risk”, “sustainability education evaluation”, “negotiation and consensus building for sustainability”, “sustainability of civil infrastructure under shrinking society”, “Smart City Projects in Kashiwanoha”, etc.	Sustainability; sustainability education; Sustainability science; SDGs	UTSIP students can participate in “sustainability education evaluation” project. The University of Tokyo is now coordinating research and education activities under a concept of Sustainable Development Goals (SDGs). In addition to participating core educational activities of GPSS-GLI including “GPSS-GLI seminars” and some of the core courses, they are expected to conduct interview surveys of GPSS-GLI faculties and students on their research topics and linkage between their topics and SDGs. By using several methods including network analysis, transdisciplinarity of GPSS-GLI will be assessed in the project. Further comparative study between GPSS-GLI and other sustainability programs in the world could be possible. In addition to the above-mentioned topic, other topic is possible based on the applicant’s interest.