UCEAP 2024 Summer Lab Research in Science - Hosting Laboratories

UCEAP nominees must read the descriptions and requirements for each lab closely before submitting their documents to the School of Science, UTokyo, for the final selection process.

Department	Hosting Faculty Member(Title)	Research Topic & Research Description Special Academic Conditions Required for Research
Mathematics	Yasuyuki KAWAHIGASHI (Professor)	Operator Algebras. This is a kind of infinite dimensional linear algebra related to quantum mechanics. **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Basic linear algebra **2）Required study field(s)** Mathematics **3）Academic background or research project experience to be considered at selection** Some knowledge on quantum physics would be better. **4）Selection and evaluation criteria, if any** None
Information Science	Takeo IGARASHI (Professor)	User Interface and Interactive Computer Graphics **1) Prerequisite knowledge and/or specific skill(s) and its proficiency** basic computer science. Programming skill. Interest in graphics and interaction **2) Required study field(s)** computer science **3) Academic background or research project experience to be considered at selection** research or development experience is appreciated **4) Selection and evaluation criteria, if any** research plan or proposal (explanation of what kind of project you want to wok on).
Physics	Yasushi OKADA (Professor)	Development of Advanced Optical Microscopy Techniques and their Application in Cell Biology Research Our laboratory specializes in developing cutting-edge optical microscopy technologies, like super-resolution microscopy, and their applications in molecular cell biology. Interns will gain hands-on experience in technical development, delving into microscope optics, probes, or image processing, or directly in cellular biology research, such as live-cell imaging and single-molecule measurements in living cells or in vitro. **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Basic knowledge of microscope optics and/or cell biology **2）Required study field(s)** Biophysics, cell biology or basic optics **3）Academic background or research project experience to be considered at selection** Animal cell culture, microscopy, live cell imaging, image processing, machine learning, molecular cloning **4）Selection and evaluation criteria, if any** Candidates will be evaluated based on their level of enthusiasm, specificity of interests, and how well their aspirations align with the direction and objectives of our laboratory.

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Physics	Kazumasa TAKEUCHI (Associate Professor)	Experimental statistical physics using soft and living matter. Our primary interests include (1) topological defects in liquid crystal and bacterial populations, (2) control of bacteria through orientation pattern, (3) data-driven search for hydrodynamic equations for bacterial collective motion, (4) anything else that internship students are interested to try and is doable in our experimental facility. See also research page on our website: https://lab.kaztake.org/research.html **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Basic knowledge of physics and interests in one (or more) of the following: statistical physics, non-equilibrium phenomena, active matter, soft matter, biophysics, dynamical systems **2）Required study field(s)** none **3）Academic background or research project experience to be considered at selection** It is helpful to have basic knowledge of statistical mechanics and fluid mechanics as well as experience of image analysis, but those are not mandatory. **4）Selection and evaluation criteria, if any** Enthusiasm and proactivity are appreciated.
Physics	Takuro IDEGUCHI (Associate Professor)	Ultrafast spectroscopy, bioimaging, laser physics. We are developing new spectroscopy and microscopy techniques based on modern optical technology. We also use machine learning methods for analyzing measured data. The developed systems are to be used in the fields of biology, medicine, chemistry and physics. **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Basic knowledge of optics **2）Required study field(s)** Physics, Chemistry, Electrical engineering or information science **3）Academic background or research project experience to be considered at selection** None **4）Selection and evaluation criteria, if any** None
Physics	Yasuhiro NAKAJIMA (Associate Professor)	Our group is conducting experimental studies of particle and astroparticle physics with neutrinos. Possible research topics for students include, but are not limited to; developing a new kind of neutrino detector, testing a new method to search for neutrinoless double-beta decay, and simulation of a large water Cherenkov detector for improved neutrino detection. **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Basic knowledge of physics. **2）Required study field(s)** Physics **3）Academic background or research project experience to be considered at selection** Preferrable to have experiences on computer programming and physics lab **4）Selection and evaluation criteria, if any** Interests in experimental particle physics and/or particle astrophysics.

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Earth & Planetary Science	Kanako SEKI (Professor)	Study of acceleration mechanisms of relativistic electrons in the radiation belt based on analysis of the plasma observation data by satellite **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Certification of the English ability and basic computer (programming/visualization) skills to conduct research of the required study field. **2）Required study field(s)** Space physics, plasma physics, geophysics, or physics **3）Academic background or research project experience to be considered at selection** At least one recommendation letter from a researcher(s) with eminent research background **4）Selection and evaluation criteria, if any** None
Earth & Planetary Science	Masataka KINOSHITA (Professor)	In the last decade or two we have obtained a series of deep-sea drilling and monitoring, seafloor observation, and seismic exploration datasets. We put focuses on integration of these data toward the assessment of physiucal properties, both along and above the seismogenic fault zone of the subducting plate boundary of Nankai Trough or other subduction zones. During this program, I introduce the data and methods, some of which you can use to speculate your own model if you want. *Overpressure estimation from Vp anomaly in seismic profiles (e.g. Matlab) *Borehole pressure data time-series analysis *Stress orientation from borehole breakouts *Slip tendency from geometry of faults *Thermal response of fault zone **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Certification of the English ability to communicate on Earth science and that of a good deal of experience in marine geology and geophysics **2）Required study field(s)** Basic physics, plate tectronics, geophysics (basic level) **3）Academic background or research project experience to be considered at selection** Basic skill on mathematics (differential equation). Better to have experience on computer programming (including macro scripting, etc.). **4）Selection and evaluation criteria, if any**
Earth & Planetary Science	Yosuke AOKI (Associate Professor)	Modeling earthquake and volcano deformation using space geodetic data Earthquake and volcanic activity involves faulting or migration of volcanic fluids below Earth's surface, and they can be detected as the deformation of the Earth's surface. This internship investigates the distribution of slip distribution due to an earthquake or images migration of magmatic fluids associated with volacnic activity. Choice of earthquake or volcano topic is up to the trainee. **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Some experience of scientific computing with Linux or Macintosh system is required. **2）Required study field(s)** Basic physics and mathematics. Some knowledge about Geology is a plus but not required. **3）Academic background or research project experience to be considered at selection** Geophysics, Geology, Mathematics, Physics, or related field **4）Selection and evaluation criteria, if any** Passion and enthusiasm for Earth Science

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Earth & Planetary Science	Shingo WATADA (Associate professor)	Application of a wave interferometry technique to seismic waves and tsunamis. A student will learn the novel data processing method which retrieves virtrual seismc waves and tsunamis from continuous ground motion and ocean bottom pressure records. These virtual waves will be compared with numerical simulations. **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Basic knowledge of computer programming (C, C++, or Python). **2）Required study field(s)** Basic (1st and 2nd year) physics and mathematics **3）Academic background or research project experience to be considered at selection** Background in earth science (geophysics, geology) is preferred but not required **4）Selection and evaluation criteria, if any** Priority will be given to junior class students who are interested in future graduate study in seismology and related subjects at the University of Tokyo.
Chemistry	Keisuke GODA (Professor)	At Goda Lab, our primary mission is to develop "serendipity-enabling technologies" that align with Louis Pasteur's famous quote, "Chance (serendipity) favors the prepared mind." Our focus is on developing innovative tools for molecular imaging and spectroscopy by integrating photonics, nanotechnology, microfluidics, and data science. By utilizing these tools, we aim to discover unknown phenomena, elucidate mechanisms, and explore new applications in science, industry, and medicine. We employ theoretical, experimental, and computational techniques to tackle critical problems. Additionally, we are committed to cultivating the next generation of global leaders who will shape the world in the 21st century. We foster an international and interdisciplinary research environment that values flat human relationships, and we actively seek out talented individuals from any university or company, regardless of their field of study. **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** 1. Applicants must possess foundational knowledge in molecular imaging, spectroscopy, photonics, nanotechnology, microfluidics, and/or data science, as our lab extensively works on integrating these domains to develop innovative tools. 2. Demonstrated skills in theoretical, experimental, and computational techniques are highly beneficial. 3. Ability to work in an international and interdisciplinary research environment with a cooperative mindset is crucial. 4. Applicants should be ready to engage actively in discovering unknown phenomena, elucidating mechanisms, and exploring new applications in science, industry, and medicine. **2）Required study field(s)** 1. We encourage applications from candidates majoring in fields related to, but not limited to, physics, chemistry, biology, data science, materials science, electrical engineering, mechanical engineering, chemical engineering, bioengineering, or a closely related field. 2. Given the interdisciplinary nature of our work, individuals from various scientific and engineering disciplines who possess a strong interest and background in the areas we focus on are welcome to apply. **3）Academic background or research project experience to be considered at selection** 1. Applicants should have a strong academic record with coursework or research experience that aligns with the areas of molecular imaging, spectroscopy, photonics, nanotechnology, microfluidics, and data science. 2. Experience in working on projects or research that involves theoretical, experimental, and computational techniques to solve critical problems is highly desirable. **4） Selection and evaluation criteria, if any** 1. Academic Excellence: Strong GPA and coursework in relevant fields. 2. Research Experience: Prior involvement in projects or research in areas like molecular imaging, spectroscopy, photonics, nanotechnology, microfluidics, and data science. 3. Technical Skills: Proficiency in theoretical, experimental, and computational techniques related to our lab’s focus. 4. Interpersonal Skills: Ability to thrive in an international, interdisciplinary research environment with strong communication and collaboration skills. 5. Alignment with Lab’s Mission: Demonstrated interest and commitment to developing technologies that enable discovery and exploration in science, industry, and medicine. 6. Leadership Potential: Evidence of potential to become a future global leader in academia, industry, or entrepreneurship.

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Chemistry	Shu KOBAYASHI (Professor)	Organic synthesis based on new design of useful catalysts. The research focuses on synthesis and application of newly designed catalysts to efficient and useful synthetic organic reactions. **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Knowledge of organic chemistry and basic experimental technique of synthetic organic chemistry **2）Required study field(s)** Organic chemistry, analytical chemistry **3）Academic background or research project experience to be considered at selection** It is better for the student to have a basic knowledge of organic chemistry. **4）Selection and evaluation criteria, if any**
Chemistry	Taro HITOSUGI (Professor)	Studies on inorganic and organic solid materials. We are interested in both synthesis and functions. **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Basic understanding of physics and/or chemistry is required. **2）Required study field(s)** One of the following fields: physics, chemistry, computer science, mechanical engineering, electrical engineering, chemical engineering, mathematical science etc. **3）Academic background or research project experience to be considered at selection** Basic understanding of physics and/or chemistry is required. **4）Selection and evaluation criteria, if any** None
Chemistry	Robert E. CAMPBELL (Professor)	Protein engineering and chemical biology for the development of fluorescent biosensors of neural activity and metabolism **1）Prerequisite knowledge and/or specific skill(s) and its proficiency** Applicants should have some familiarity with introductory organic chemistry, protein biochemistry, spectroscopy, and molecular biology. **2）Required study field(s)** Protein engineering and chemical biology. **3）Academic background or research project experience to be considered at selection** Some previous experience in a chemistry or biochemistry laboratory would be ideal, but it is not essential. **4）Selection and evaluation criteria, if any** We are committed to fostering a diverse, inclusive, and equitable laboratory environment.