UTRIP 2027 Host Laboratory Information

Department	Name and Title of Hosting Faculty Member	Laboratory Website	Research Topic & Research Description
Physics	Naoki YOSHIDA (Professor)	https://www-utap.phys.s.u-tokyo.ac.jp/naoki.yoshida/	We work together on machine learning applications in astrophysics and cosmology. Students are expected to perform numerical simulations of structure formation of the universe and then to use the data for training of generative AI models. The trained AI model can be used for statistical analysis of data from wide-field cosmology surveys and/or will be used to generate mock observational catalogues for future space/ground-based missions.
			Special Academic Conditions Required for Research
			1) Prerequisite knowledge and/or specific skills, and required level of proficiency Basic physics and math (algebra and calculus) for astrophysics research. Knowledge on Astronomy 101 is not required, but having astronomy/astrophysics background will help initially to work on the project smoothly. Very basic knowledge and skill in statistical analysis.
			2) Required major field(s) of study Physics
			3) Academic background or research project experience to be considered during selection Basic programming using python.
			4) Selection and evaluation criteria (if any) Previous acadmic record in physics and math. Preferably some experience in short research.
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Physics	Yasushi OKADA (Professor)	https://www.okada-lab.phys.s.u-tokyo.ac.jp/en/	**Development of Advanced Optical Microscopy and Fluorescent Probes for Biological Research** Our laboratory develops advanced optical microscopy techniques, including super-resolution microscopy, and fluorescent probes to investigate biological processes at multiple scales, from individual protein molecules to cells and whole organisms. Interns will gain hands-on experience through a project in optical system development, fluorescent probe development, image processing, biophysics, or cell biology. Projects may involve live-cell imaging or single-molecule measurements in living cells or in vitro. The project will be tailored to each intern's interests, background, and skills.
			Special Academic Conditions Required for Research
			1) Prerequisite knowledge and/or specific skills, and required level of proficiency Basic knowledge of microscope optics and/or cell biology
			2) Required major field(s) of study Physics, biophysics, biology, biochemistry, chemistry, engineering, computer science, or related
			3) Academic background or research project experience to be considered during 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.

Department	Name and Title of Hosting Faculty Member	Laboratory Website	Research Topic & Research Description
Physics	Synge TODO (Professor)	https://exa.phys.s.u-tokyo.ac.jp/en	Computational Approaches to Quantum Many-Body Physics and Quantum Computing Our group develops and applies computational methods to understand the phases, phase transitions, and dynamics of quantum many-body systems. Our main approaches include Monte Carlo sampling, tensor network representations for efficient information compression, and statistical machine learning. We also investigate quantum algorithms and quantum machine learning, with an emphasis on their connections to many-body physics. During UTRIP, the student will undertake a focused numerical project on one of these topics. Possible projects include studying phase transitions using Monte Carlo or tensor network methods, simulating quantum circuits and benchmarking quantum algorithms with tensor networks, or exploring machine learning methods for quantum many-body problems. The student will implement or adapt simulation codes, analyze numerical results, and interpret the underlying physics. The specific topic and scope will be tailored to the student's background and interests.
			Special Academic Conditions Required for Research
			1) Prerequisite knowledge and/or specific skills, and required level of proficiency Applicants should have a basic understanding of statistical physics and quantum mechanics, and basic programming skills in at least one of Python, C++, or Rust. They should be able to write and run simple programs for numerical calculations and data analysis.
			2) Required major field(s) of study Physics, with an interest in statistical physics, quantum information, or computational physics.
			3) Academic background or research project experience to be considered during selection No prior research experience is required. Experience with numerical simulations or programming projects in physics will be considered an advantage.
			4) Selection and evaluation criteria (if any) Selection will be based on the applicant's understanding of basic physics, programming skills, motivation, and fit with the proposed research topics. Applicants should describe relevant coursework, programming experience, and research interests in their personal statement.
Department	**Name and Title of Hosting Faculty Member**	**Laboratory Website**	**Research Topic & Research Description**
Physics	Haozhao LIANG (Associate Professor)	https://tnp.phys.s.u-tokyo.ac.jp/en/index.html	Quantum many-body theories for properties of atomic nuclei. The research focuses on applying and developing quantum many-body theories to investigate the novel properties of stable and unstable nuclei and the impacts on astrophysical nucleosynthesis.
			Special Academic Conditions Required for Research
			1) Prerequisite knowledge and/or specific skills, and required level of proficiency Knowledge on quantum mechanics
			2) Required major field(s) of study Theoretical physics or Computational physics
			3) Academic background or research project experience to be considered during selection It would be better to have some basic knowledge of nuclear physics or atomic physics
			4) Selection and evaluation criteria (if any) None
Department	**Name and Title of Hosting Faculty Member**	**Laboratory Website**	**Research Topic & Research Description**
Physics	Kuniaki KONISHI (Associate Professor)	https://www.kkns.ipst.s.u-tokyo.ac.jp/en/home	We are investigating new physical phenomena caused by the interaction of light with nano- and micro-scale ultra-fine artificial structures fabricated by state-of-the-art microfabrication techniques, and their application to optical control (Metasurface and Meta-optics). Furthermore, based on condensed matter physics, we are exploring the scientific principles of laser processing to understand why light can break things, and are developing new methods for fabricating micro three-dimensional structures using state-of-the-art ultrashort pulsed lasers. This UTRIP progrum provides an opportunity to experience the fundamentals of metamaterials or laser processing research.
			Special Academic Conditions Required for Research
			1) Prerequisite knowledge and/or specific skills, and required level of proficiency Basic knowledge of optics, lasers, and solid state physics. English language skills for communicating.
			2) Required major field(s) of study Optics, Solid State Physics
			3) Academic background or research project experience to be considered during selection It is better for the student to have previous experience of conducting optical experiments and working with lasers.
			4) Selection and evaluation criteria (if any) Priority will be given to junior class students who are interested in future graduate study in Japan