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. Yasushi ONO Assist.Prof. Hiroshi TANABE	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 economic ultra-high-b confinement uaing economic high-power heating, where the beta is the plasma thermal pressure P confined by the unit magnetic field: b=P/(B2/2μ0). We have developed a number of new ideas for (1) high-b confinements: Spherical Tokamak (ST) and Field-Reversed Configuration (FRC) and (2) high-power heating: merging/ reconnection heating, using the TS-3, TS-4, UTST and MAST devices (based on UK-Japan collaboration). Since the magnetic field-line reconnections converts magnetic energy into plasma kinetic/ thermal energy, our TS-3 and MAST experiments documented significant ion heating over 0.25keV and 1keV, respectively. We found the new scaling law of reconnection heating energy proportional to Brec2, indicating that the high-B rec ST merging will heat ions to the burning plasma regime without using any additional heating facility. This fact leads us to new high-magnetic field ST merging/ reconnection experiments TS-U with Brec > 0.3-0.5T for ion heating >1keV. We are now organizing the international world-wide	1) Plasma experiment 2) Fusion energy 3) Spherical Tokamak (ST) 4) Field-Reverse Configuration (FRC) 5) Magnetic Self-Organization	We, international plasma research groups propose annual interdisciplinary schools and workshops of plasma astrophysics based on 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, complexity, space-astrophysical science, physics and electrical engineering. We believe that our annual school and workshop will provide new opportunities of international and interdisciplinary lectures,

		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.) and MAST (Culham lab.) etc. Web：http://tanuki.t.u-tokyo.ac.jp/		discussions and experiments to all plasma-course students.
Yoshida/Nishiura Laboratory	Assoc. Prof. Masaki NISHIURA	Our group has a new concept fusion plasma machine (RT-1, ring trap 1) to study plasma physics and to understand their behaviors for thermonuclear fusion and interstellar plasmas. The RT-1 is a unique fusion plasma device to produce the dipole magnetic field for plasma confinement by a levitation of a superconducting coil. Plasma physics is one of good research subjects to study the nonlinear science and collective phenomena. In our laboratory you experience recent plasma experiments and developments of advanced diagnostic system.	1) Plasma physics 2) Magnetosphere plasma 3) Plasma diagnostics 4) Nuclear fusion	Participants can take the opportunity to choose mainly experimental subjects at RT-1 and partly include theoretical subjects. At RT-1 plasma experiments, you can participate in plasma production by electromagnetic wave (electron cyclotron heating and ion cyclotron heating) and basic plasma experiments. You will use some of plasma diagnostic devices; Langmuir probe and reflectometer to measure electron density. These principles are learnt, and you will compare with plasma parameters each other. For more understanding plasma behaviors you can combine other diagnostics. We also have an opportunity for you to request something.