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
Takase-Ejiri Laboratory	Prof. Yuichi TAKASE	Our group is performing experimental research on high-temperature plasmas with the aim of realizing fusion energy. Plasmas are collections of charged particles which exhibit collective behavior under the influence of electromagnetic fields. The greatest challenge of fusion research is to confine a plasma with sufficiently high density and temperature for long enough time. In our laboratory, research is performed using the TST-2 spherical tokamak. Research topics include: development of a new method to form and maintain the plasma, development of heating and current drive techniques using radiofrequency (RF) waves, studies of plasma instabilities and energy transport processes, and development of methods to control them. Using a new confinement concept, the spherical tokamak is capable of producing high-performance plasmas in a compact device, and may provide a way to realize an economically competitive fusion reactor. Research at our laboratory focuses primarily on plasma heating and current drive by RF waves, plasma performance improvement, and development of plasma start-up scenarios without the use of the central solenoid, which is indispensable for realizing a fusion reactor based on the ST concept. In addition, various plasma diagnostics based on a variety of physical processes are being developed.	1) Plasma 2) Fusion 3) Tokamak	Students can participate in experimental or computational research in any of the research topics described above, under the guidance of our research staff. Examples in experimental research include plasma start-up experiments using RF waves, and measurement and characterization of plasma turbulence. These will involve data acquisition using existing diagnostics and analysis of the acquired data. Diagnostic development using various techniques, including low frequency electromagnetics, RF waves, microwaves, light (infrared, visible, ultraviolet), X-rays, or particles (electrons or ions) are also possible. Examples in computational research include modelling of RF wave excitation, propagation and absorption, and subsequent development of the particle velocity distribution function, leading to heating and current drive. Another possibility is to work on time-dependent plasma modelling in order to realize the achievement of highly autonomous advanced tokamak plasma with high confinement, high stability, and high fraction of self-driven plasma current, which is the leading candidate for realizing the fusion reactor.

Nose-Kohsaka Laboratory	Prof. Akinao NOSE Lecturer Hiroshi KOHSAKA	We use the fruit fly, Drosophila, as a model to try to understand the operational principle of neural circuits, based on the realistic neuronal connectivity and activity pattern. We use optogenetics, calcium imaging and electrophysiology to record and manipulate neural activity and connectome analyses to dissect neural wiring. By systematically using these techniques, we try to elucidate the functional connectivity among component neurons and information processing of the neural circuits.	1) Neural circuits 2) Calcium Imaging 3) Connectomics 4) Fruitfly 5) Animal behavior	・ Imaging neural activity and connectivity ・ Simulation of neural circuit function ・ Statistical analyses of neuronal dynamics and behaviors.