

Nuclear Theory Group
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Call for Master's and Doctoral Course Students in Nuclear Theory Group at Tokyo Institute of Technology

Description

A brand-new Nuclear Theory Group (since April 2021), Tokyo Tech (PI: Dr. Kazuyuki Sekizawa), is seeking for students who wish to join our group, to pursue a Master's- or Doctoral-course program, and to explore the wonder of fantastic quantum-mechanical world with us!

Tokyo Tech offers the *International Graduate Program (IGP)* and two courses 'A' and 'C' are relevant here. Hereafter we will refer to them as IGP(A) and IGP(C), respectively. IGP(A) is a 5-year, PhD program for foreign students that combines Master's and Doctoral courses, starting in September. Because it covers a whole PhD experience, we have higher expectation for applicants, that is, we will assess if he or she has enough ability and enthusiasm to complete the PhD study. IGP(C) consists of a 2-year Master's course and a 3-year Doctoral one for foreign students, where for both cases the starting month can be chosen to be either April or September. While, for the Master's course the selection may be to some extent less demanding as compared to IGP(A), for the Doctoral course we set a similar screening process to assess applicants' ability.

A brief summary of the graduate programs is given in Table 1. Applicants will be subjected to a written exam and an interview. Note that there is no Japanese language requirement for IGP(A) and IGP(C) as all lectures are held in English. Students are eligible to attend Japanese language classes on a regular basis in order to better adapt to daily life in Japan.

Table 1: A summary of relevant graduate programs at Tokyo Tech.

Program	Application period	Starting month	Remarks
IGP(A)	Sept.–Dec.	Sept.	A <i>combined</i> program of Master's and Doctoral courses (5 years)
IGP(C)	Aug.–Oct. (in the previous year) Jan.–Apr. (in the same year)	Apr. Sept.	Master's (2 years) and Doctoral (3 years) courses, <i>separated</i> programs

Projects examples

We are studying quantum many-body problems in Fermionic systems, which are broadly defined, ranging from atomic nuclei, neutron stars, superfluid phenomena, to unitary Fermi gas. Possible projects can be related to, e.g.:

- **Structure and reactions of atomic nuclei:** fusion below and above the Coulomb barrier, deep-inelastic, (multi)nucleon transfer and quasifission processes, fission dynamics, superheavy element synthesis, etc.
- **Superfluid dynamics in neutron stars:** vortex pinning and dynamics in the neutron-star crust, pulsar glitch, effects of band structure and entrainment, superconducting flux tubes in the neutron-star core, etc.
- **Superfluid dynamics in the unitary Fermi gas:** Josephson effects, solitonic excitations, vortex crossing and reconnection, quantum turbulence, etc.

Of course, one's research theme can be outside the scope of the list; e.g., condensed matter physics, (nuclear)astrophysics, hadron physics, can be involved. Also, our study takes great advantage of High-Performance Computing (HPC) utilizing both CPUs and GPUs. Quantum computing and machine learning are also of great interest. We can discuss and newly develop research subjects, along with the applicant's interest.

Additional information

Tokyo Tech offers an own "*Tsubame Scholarship*" for doctoral students that compensates substantial portion of the tuition fees. A limited number of students with outstanding academic records can apply for a scholarship from Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) with a formal recommendation from Tokyo Tech. There are also Research Fellowships for Young Scientists provided by, e.g., Japan Society for the Promotion of Science (JSPS) (for PhD students, category is: DC1 or DC2, see <https://www.jspcs.go.jp/english/e-pd/>). You can check *Information for International Students* (<https://www.titech.ac.jp/english/prospective-students>) provided by Tokyo Tech, and follow various links therein, for further detailed information.