Department of Physics, Tokyo Institute of Technology

HIDEKAZU TANAKA
DEPARTMENT OF PHYSICS, SCHOOL OF SCIENCE, TOKYO INSTITUTE OF TECHNOLOGY

Fig. 1: Main building of Ookayama Campus where the Department of Physics is located.

TOKYO INSTITUTE OF TECHNOLOGY

Tokyo Institute of Technology (Tokyo Tech) was founded in 1881 as Tokyo Vocational School to train vocational school teachers and senior engineers needed for the modernization of Japanese industry. The first campus was built at Kuramae, Tokyo near the Sumida River. The School was renamed Tokyo Technical School in 1890 and Tokyo Higher Technical School in 1901. Albert Einstein visited the School in 1922 (see Fig. 2). The School was severely damaged by the Great Kanto Earthquake in 1923 and moved to Ookayama in 1924. The school became a degree-conferring university called Tokyo University of Engineering in 1929. Around 1946, it was renamed Tokyo Institute of Technology. At present, Tokyo Tech has three campuses in the Tokyo and Yokohama areas.

DEPARTMENT OF PHYSICS

The Department of Physics was established in 1929. The Department aims to contribute to the development of science and technology through deep exploration of natural laws and phenomena. At present, approximately 200 students are enrolled in the undergraduate course and 180 students in the graduate course. In the latter, approximately 130 and 50 students are in Master and Doctor courses, respectively. Approximately 70 faculty members are working in the Department.

The Department provides a variety of subjects for undergraduate course students covering the fundamentals of physics (mechanics, electromagnetics, quantum mechanics, thermodynamics, statistical mechanics, etc.), many of which are combined with exercises, and experiments. A systematic curriculum is provided for graduate course students covering general knowledge of physics and research in specialized fields through seminars and experiments under the instruction of supervisors. An opportunity for research and education in partnership with other universities and research institutes is also provided.

The Department of Physics also provides basic science and technology courses (Fundamentals of mechanics and electromagnetism, Exercises in Physics, Physics Experiment) for all first-year students at Tokyo Tech.

RESEARCH AREAS

Department of Physics consists of more than 30 laboratories and conducts state-of-the-art research in a wide range of fields such as particle and nuclear physics, condensed matter physics, and cosmology and astrophysics, which cover almost all the research fields in physics. The research areas are shown below.

Particle and nuclear physics Theory
- Toward the unified theory of elementary particles.
- Unraveling mysteries of quantum chromodynamics.

Experiment
- Exploring neutrino oscillations.
- Search for the new particles at LHC/ATLAS.
- From neutron-rich exotic nuclei to neutron stars.
- Exploring strange nuclei with impurities embedded.

Cosmology and astrophysics Theory
- Challenging important problems in cosmology.
- Unraveling the mysteries of cosmology, particle physics and gravitation.

Experiment
- Deciphering the biggest explosions in the distant universe.
- Observing space-time ripples from a distant universe.

Condensed matter physics, statistical physics Theory
- Condensed matter physics from Quantum mechanics.
- Clarifying the nature and principles of non-equilibrium many-body systems.
- Computation in quantum statistical mechanics.
- Insights into hot dense plasma including atomic processes.
- Exploring quantum phenomena in many-body systems.
- Universality hidden within diversity.
- Topological phases and spintronics.

Experiment
- Spintronics and applied novel materials.
- Elucidating novel physical properties in surfaces and nanomaterials.

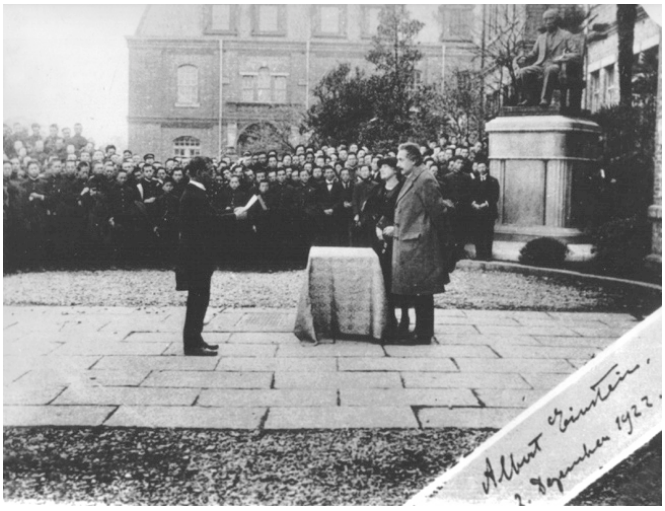

Fig. 2: A photo of the visit by Albert Einstein to Tokyo Higher Technical School on 22 December 1922. Photo courtesy of Tokyo Tech Museum and Archives.

- Exploring quantum phenomena in magnetic systems.
- Quantum transport in low-dimensional structures.
- Single-protein detection at cryogenic temperatures.
- Probe microscopy of nanodevices and biointerfaces.
- Coherent interaction with light and molecules.
- Quantum simulation with ultra-cold neutral atoms in an optical trap.
- Spin-photonics — Spin and photon —.
- Studying the local state of materials using muons.
- From superconductors to nonequilibrium phenomena.
- Quantum phenomena at surfaces, interfaces and ultrathin films.
- Investigating properties of laser-trapped nanograins.
- Exploring novel optical physics using nano-scale artificial structures.
- Investigating exotic quantum states of electrons.

Hidekazu Tanaka After receiving a Dr. Sci. from the Tokyo Institute of Technology (Tokyo Tech) in 1986, he worked at Tokyo Tech as a research associate, and at Nagoya University and Sophia University as an associate professor. In 1996 he returned to Tokyo Tech as an associate professor. He now is a professor in the Department of Physics, Tokyo Tech. His research field is experimental magnetism focusing on quantum many-body effects.