



“The Electron-Ion Collider: A New Era in Particle and Nuclear Physics – The Dawn of Femtotechnology”

by Satoshi Yano (Hiroshima University)

Time and Date: 15:00-17:00, July 23, 2025

Place: Room 745, Science Complex B (H-03) (hybrid)

Registration: "https://us02web.zoom.us/meeting/register/9e9mhpejSbOJFrm0WW4_cw"

Abstract:

The Electron-Ion Collider (EIC), a next-generation particle accelerator to be constructed at Brookhaven National Laboratory in the United States, is scheduled to begin operations in the late 2030s. This accelerator will enable high-energy collisions between electrons and protons or nuclei, aiming to investigate the emergent properties of matter—such as mass and spin, through the dynamics of its most fundamental constituents: quarks and gluons. Most of the mass of ordinary matter does not originate from the intrinsic masses of quarks, but rather from the energy associated with the strong interactions mediated by gluons. Unraveling such nontrivial phenomena governed by Quantum Chromodynamics (QCD) is one of the central challenges in contemporary physics. EIC is expected to serve as a “femtometer-scale microscope,” capable of directly imaging the internal structure of protons and nuclei by using electron beams, thus providing unprecedented insight into the fundamental dynamics of quarks and gluons. Moreover, a detailed understanding of femtoscale structure may lay the foundation for the emerging field of femtotechnology, envisioned as the next frontier beyond nanotechnology. By exploring and potentially manipulating sub-nanometer structures—such as quarks and gluons themselves—this field holds the potential to revolutionize our capacity to control matter at the most fundamental level, opening new horizons in both science and engineering. In this seminar, I will introduce the scientific goals of the EIC in an accessible manner and explain how we are striving to address fundamental questions such as the origin of mass and the spin structure of matter. I will also present the ePIC experiment, the primary detector project at EIC, and discuss how Japanese universities and research institutions are contributing to this international collaboration. Finally, I will touch on future opportunities for involvement in this groundbreaking research. Participation is warmly welcomed from those interested in exploring the femtoscale and advancing the technologies of the next generation.

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