Contribution ID: **125** Type: **invited presentation**

Study of Neutron Optics and Physics in Japan

Thursday 11 September 2025 09:00 (30 minutes)

Neutrons exhibit significant quantum mechanical wave properties in the low-energy region. This optical characteristic not only makes neutron beam transport practical but also allows for precision measurements. One well-known example in fundamental physics is neutron confinement using the total reflection phenomenon of neutrons at a material surface, resulting in a well-known experiment measuring the neutron electric dipole moment. To pioneer neutron physics using neutron optics, the NOP beamline (Neutron Optics and Physics) has been installed at the BL-05 beam port of the MLF (Material and Life-science Facility) of J-PARC (Japan Proton Accelerator Research Complex). Using beam branching based on neutron reflection optics, neutron lifetime measurements using electromagnetic beam steering, pulsed ultracold neutron generation using a neutron reflector with an extremely large critical angle, and the development of a neutron interferometer using a set of multilayers compatible with pulsed neutron sources are currently in operation. Among these, neutron interferometers have dramatically improved the capability to measure neutron scattering length and are introducing possibilities of searches for new interactions. Furthermore, research is expanding into the optical properties of epithermal neutrons, and a new-physics search experiment (J-PARC E99 NOPTREX: Neutron Optical Parity and Time-Reversal EXperiment) is in preparation applying the amplification effect of space-time symmetry breaking based on detailed studies of the reaction mechanism of compound nuclear states. This new physics search opens up a different parameter space to conventional electric dipole moment searches, and is enabled by short-pulse neutron sources such as J-PARC.
In this presentation, I will explain the background and current status of the above, and discuss future prospects, including the possibility of using a steady-state neutron source brought about by a new research reactor, the construction of which is currently being planned.

Author: SHIMIZU, Hirohiko (Nagoya University)

Presenter: SHIMIZU, Hirohiko (Nagoya University)

Session Classification: Session