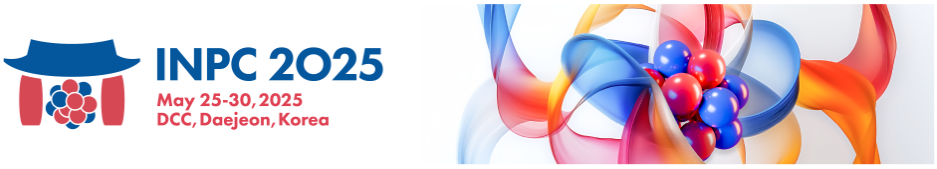

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Microscopic Investigation of Proton Fluxtubes and Neutron Quantum Vortices in the Neutron Star Core and its Implication to the Pulsar Glitch Phenomenon

Friday, 30 May 2025 11:45 (15 minutes)

Neutron stars are high-density steller objects composed mainly of neutrons and are one of the most important research targets in nuclear physics. Neutron stars are known to exhibit sudden changes of its rotational velocity, known as “pulsar glitches”. It has been believed that glitches are mainly caused by dynamic rearrangemenmt of superfluid neutron vortices in the inner crust of neutron stars. However, importance of contributions of the outer core has been recently discussed, and further microscopic investigations of quantum vortices and flux-tubes in the outer core of neutron stars are highly desired.

In this study, we investigate the interaction between quantum vortices of $^3P_2$ superfluid neutrons and flux-tubes of $^1S_0$ superconducting protons in the outer core of neutron stars, based on a successful bosonic theory of superfluid, the Gross-Pitaevskii equation (GPE). In this talk, we will discuss the effects of the interaction between the superfluid quantum vortices and the superconducting magnetic flux-tubes on the $^3P_2$ superfluid quantum vortices and its implication to the mechanism of the pulsar glitch phenomenon.

Primary author: HATTORI, Tatsuhiro (Institute of Science Tokyo)

Co-author: SEKIZAWA, Kazuyuki (Institute of Science Tokyo)

Presenter: HATTORI, Tatsuhiro (Institute of Science Tokyo)

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