

Experimental studies of gravity with slow neutrons

Masaaki Kitaguchi
KMI, Nagoya University

Neutron is a chargeless massive particle with the lifetime in the macroscopic range, which is suitable for precision measurement of the small influence of new physics. We are studying the gravity experimentally with slow neutrons.

Neutron scattering experiments with noble gas were performed at pulsed neutron beamline BL05 NOP in J-PARC in order to search non-Newtonian effect at the short range. New limit for Yukawa-type force was placed at the interaction range of the order of 1 nm [1]. The measurements are continuing to improve the sensitivity.

Combination of the well-controlled neutrons and the advanced optical devices enables us to perform new types of precision measurements for gravity studies. Ultra-high resolution detector was developed to observe the spatial distribution of neutron's quantum-mechanical states induced by gravity [2]. We are also developing a large-scale neutron interferometer to measure the gravitational potential including dark energy precisely.

[1] C. C. Haddock, et al., Phys. Rev. D97, 062002 (2018).

[2] N. Naganawa et. al., Eur. Phys. J. C 78:959 (2018).