

GRANIT spectrometer

The existence of quantum states of matter in the gravitational field has been demonstrated recently by a series of experiments ¹⁻³ with ultracold neutrons (UCN). The GRANIT ⁴ is a follow-up project based on a second-generation UCN gravitational spectrometer with ultra-high energy resolution. It will provide more accurate studies of/with the quantum states as well as measurements of the resonant transitions between them ⁵. It will benefit from a dedicated ⁴He UCN source ⁶ delivering UCN to the spectrometer with no significant dilution of the phase-space density ⁷⁻⁸.

The key property of GRANIT is UCN storage in a selected gravitationally bound state for extended period of time using a closed specular trap ⁹. According to the uncertainty principle, longer observation time corresponds to better defined energy of a state thus higher measurement precision. External perturbations, such as vibrations or magnetic fields, have to be minimized. As the fraction of gravitationally bound neutrons is extremely small, we develop neutron detectors with extremely low backgrounds, UCN sources with maximum neutron phase-space density, and neutron transport systems with minimal losses.

The GRANIT spectrometer will be a unique tool for carrying out a wide range of investigations in particle fundamental physics, foundations of quantum mechanics, in surface physics, as well as for development of experimental techniques and their applications. The physical program to be carried out using the GRANIT spectrometer involves a number of scientific institutions from all over the world; also we are open for new ideas and collaborations.

The GRANIT project is being constructed in the framework of ANR (Agence Nationale de la Recherche, France) grant received in 2005-2009 by a joint collaboration ILL-LPSC-LMA. Permanent installation of GRANIT at the ILL high-flux reactor is financed by the ILL and IN2P3 institutes. We hope to start physical measurements at the end of 2009. Thus, some actual parameters of the spectrometer could become known just before the GRANIT-2010 Workshop.

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