Preliminary Conceptual Design of the High-Intensity Ultracold Neutrons Source at the WWR-K Reactor

S. Sakhiyev[1], V. Nesvizhevsky[2], E. Korobkina[3], E. Lychagin[4], A. Muzychka[4], A. Nezvanov[4], A. Strelkov[4], A. Frank[4], D. Sairanbayev[1], A. Shaimerdenov[1], K. Turlybekuly[1,4], B. Muhametuly[1,4]

[1] *Institute of Nuclear Physics, Almaty, Kazakhstan*
[2]*Institute Laue-Langevin, Grenoble, France*
[3]*North Carolina State University, Raleigh, USA*
[4]*Joint Institute for Nuclear Research, IIO, Dubna*

Because of their unique feature, ultracold neutrons (UCN) are used as a sensitive instrument in fundamental physics experiments where high-precision measurements are required. Various UCN measurements are especially aimed at solving unanswered questions in fundamental physics, astrophysics and cosmology. These include the verification of fundamental theories, such as the search for the electric dipole moment of the neutron, the measurement of the neutron lifetime and the search for new types of interactions at short distances, the search for neutron-antineutron oscillations, etc.

However, the solution of these problems is limited by the intensity of the UCN source, so the development and construction of a high-intensity UCN source is extremely important, which will make measurements more comprehensive and minimize statistical errors. In this regard, it is proposed to develop high-intensity UCN source in the thermal column of the WWR-K research reactor.

The thermal column of the 6 MW WWR-K reactor is available for construction of the UCN source with record UCN density for fundamental studies. The large diameter (1 meter) of the thermal column makes it possible to place a lead shield 10 cm thick to reduce the heat load; room temperature graphite will moderate neutrons to thermal energy range; 19 K low-temperature converter will produce cold neutrons, and superfluid helium at a temperature of 0.8–1.25 K will convert cold neutrons into ultracold neutrons. The estimated volume density of UCN in the source chamber of 35 *l* is about $1.6 \cdot 10^5$ n/cm^3 at a helium temperature of 0.8 K, which is more than 1000 times higher than the maximum achievable UCN density at the ILL source.