A Tool for Production of Ultra Cold Neutrons in Superfluid He-II

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Recently we have elaborated two ideas based on the use of impurity-helium nanocluster condensates (quantum gels) in He-II as a tool for production of ultra cold neutrons (UCN) at high densities. The first idea consists in the equilibrium cooling of very cold neutrons down to the He-II bath temperature, cooled preliminary to a few mK, owing to their many *quasielastic collisions with nanoparticles* made of low-absorbing materials (D_2, D_2O, O_2, etc.) during diffusion motion of neutrons through a macroscopically large ensemble of nanoparticles. The second idea consists in modernization of the existing now source of UCN on superfluid He-II: diffusive propagation of cold neutrons through the gel sample placed inside container with liquid He-II at high gel densities should lead to a strong increase of effective time of the neutron propagation through the container, resulting in sharp increase of the probability of transformation of very cold neutrons to UCN owing to their *inelastic interaction with liquid He-II* permeating the pores between clusters even at the bath temperature $T \geq 0.5\,\mathrm{K}$. Of a strong interest is a question on spectrum of excitations of He-II in this pores.
The report will include results of our experimental study of the thermal neutron interaction with D_2 and D_2O samples made at the bath temperature $T \geq 1.6\,\mathrm{K}$.