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Preparation of facilities for fundamental research with ultracold neutrons at PNPI

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The WWR-M reactor of PNPI offers a unique opportunity to prepare a source for ultracold neutrons (UCN) in an environment of high neutron flux (about 3×10^{12} n/cm²/s) but still acceptable radiation heat release (about 4×10^{-3} W/g). It can be realized within the thermal column situated close to the reactor core. With its large diameter of 1 m, this channel allows to install a 15-cm-thick bismuth shielding, a graphite moderator at room temperature, liquid deuterium premoderator and a superfluid helium converter (35 dm³). At a temperature of 1.2 K it is possible to remove the heat release power of about 20 W. Using 4π flux of cold neutrons within the reactor column can bring more than a factor 100 of cold neutron flux incident on the superfluid helium with respect to the present cold neutron beam conditions at the ILL reactor. The storage lifetime for UCN in superfluid He at 1.2 K is about 30 s, which is sufficient when feeding experiments requiring a similar filling time. The calculated density of UCN with energy between 50 and 230 neV in an experimental volume of 40 l is about 10^4 n/cm³. Technical solutions for realization of the project are discussed.

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