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Ultracold neutrons at the Institut Laue Langevin in Grenoble, France

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Due to their outstanding property to be storable and hence observable for long periods of time (several hundreds of seconds) in suitable material or magnetic traps, ultra-cold neutrons (UCN) with energies around 100 neV are a unique tool to study fundamental properties of the free neutron.

The ultracold neutron (UCN) and very cold neutron (VCN) facility PF2 (Physique Fondamentale 2) is one of two public installations at the Institut Laue Langevin (ILL) where fundamental properties of the free neutron can be studied. It came into operation in 1985 (TU Munich in collaboration with the ILL) and is ILL's only user instrument located on level D of the reactor building. Its close distance to the reactor core necessitates important safety measures, especially after the Fukushima event. After 30 years of successful and reliable operation, PF2 is still amongst the strongest UCN user source in the world, providing densities of up to 30 UCNs per cm³ with speeds less than 8 ms⁻¹ at the different experimental positions. It also provides a unique beam of VCNs peaking around 10 nm. PF2 is a "high current DC source" with a constant flux and able to fill any experimental volume without load on the source. It offers four UCN beam positions, three in time sharing mode, and one VCN beam position to the users. While the user groups bring their dedicated equipment to the corresponding beam positions, the PF2 crew adapts it to the beam position, also ensuring smooth operation of the groups operating experiments in parallel at the various beam ports of PF2.

Since some years ILL is developing a next generation UCN source based on the production of UCNs in superfluid helium at an external beam of cold neutrons. Prototype sources showed very encouraging results so that within ILL's modernization programme a new facility "SuperSUN" will be built in the near future.

The latest achievements on the way to this new user facility will be presented.

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