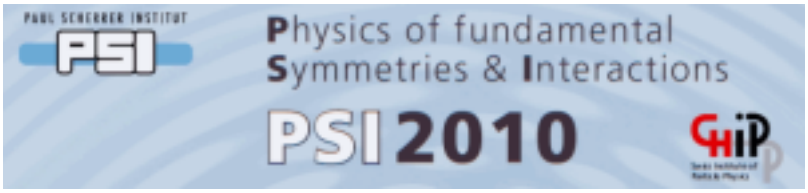

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A search for nEDM and new constraints on short-range ”pseudo-magnetic” interaction of neutron with matter using new effects in neutron optics of noncentrosymmetric crystals

Thursday, 14 October 2010 09:40 (20 minutes)

Here we will discuss new effects resulting from the recently predicted and discovered strong electric fields (up to 10ˆ9 V/cm), which affect the neutrons moving in noncentrosymmetric crystals. Such fields depend on the value and direction of the neutron momentum and result in some new polarization phenomena observable in neutron diffraction and optics.
That opens, for example, a new way for searching the electric dipole moment of a neutron (nEDM) with the sensitivity comparable or exceeding that for the most sensitive now magnetic resonance method using ultra cold neutrons (the current best limit of Dn 3 10ˆ{-26}e cm (at 90% C.L.) obtained at the ILL reactor at Grenoble resulted the long-term efforts of PNPI and ILL groups). The new limits on the EDM value would be of great importance for understanding the nature of the CP violation as well as of the Universe baryon asymmetry.
A series of experiments on neutron diffraction and optics was carried out in Gatchina at the PNPI reactor WWR-M to study the polarization phenomena in the noncentrosymmetric quartz crystals. Observed effects give a real prospects for a search for neutron electric dipole moment using the crystal diffraction technique with the comparable or better sensitivity as the UCN method. Recent test crystal-diffraction experiment on a search for neutron EDM carried out at ILL reactor has confirmed this conclusion.
Also the direct constraint on the parameters of short range pseudomagnetic interaction of free neutron with matter is obtained from that test experiment. It is shown that this constraint on a product of scalar to pseudo-scalar coupling constants g_s g_p is better than that of any other method for the range < 10ˆ{-5}cm.

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