Feasibility study of neutron wavelength compressor for EDM measurement

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The permanent electric dipole moment of neutrons (EDM) signals the violation of time-reversal invariance. Recent experiment was performed by using stored ultra-cold neutrons (UCNs) in the electric field. In order to improve the sensitivity, the density of UCNs are quite important. Superthermal method by using superfluid He-II can convert from cold neutrons to UCNs directly. This requires the neutron with the wavelength of 0.89 nm to interact with the resonant phonon. When neutrons with the certain wavelength are injected, the UCNs are provided more efficiently.

Neutrons can be accelerate and/or decelerate by using spin flip in the gradient magnetic field. Controlling the resonance condition for the spin flip enables us to change the energy of the acceleration/deceleration. In the case of pulsed neutrons, the arrival time to the flip position depends on the kinetic energy of the neutrons. The wavelengths of these neutrons can be compressed by accelerating properly in the middle of the transport. We have already demonstrated the proper acceleration of neutrons with this technique, although the change of energy was 200 neV. We will discuss the feasibility of the ‘wavelength compressor’.