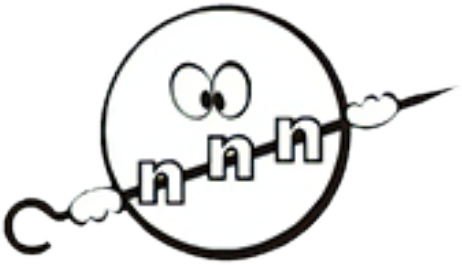

Contribution ID: **52** Type: **not specified**

Two-Wave Acceleration Effect and Ultra-Sensitive UCN Spectrometry

Monday, 26 May 2025 14:30 (30 minutes)

The Acceleration Effect (AE), the existence of which was recently predicted in [1], is a generalization of the previously discovered of optical Accelerating Matter Effect (AME) [2]. It consists in the fact that the result of the interaction of a wave with an accelerating object is a change in its frequency. The effect is proportional to the acceleration of the object and the time delay caused by this interaction. The existence of AE in macrophysics, for example, when transmitting a signal to an accelerating transceiver, is beyond doubt, since in this case it can be interpreted simply as a differential Doppler effect. The same interpretation is valid in the case of AME, when a wave passes through an accelerating layer of matter, experiencing Doppler frequency shifts of various magnitudes on the input and output surfaces of the sample. Verification of the validity of the AE concept in the quantum sector [3], when its relationship with the Doppler effect is not obvious, is still awaiting its experimental confirmation.

A special case of AE, which occurs when a wave passes through an accelerating sample of a birefringent substance, was considered in [4]. In neutron optics, the phenomenon of birefringence is usually associated with the different spin states of the two waves. The difference in the refractive index for these two waves leads to a difference in their propagation times in the sample and, as a result, to a difference in the magnitude of the frequency shift of these two waves passing through the accelerating sample. The interference of these two waves, which have changed frequencies by a different amount due to the AE, leads to periodic oscillations of the polarization of the resulting state, which can easily be transformed into oscillations of the counting rate. Thus, it is possible to register a very small difference in the energies of two spin states, and the sensitivity of the measurement increases with decreasing neutron energy. In the case of UCN, it is possible, in principle, to register the energy difference of two waves on the order of 10ˆ(-15)eV.

The project of the UCN source currently under discussion at JINR makes it necessary to consider the two-wave Acceleration Effect as one of the important fields of research with this source. The report is devoted to discussing this possibility. The aim of future work will be to demonstrate the validity of EC in neutron scattering on quantum objects with a characteristic interaction time of the order of 10ˆ(-7)s, as well as measurements of the spin-dependent neutron-nuclei scattering amplitudes. The high sensitivity of the method makes it possible to carry out such measurements with samples characterized by very low, up to 10-7, polarization of nuclei, because of which there is no need for a complex and expensive technique for preparing a polarized nuclear target.

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Session Classification: Plenary Session

Track Classification: Plenary session