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Acceleration Effect in Quantum Mechanics and Neutron Optics

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ACCELERATION EFFECT IN QUANTUM MECHANICS AND NEUTRON OPTICS

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The report is devoted to the problem of interaction of neutrons with accelerating objects. As was recently shown [1], the previously known Accelerating Matter Effect (AME) [2], is only a special case of a more general effect, consisting in the fact that the result of the interaction of a wave with any object moving with acceleration is a change in its frequency. With some reservations, this Acceleration Effect (AE) can be interpreted as a differential Doppler effect, in which the absorption and emission of a wave are separated by a time interval during which the velocity of the object changes.

The most important question is whether the AE is valid in quantum mechanics, when the process of interaction of a particle or quanta with an object, although it has a finite duration, cannot be divided into the absorption and emission phases. Substantial arguments in favor of such an assumption were obtained in [3]. Assuming that the AE is valid in quantum mechanics, we must conclude that the conclusion about the change in the frequency and energy of the neutron should also be valid in the case of neutron scattering on an atomic nucleus moving with acceleration. This means that neutron scattering by the nuclei of accelerating matter is inelastic and not isotropic.

Since it is the elasticity and isotropy of scattering that form the basis of the theory of dispersion of neutron waves in matter, it can be expected that at high accelerations of matter, completely new neutron-optical effects can be expected to appear. The report discusses a possible experiment to observe this kind of effect.

References

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