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Interaction of electromagnetic and matter-waves with linear accelerating matter

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It was found theoretically almost 30 years ago that the wave number and frequency change when the wave passes through an accelerating sample of a refractive medium. K. Tanaka [1] was the first to show it for the case of light optics. Later the same result was obtained for neutron waves [2-4]. More generally, a refractive index may be introduced for waves of any nature and the only requirement is the presence of scatterers in the medium. Therefore, particles of any nature should change their energy passing through the bounded volume of accelerating medium [5,6] and one can speak about very general Accelerating Matter Effect (AME). It was found later [6], that AME very closely relates with equivalence principle and can be generated not only by an acceleration of a bounded volume of matter but also by a spatial region characterized by the presence of a force field.

It is worth noting that the Tanaka effect for light is so small that despite the fantastic sensitivity of modern optical methods, it has not been observed yet. However, the neutron-optics experiment of this kind appeared to be feasible and was performed with Ultra Cold Neutrons (UCN) [5.6]. The results of these spectroscopic experiments as well as description of new time of flight experiment will be presented in the report. The maximum value of the energy transform in these experiments was equal to ± (2÷6) ×10-10 eV . Results testify that the effect correspond to theoretical predictions with accuracy better than 10%.

Some future possibilities for the investigation of the AME and its possible manifestation in astrophysical phenomena will be also discussed.

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