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Neutrino propagation in moving and polarized matter

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The rapid development of neutrino astronomy, which is expressed, among other things, in the emergence of new neutrino mega-projects capable of effectively registering astrophysical neutrino fluxes requires a detailed knowledge of a neutrino evolution inside the neutrino sources (type II supernovae, gamma-ray bursts). The evolution can be influenced by many factors each should be accounted for by the relevant theory. In this work, we develop the theory of neutrino propagation in moving and/or polarized matter by introducing for the first time the exact spin integral of motion. This enables us to obtain the neutrino dispersion under these conditions and to discuss the features of the neutrino motion. Our approach opens up the possibility of consistent classification of neutrino states in moving and/or polarized medium and, as a consequence, a systematic description of the related physical phenomena (e.g., neutrino oscillations, neutrino electromagnetic radiation).

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A.Grigoriev, A.Studenikin, A.Ternov, Neutrino spin operator and dispersion in moving matter,
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