Contribution ID: **124** Type: **Poster**

Electromagnetic interactions of neutrinos in processes of low-energy elastic neutrino-electron scattering

In the standard model neutrinos are massless left-handed fermions which very weakly interact with matter via exchange of the W and Z0 bosons. The development of our knowledge about neutrino masses and mixing provides a basis for exploring neutrino properties and interactions beyond the standard model (BSM). In this respect, the study of nonvanishing electromagnetic characteristics of massive neutrinos is of particular interest. It can help not only to shed light on whether neutrinos are Dirac or Majorana particles, but also to constrain the existing BSM theories and/or to hint at new physics.

The possible electromagnetic properties of massive neutrinos include the electric charge (millicharge), the charge radius, the dipole magnetic and electric moments, and the anapole moment. Their effects can be searched in astrophysical environments, where neutrinos propagate in strong magnetic fields and dense matter, and in laboratory measurements of neutrinos from various sources. In the latter case, a very sensitive and widely used method is provided by the direct measurement of low-energy elastic (anti)neutrino-electron scattering in reactor, accelerator, and solar experiments. A general strategy of such experiments consists in determining deviations of the scattering cross section differential with respect to the energy transfer from the value predicted by the standard model of the electroweak interaction.

The experimental bounds for the neutrino millicharges and charge radii discussed in the literature have been obtained under an implicit assumption that neutrinos do not change flavor when scattering on electrons in the detector. However, making this assumption for neutrino-electron scattering due to weak interaction is not necessarily justified in the case of electromagnetic interaction. It means that possible contributions from the neutrino flavor-transition electromagnetic properties should also be taken into account in the data analysis. Therefore, the present contribution aims at filling the lacuna in the basic theoretical apparatus usually employed for interpretation and analysis of the data of experiments searching for electromagnetic interactions of massive neutrinos in the elastic neutrino-electron scattering.

A thorough account of electromagnetic interactions of massive neutrinos in the theoretical formulation of low-energy elastic neutrino-electron scattering is given. The formalism of neutrino charge, magnetic, electric, and anapole form factors defined as matrices in the mass basis is employed under the assumption of three-neutrino mixing. The flavor change of neutrinos traveling from the source to the detector is taken into account and the role of the source-detector distance is inspected. The effects of neutrino flavor-transition millicharges and charge radii in the scattering experiments are pointed out.

Authors: KOUZAKOV, Konstantin (Lomonosov Moscow State University); STUDENIKIN, Alexander

Presenters: KOUZAKOV, Konstantin (Lomonosov Moscow State University); STUDENIKIN, Alexander

Session Classification: Poster Session

Track Classification: Neutrinos