Contribution ID: 407

Type: Oral

Excitation of the Glashow resonance without neutrino beams

Thursday 3 July 2025 15:20 (20 minutes)

The s-channel process $\bar{\nu}_e e^- \to W^-$ (on-shell), usually referred to as the Glashow resonance, is now being searched for at kilometer-scale neutrino ice/water detectors like IceCube, Baikal-GVD or KM3NeT. After over a decade of observations, IceCube has recorded only a few relevant neutrino events such that further exploration yet remains necessary for unambiguous confirmation of the existence of this resonant interaction [1]. Meanwhile, its experimental discovery would provide an additional important test of the Standard Model. In view of this, one might ask: are there reactions with the Glashow resonance that would not necessitate having initial (anti)neutrino beams? We suggest a positive answer to the question - the process could proceed in electron-positron collisions at accelerator energies, occurring, for instanse, as $e^+e^- \to W^-\rho(770)^+$. Although the resonance appears somewhat disguised, the underlying physics is transparent and analogous to the well known radiative return: emission of ρ^+ from the initial state converts the incident e^+ into $\bar{\nu}_e$. Likewise, the CP conjugate channel, $\nu_e e^+ \to W^+$, takes the form $e^+e^- \to W^+\rho(770)^-$. Similar reactions with other mesons and leptons are also possible. Future high-luminosity lepton colliders seem to be promising for excitation of the Glashow resonance in laboratory conditions. More details can be found in [2].

1. M. G. Aartsen et al. [IceCube Collaboration], Nature 591, 220 (2021).

2. I. Alikhanov, arXiv:2504.02820.

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Session Classification: 5. Physics of neutrino and nuclear astrophysics

Track Classification: Section 5. Physics of neutrino and nuclear astrophysics.