Phenomenology 2025 Symposium



Contribution ID: 81

Type: not specified

Neutrino force at all length scales

Tuesday 20 May 2025 16:30 (15 minutes)

The exchange of a pair of neutrinos can mediate a long-range force. This "neutrino force" is a unique quantum force predicted by the Standard Model; it is also sensitive to the nature of the neutrino mass. Yet, this force is too weak to be detected so far. In this talk, I will introduce our recent progress in detecting the neutrino force from two aspects.

(1) At the **microscopic** scale, since the neutrino interaction breaks the parity symmetry, we propose to use the atomic parity violation (APV) to probe the neutrino force. We derive a new formula for the neutrino force that is valid at all distances and apply it to study APV effects in different atomic systems. We find that the neutrino force effect is significant compared with the current sensitivity of APV experiments. It also has an important effect on the atomic measurement of the Weinberg angle. The first part is based on [2410.19059].

(2) At the **macroscopic** scale, the neutrino force can be coherently enhanced by a neutrino background. We calculate the finite-temperature correction to the neutrino force in the background of cosmic neutrinos and solar/reactor neutrino flux. We find the background correction can significantly change the scaling behavior of the neutrino force at long distances, greatly enhancing the chance to detect this force. The second part is based on [2209.07082].

(3) Finally, if I have time, I will briefly discuss the BSM extension, that is, using our strategy to probe the quantum force from other exotic light particles (e.g., axion), which is based on [2504.00104].

Mini Symposia (Invited Talks Only)

Plenary (Invited talks only)

Author: YU, Bingrong (Cornell University)Presenter: YU, Bingrong (Cornell University)Session Classification: Neutrino

Track Classification: Neutrino Physics