



Contribution ID: 202

Type: Poster

The MSW matter potential at the one-loop level in the Standard Model

Monday, 3 July 2023 15:30 (1 hour)

When neutrinos are propagating in ordinary matter, their coherent forward scattering off background particles results in the so-called Mikheyev-Smirnov-Wolfenstein (MSW) matter potential, which plays an important role in neutrino flavor conversions. In this talk, I will show a complete one-loop calculation of the MSW matter potential in the Standard Model (SM). We carry out the one-loop renormalization of the SM in the on-shell scheme. The finite corrections to the scattering amplitudes of neutrinos with the electrons and quarks are calculated, and the one-loop MSW matter potentials are derived. Adopting the latest values of all physical parameters, we find that the relative size of one-loop correction to the charged-current matter potential of electron-type neutrinos or antineutrinos turns out to be 6%, whereas that to the neutral-current matter potential of all-flavor neutrinos or antineutrinos can be as large as 8%. The implications of such corrections for neutrino oscillations are briefly discussed.

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Session Classification: Poster session & Coffee break