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Mikheyev-Smirnov-Wolfenstein Matter Potential at the One-loop Level in the Standard Model

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 present a complete one-loop calculation of the MSW potential in the Standard Model (SM). We carry out the renormalization 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. With 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%.

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