Contribution ID: **25** Type: **Talk**

EFT analysis of New Physics at COHERENT

Wednesday 22 March 2023 12:10 (15 minutes)

Using an effective field theory approach,we study coherent neutrino scattering on nuclei, in the setup pertinent to the COHERENT experiment. We include non-standard effects both in neutrino production and detection, with an arbitrary flavor structure, with all leading Wilson coefficients simultaneously present, and without assuming factorization in flux times cross section. A concise description of the COHERENT event rate is obtained by introducing three generalized weak charges, which can be associated (in a certain sense) to the production and scattering of ν_e, ν_μ and $\bar{\nu}_\mu$ on the nuclear target. Our results are presented in a convenient form that can be trivially applied to specific New Physics scenarios. In particular, we find that existing COHERENT measurements provide percent level constraints on two combinations of Wilson coefficients. These constraints have a visible impact on the global SMEFT fit, even in the constrained flavor-blind setup. The improvement, which affects certain 4-fermion LLQQ operators, is significantly more important in a flavor-general SMEFT. Our work shows that COHERENT data should be included in electroweak precision studies from now on.

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Session Classification: Phenomenology/ Theory