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Nuclear Probes of Physics Beyond the Standard Model

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Low-energy tests of fundamental symmetries are extremely sensitive probes of physics beyond the Standard Model (BSM), reaching scales that are comparable, if not higher, than directly accessible at the energy frontier. The interpretation of low-energy precision experiments and their connection with models of BSM physics relies on controlling the theoretical uncertainties induced by the nonperturbative nature of QCD at low energy and of the nuclear interactions. In this talk I will discuss how Effective Field Theories (EFTs) techniques can lead to a unified description of high- and low-energy probes of new physics, allowing for detailed comparisons between their sensitivities, and to improved predictions for low-energy experiments, with controlled theoretical uncertainties.

I will discuss in details the examples of hadronic and nuclear electric dipole moments (EDMs) and neutrinoless double beta decays. After establishing a model-independent EFT description for these process, I will review progress in the first-principle calculations of the nucleon EDM and of the time-reversal-violating and lepton-number-violating chiral potentials, the key one- and two-nucleon input for few-body calculations. I will then discuss recent few-body results and the phenomenological implications for BSM physics.