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Shedding light on neutrinoless double-beta decay nuclear matrix elements

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The rarest known nuclear process, standard double-beta decay, in which two neutrons in an atomic nucleus turn into protons and two electrons together with two antineutrinos are emitted, has been observed in a dozen nuclei. A neutrinoless mode of the decay, in which only two electrons would be emitted, has been hypothesized but so far not discovered. Observing the neutrinoless mode would however provide unique vistas beyond the standard model of particle physics. It would not only prove that neutrinos are their own antiparticles but also shed light on the unknown absolute mass-scale of them. Nevertheless, observing the decay is extremely difficult, and both planning the experiments and extracting information from the measurements require knowledge on nuclear matrix elements, which are presently not well constrained.

In my talk, I will discuss complementary ways to constrain the nuclear matrix elements by using data on other nuclear observables, especially the standard-model-allowed two-neutrino double-beta decay. I will also discuss the potential of ordinary muon capture to shed light on neutrinoless double-beta decay.

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