Many-body nuclear effects in neutrino-nucleus scattering

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March 14, 2017

Abstract

The past decade has witnessed tremendous progress in the theoretical and computational tools that produce our understanding of nuclei. A number of microscopic calculations of nuclear electroweak structure and reactions have successfully explained the available experimental data, yielding a complex picture of the way nuclei interact with electroweak probes. This achievement is of great interest from the pure nuclear-physics point of view. But it is of much broader interest too, because the level of accuracy and confidence reached by these calculations opens up the concrete possibility of using nuclei to address open questions in other sub-fields of physics, such as, understanding the fundamental properties of neutrinos, or the particle nature of dark matter.

In this talk, I will review recent progress in microscopic calculations of electroweak properties of light nuclei. I will illustrate the key many-body dynamical features required to explain the available experimental data, and present a novel framework to calculate neutrino-nucleus cross sections for $A > 12$ nuclei.