Contribution ID: **87** Type: **Contributed Oral/Poster**

Towards an ab initio description of nuclear radiative captures

Tuesday, 12 July 2016 09:25 (15 minutes)

The recent progresses in the development of ab initio approaches makes possible the description of bound and scattering states for light nuclear systems in a unified framework, based on microscopic Hamiltonians built within chiral effective theory. Among these approaches, the No-Core Shell Model with Continuum (NCSMC) [1,2] has been proved to be particularly successful for studying resonances and elastic scattering for five- and six-nucleon systems [3,4]. The extension of this approach to the description of electromagnetic transitions in nuclear systems will be presented. This provides an interesting tool to probe the quality of the ab initio wave functions and thus of the chiral inter-nucleon interactions. I will present the application of the NCSMC approach to the radiative capture processes, in particular, to the astrophysically important ^{3}He(α,γ)^{7}Be and ^{3}H(α,γ)^{7}Li reactions [5]. Both reactions are essential to calculate the primordial ^{7}Li abundance in the universe. Moreover, the ^{3}He(α,γ)^{7}Be capture is one of the key reactions to understand the solar neutrino flux, along with the ^{7}Be(p,γ)^{8}B reaction. If time allows, the ^{7}Be(p,γ)^{8}B reaction will be also considered.

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Track Classification: Theoretical developments of direct reactions