UNIVERSITY OF NOTRE DAME
DEPARTMENT OF PHYSICS

NUCLEAR SEMINAR

Monday, April 25

Halo effective field theory constrains the solar Beryllium-7 + proton -> Boron-8 + photon rate

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The radiative proton capture reaction, 7Be+p->8B+photon, is a subject of long-standing interest for nuclear astrophysics. It needs to be known at very low energies (e.g. around 20 keV as relevant for our Sun), which unfortunately is too small to be measured directly in lab. Therefore, theoretical studies are needed to extrapolate the measurements available at higher energies down to low energies.

In this talk I will present our studies of this reaction based on the Halo-Effective-Field-Theory (Halo-EFT) framework. The theory provides a systematic expansion for the reaction amplitude in terms of the ratio between the low energy scale and the high energy scale in the reaction. In our leading order (LO) calculation (http://inspirehep.net/record/1278133), the relevant four EFT couplings were fixed against the 8B bound state properties and the proton-7Be s-wave scattering lengths. The LO results are consistent with direct capture data within our theoretical uncertainty. In the next-to-leading order (NLO) calculation (http://inspirehep.net/record/1385067), another five EFT parameters needed to be calibrated. We used Bayesian analysis to infer the parameters from the direct capture data and measured s-wave scattering lengths. As a result, we got a stringent constraint on the zero energy S factor, S(0)=21.3 ± 0.7 (eV b). The error is less than half of the recommended value, S(0)=20.8 ± 1.6 (eV b).

4 pm – 5 pm

Nuclear Science Laboratory

124 Nieuwland Science Hall

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All interested persons are cordially invited to attend

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Refreshments will be served prior to the seminar in room 124