Contribution ID: **9** Type: **not specified**

Cluster Effective Field Theory calculation of electromagnetic breakup reactions with Lorentz Integral Transform method

Wednesday, 11 October 2023 11:00 (20 minutes)

The inverse process of ^{9}Be photo-disintegration, including both sequential and direct reactions combining two α and a neutron into ^{9}Be, is a reaction of astrophysical interest, because it represents an alternative path to the ^{12}C formation in a neutron-rich environment. Here we present the study of the inclusive reaction $\gamma + {}^9\mathrm{Be} \to \alpha + \alpha + n$, in the low-energy regime, where the cross section is calculated using the Lorentz Integral Transform method [1]. Furthermore, we calculate the ^{9}Be three-body binding energy via the Non-Symmetrized Hyperspherical Harmonics (NSHH) method [2].
The shallow binding of ^{9}Be below the $\alpha\alpha n$ three-body threshold and the deep binding of α indicates a clear separation of energy scales, therefore, in the low energy regime, we are allowed to study ^{9}Be as a three-body *clustering* system interacting through *effective* potentials. In the literature one finds calculations where α-α and α-n potentials of phenomenological character have been used; here we present an attempt to use potentials derived from Halo Effective Field Theory (EFT) [3].
In order to quantify the contributions of the one- and *higher*-body nuclear currents to the reaction cross section, we compute the nuclear current matrix element using either the one-body convection current [4] or the dipole operator matrix element. The reason for this twofold calculation is that, at low energy, the latter includes the contributions of the one-body convection current as well as that of *higher*-body currents (Siegert theorem). We will discuss the results focusing on the interplay between these two contributions, driven by the EFT parameters, and in connection with the experimental results.

References

[1] V. D. Efros, *et al.*, J. Phys. G: Nucl. Part. Phys. **34**, R459 (2007).
[2] S. Deflorian, N. Barnea, W. Leidemann, and G. Orlandini, Few-Body Syst. **54**, 1879 (2013).
[3] H. W. Hammer, C. Ji, and D. R. Phillips, J. Phys. G: Nucl. Part. Phys. **44**, 103002 (2017).
[4] E. Filandri, *Doctoral Thesis*, Università di Trento (2022).

Primary authors: CAPITANI, Ylenia (Università di Trento, INFN-TIFPA); FILANDRI, Elena (Università di Pisa, INFN); JI, Chen (Central China Normal University); ORLANDINI, Giuseppina (Università di Trento, INFN-TIFPA); LEIDEMANN, Winfried (Università di Trento, INFN-TIFPA)

Presenter: CAPITANI, Ylenia (Università di Trento, INFN-TIFPA)

Session Classification: Strongly correlated nuclear systems (II)