

# Iniziativa Specifica: NUCSYS

29 Giugno 2021

# Title: The strongly correlated nuclear system: effective interactions, models, reactions, fundamental symmetries and applications

Responsabile Nazionale: Alejandro Kievsky

Unita' e Responsabili Locali:

- Lecce: Luca Girlanda
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Composizione dell'unita' di Pisa:

- Alejandro Kievsky (PR, afferenza al 100)
- Laura E. Marcucci (PO, afferenza al 100)
- Michele Viviani (PR, afferenza al 100)

# Temi di ricerca

The present project intends to describe particular aspects of atomic nuclei which are relevant for the progress in the knowledge of fundamental interactions.

Argomenti seguiti principalmente a Pisa:

- **Ab-initio approaches in few-nucleon systems**

[1] The Hyperspherical Harmonic Method: a tool for testing and improving nuclear interaction models. L. E. Marcucci, J. Dohet-Eraly, L. Girlanda, A. Gnech, A. Kievsky, and M. Viviani, *Front. in Phys.* 8, 69 (2020)

[2] Study on  $n+3H$ ,  $p+3He$ ,  $p+3H$ , and  $n+3He$  scattering with the HH method. M. Viviani, L. Girlanda, A. Kievsky, and L.E. Marcucci, *Phys. Rev. C* 102, 034007 (2020)

[3] Calculation of the  $6Li$  ground state within the hyperspherical harmonic basis. A. Gnech, M. Viviani, and L.E. Marcucci. *Phys. Rev. C* 102, 014001 (2020)

[4] Non-resonant Density os States Enhancement at Low Energis for Three or Four Neutrons. M.D. Higgins, C.H. Greene, A. Kievsky and M. Viviani, *Phys. Rev. Lett.* 125, 052501 (2020)

[5] A comprehensive Study of the three- and four-neutron systems at low energies. M.D. Higgins, C.H. Greene, A. Kievsky and M. Viviani, *Phys. Rev. C* 103, 024004 (2021)

- **The contact three-nucleon interaction**

[1] Unitary ambiguity of NN contact interactions and the 3N force. L. Girlanda, A. Kievsky, M. Viviani and L.E. Marcucci, *Phys. Rev. C* 102, 054003 (2020)

## • The pionless approach and universal properties

- [1] From few to many bosons inside the unitary window: a transition between universal to non-universal behavior. A. Kievsky, A. Polls, B. Julia-Diaz, N.K. Timofeyuk, and M. Gattobigio, Phys. Rev. A 102, 063320 (2020)
- [2] Gaussian characterization of the unitary window for  $N=3$ : bound, scattering and virtual states. A. Deltuva, A. Kievsky, M. Gattobigio, and M. Viviani. Phys. Rev. C 102, 064001 (2020)
- [3] Two- and three-nucleon contact interactions and ground-state energies of light- and medium-mass nuclei. R. Schiavilla, L. Girlanda, A. Gnech, A. Kievsky, A. Lovato, L.E. Marcucci, M. Piarulli, and M. Viviani. Phys. Rev. C (2021)
- [4] Efimov Physics and Connections to Nuclear Physics. A. Kievsky, M. Gattobigio, L. Girlanda, and M. Viviani. Annual Review for Nuclear and Particle Science, in press.

## • Nuclear processes of astrophysical interest

- [1] The baryon density of the Universe from an improved rate of deuterium burning. V. Mossa et al. Nature 587, 210 (2020)

## • Fundamental symmetries and applications

- [1] The X17 boson and the  $3\text{H}(p, e^+ e^-)4\text{He}$  and  $3\text{He}(n, e^+ e^-)4\text{He}$  processes: a theoretical analysis. M. Viviani, E. Filandri, L. Girlanda, C. Gustavino, A. Kievsky, L.E. Marcucci, and R. Schiavilla. Physical Review C, submitted.

Talk by M. Viviani on July 7th and part of a INFN PRIN project

Richieste alla sezione:

- Incontro di NUCSYS a Pisa per ripartire con gli incontri di persona