

# $\eta N$ interactions in the nuclear medium and $\eta$ -nuclear bound states

Thursday, 2 June 2016 15:45 (0:20)

## Collaboration

## Abstract content

Recent calculations of  $\eta$ -nuclear bound states in few-body, as well as many-body systems are reviewed [1,2,3]. Underlying energy-dependent  $\eta N$  interactions are derived from coupled-channel models that incorporate the  $S_{11}$   $N^*(1535)$  nucleon resonance.

The role of self-consistent handling of the subthreshold, strongly energy-dependent  $\eta N$  interactions is thoroughly discussed. Due to relatively large downward energy shift and rapid decrease of the  $\eta N$  amplitudes, our calculations impose stronger constraints than ever on the onset of  $\eta$ -nuclear binding. Binding energies and widths of  $\eta$ -nuclear bound states were calculated within several  $\eta N$  interaction models for nuclei across the periodic table. No  $\eta NN$  bound states were found in models where  $\text{Re}a_{\eta N} \leq 1$  fm, with  $a_{\eta N}$  the  $\eta N$  scattering length, i.e., in the majority of coupled-channel models of the  $N^*(1535)$  resonance. For  $\eta NNN$ , a weakly bound and relatively broad state was found within the GW model [4] where  $\text{Re}a_{\eta N} \approx 1$  fm. Bound states of the  $\eta$  meson in  $^{12}\text{C}$  are unlikely in models with  $\text{Re}a_{\eta N} \leq 0.5$  fm, and  $\text{Re}a_{\eta N} \approx 0.9$  fm is required to reproduce the  $\eta$  bound-state candidate in  $^{25}\text{Mg}$  from the COSY-GEM experiment [5].

[1] N. Barnea, E. Friedman, A. Gal, Phys. Lett. B 747 (2015) 345

[2] E. Friedman, A. Gal, J. Mares, Phys. Lett. B 725 (2013) 334

[3] A. Cieply, E. Friedman, A. Gal, J. Mares, Nucl. Phys. A 925 (2014) 126

[4] A. M. Green, S. Wycech, Phys. Rev. C 71 (2005) 014001

[5] A. Budzanowski et al (COSY-GEM Collaboration), Phys. Rev. C 79 (2009) 012201(R)

**Primary author(s) :** MARES, Jiri (Nuclear Physics Institute, Rez)

**Co-author(s) :** BARNEA, Nir (Hebrew University, Jerusalem); CIEPLY, Ales (Nuclear Physics Institute); FRIEDMAN, Eliahu (Racah Institute of physics, Hebrew University, Jerusalem); GAL, Avraham (Hebrew University, Jerusalem, ISRAEL)

**Presenter(s) :** MARES, Jiri (Nuclear Physics Institute, Rez)

**Session Classification :** Parallel Session A1