

Contribution ID: 26

Type: not specified

## Structure of Ca isotopes between doubly closed shells

Friday, 25 March 2022 15:15 (30 minutes)

Calcium nuclei between doubly closed shells, i.e. N=20 and N=28, offer a unique opportunity to investigate the evolution of nuclear structure from symmetric to neutron-rich systems. Along this isotopic chain, spherical configurations at shell closures are expected to be overcome by deformed structures in mid-shell nuclei, already at low excitation energy. This will significantly affect the interplay between single-particle and collective excitations, as well as particle/hole-core coupling schemes which appear in odd-mass isotopes. In this context, Ca nuclei lie in a mass region where different theoretical models, with different predictive powers, can be applied and turn out to be complementary to each other. This embraces ab initio approaches [1], shellmodel calculations [2], DFT's [3] and beyond-mean-field models [4-5].

In this work, we present recent results on the low-spin structure of  $^{41-49}$ Ca nuclei, populated in a series of  $(n,\gamma)$ , neutron-capture experiments performed at Institut Laue-Langevin in Grenoble. These studies required the use of very rare target materials, such as  $^{46}$ Ca and  $^{48}$ Ca, as well as a radioactive  $^{41}$ Ca sample. High-resolution  $\gamma$ -ray spectroscopy was performed by using the high-efficiency EXILL [6-7] and FIPPS [8] HPGe composite arrays. Several new  $\gamma$  rays were found, and level schemes were substantially extended up to the neutron-capture state, approaching a complete low-spin spectroscopy for these isotopes. Moreover,  $\gamma$ -ray angular correlations were performed in order to pin down the multipolarity of a number of transitions, thus helping in the spin-parity assignment of the observed states. A selection of the experimental results is discussed and compared with theoretical calculations, including those obtained with the Hybrid Configuration Mixing model recently developed by the Milano group [4,5,7].

- [1] J. D. Holt et al., Phys. Rev. C 90, 024312 (2014).
- [2] Y. Utsuno et al., Progr. Theor. Phys. Suppl. 196, 304 (2012).
- [3] M. Bender et al., Rev. Mod. Phys. 75, 121 (2003).
- [4] G. Colò et al., Phys. Rev. C 95 (2017) 034303.
- [5] S. Bottoni et al., in preparation.
- [6] M. Jentschel et al., J. Instrum. 12, 11003 (2017).
- [7] S. Bottoni et al., Phys. Rev. C 103, 014320 (2020).
- [8] C. Michelagnoli et al., EPJ Web of Conf. 193 04009 (2018).

## Primary author: BOTTONI, Simone (Università degli Studi di Milano and INFN)

**Co-authors:** LEONI, Silvia (University of Milano and INFN Milano); BENZONI, Giovanna (INFN Milano); BRACCO, Angela (University of Milano and INFN); COLÒ, Gianluca (University of Milano and INFN); COLOMBI, Giacomo; CRESPI, Fabio (Università degli Studi di Milano / INFN); ISKRA, Lukasz; FORNAL, Bogdan (IFJ PAN Krakow); CIEPLICKA-ORYNCZAK, Natalia (IFJ PAN); JENTSCHEL, Michael (Institut Laue-Langevin); KIM, Yung Hee; KOESTER, Ulli; Dr MICHELAGNOLI, Caterina (Institut Laue-Langevin); MUTTI, Paolo; SOLDNER, Torsten; REGIS, Jean Marc (University of Cologne, Germany); KNAFLA, Lukas; MARGINEAN, Nicolae Marius (IFIN-HH Bucharest); UR, Calin (ELI-NP, Magurele-Bucharest, Romania); URBAN, Waldek (University of Warsaw, Poland); TÜRLER, A. (Universität Bern and Paul Scherrer Institut, Villigen, Switzerland); NIU, Yifei (University of Lanzhou, China)

Presenter: BOTTONI, Simone (Università degli Studi di Milano and INFN)