

Ab initio investigations of A=8 nuclei: Alpha-clustering, deformation in ^8He , $p+^7\text{Li}$ radiative capture and the X17 boson

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A realistic description of atomic nuclei, in particular light nuclei characterized by clustering and low-lying breakup thresholds, requires a proper treatment of continuum effects. We have developed an approach, the No-Core Shell Model with Continuum (NCSMC) [1,2], capable of describing both bound and unbound states in light nuclei in a unified way. With chiral two- and three-nucleon interactions as the only input, we can predict structure and dynamics of light nuclei and, by comparing to available experimental data, test the quality of chiral nuclear forces. Recently, the capability to describe α -clustering has been implemented [3].

We will discuss applications of NCSMC to the α - α scattering and the structure of ^8Be , the $p+^7\text{Li}$ radiative capture and the production of the hypothetical X17 boson claimed in ATOMKI experiments [4]. Finally, we will highlight our investigation of the neutron rich exotic ^8He that has been recently studied experimentally at TRIUMF with an unexpected deformation reported [5].

Supported by the NSERC Grants No. SAPIN-2016-00033 and by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics, under Work Proposals No. SCW1158 and No. SCW0498. TRIUMF receives federal funding via a contribution agreement with the National Research Council of Canada. This work was prepared in part by LLNL under Contract No. DE-AC52-07NA27344. Computing support came from an INCITE Award on the Summit supercomputer of the Oak Ridge Leadership Computing Facility (OLCF) at ORNL, from Westgrid and Compute Canada, and from the LLNL institutional Computing Grand Challenge Program.

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Déposé par **PETR, Navratil** le **samedi 26 mars 2022**