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The structure of 7,8,9He in the rotational model*

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Inspired by the recent results of Ref. [1] showing strong evidence for a deformed 8He nucleus, we present a study of the structure of the odd-A 7He and 9He isotopes in the rotational model. While the ab initio calculations predict an oblate shape, in this work we consider two cases corresponding to an oblate and a prolate core with deformation $|\varepsilon 2| \approx 0.38$ as inferred in [1].

A comparison of the experimental moment of inertia of 8He, derived from the experimental 2+ energy, is in good agreement with the estimates from the Migdal formula [2], with the proton and neutron radii adjusted to reproduced experimental RMS charge and matter radii. At the adopted deformation, the relevant neutron Nilsson levels arising from the p and sd spherical shells are:

• 7He: [101] 3/2, [110] 1/2 on the prolate and oblate side respectively, and
• 9He: [101] 1/2 , [220] 1/2 on the prolate and [220]1/2 and [202] 5/2 on the oblate side.

Particle plus Rotor Model calculations for both prolate and oblate configurations will be discussed and compared to available experimental data [3,4]. We will present predictions for electromagnetic properties and spectroscopic factors for the 8He(p,d)7He and 8He(d,p)9He reactions, which may stimulate further studies of these exotic nuclei. We also speculate on the structure of 7H, seen as a proton-hole in the 8He deformed core.

The rotational model offers an appealing and intuitive framework that appears to capture the physics at play in the low-lying structure of 7,8,9He and is complementary to shell-model and
ab initio approaches.

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[1] M. Holl, R. Kanungo, Z.H. Sun, G. Hagen, J.A. Lay, et al., Phys. Lett. B822, 136710(2021).
[2] B. Migdal, Nucl. Phys. 13, 655 (1959).
[3] ENSDF: Evaluated Nuclear Structure Data File. https://www.nndc.bnl.gov/ensdf/
[4] XUNDL: Experimental Unevaluated Nuclear Data List. https://www.nndc.bnl.gov/ensdf/ensdf/xundl.jsp

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