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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 $|\epsilon_2| \approx 0.38$ 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 $8\text{He}(p,d)7\text{He}$ and $8\text{He}(d,p)9\text{He}$ 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 $7,8,9\text{He}$ 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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