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Investigating the structure properties of the low-lying states of ^{140}Ba

The neutron-rich $^{144-146}$Ba isotopes have been studied recently in terms of their experimental B(E3) values [1,2]. Although featuring large uncertainties, the results were found to be significantly larger than any theoretical calculation. Similar questions exist for the slightly lighter isotope ^{140}Ba, which is particularly interesting since it is located at the onset of octupole correlations. The lifetimes of the lower lying states are completely unknown, with the sole exception of the first 2^+ state [3].

In this work, we report on the outcome of a short test run, attempting to populate the states of interest by the ^{138}Ba(^{18}O,^{16}O)^{140}Ba reaction. The experiment was carried out at IFIN-HH using a specially manufactured natBa target sandwiched between two Au layers. This was considered imperative due to barium's quick oxidation. Four energies (61,63,65,67 MeV) below the Coulomb barrier have been tested. The subsequent γ-decay was measured using the Bucharest ROSPHERE array, consisting of 15 Ge detectors and 10 $LaBr_3$(Ce) scintillators.

The preliminary results from the test run report on the level population strengths and the limits in lifetime measurements. A new run has been approved to complete the measurements of the lifetimes in the ground state band of ^{140}Ba, which are expected to provide new information on the structural effects in neutron-rich barium isotopes, especially regarding quadrupole and octupole degrees of freedom. The findings are also expected to act as stringent tests to theoretical modeling in this mass regime.

[1] B. Bucher et al., PRL 116, 112503 (2016)
[2] B. Bucher et al., PRL 118, 152504 (2017)
[3] C. Bauer et al., PRC 86, 034310 (2012)

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