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Octupole Excitations in U isotopes

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Abstract content
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The actinide region attracts considerable interest due to the rich variety of octupole phenomena encountered both theoretically and experimentally [1]. These include octupole vibrational bands which, as a function of neutron number an angular momentum, develop into alternating parity bands that have been interpreted as the onset of octupole deformation, or more recently, in terms of refection-asymmetric tidal waves [2]. The most spectacular example of octupole shape may well be the hyperdeformed bands known from fission resonances.

A new possibility is the existence of the triaxial octupole shape, which in its purest form has a tetrahedral structure and is characterized by a zero quadrupole moment [3]. Thus negative parity bands in even-even nuclei with unobserved in-band E2 transitions are often regarded as candidates for the rotation of a tetrahedral shape. In the actinides, 230U and 232U fall in this category. These nuclei have been populated at iThemba LABS, using 232Th(⍰,xn) reactions at 61 and 42 MeV, respectively. Here we report the results of these measurements, which include the first observation of in-band E2 transitions in the negative parity bands in these nuclei, using the AFRODITE array in conjunction with the iThemba LABS recoil detector. The results are discussed and compared to Skyrme-Hartree-Fock calculations and systematics throughout the region.
1. P.A. Butler and W Nazarewicz, Rev. Mod. Phys. 68, 349 (1996).
2. W. Reviol et al., Phys. Rev. C 74, 044305 (2006).
3. J. Dudek et al, Phys. Rev. Lett. 88, 252502 (2002).

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