

Frontiers in Gamma Ray Spectroscopy

FIG18

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Alternating parity bands in ^{216}Fr

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Content :

Nuclei in the region between the doubly magic ^{208}Pb and reflection asymmetric nuclei around $A \sim 220$ provide an ideal platform to understand evolution of octupole collectivity. It has been established that octupole correlation suddenly emerge at $N = 129$, while nuclei with $N < 129$ show characteristic of near spherical nucleus. The octupole correlations are reflected in sequences of alternating-parity levels connected by E1 transitions and ^{216}Fr is identified as the lightest nucleus to display such sequence. In the case of odd- A or doubly-odd nuclei, these sequences are expected to form pairs of nearly degenerate energy levels of same spin but with opposite parity. Although considerable information exists in the region of stably octupole deformed nuclei, very limited experimental and theoretical efforts have attempted to study nuclei in the transitional region. Therefore, high-spin states in ^{216}Fr ($N=129$) were investigated in order to understand the evolution of octupole collectivity near the light actinide region.

The excited states in ^{216}Fr nucleus were populated using the $^{208}\text{Pb}(^{11}\text{B}, 3n)$ reaction at 57 MeV, with the beam from 15-UD pelletron accelerator at IUAC, New Delhi. The gamma rays originating in the de-excitation process were detected using an array of 14 Compton suppressed clover detectors. The data collected in a coincidence were sorted in RADWARE compatible histograms for further analysis.

The data analysis revealed presence of several new gamma transitions. Some of the new levels establish simplex partner of previously reported band in ^{216}Fr ($Z = 87$, $N = 129$), and form parity doublets with very small average (~ 55 keV) energy splitting. Such a small value is a typical feature of nuclei with stable octupole deformation. This is interesting, since ^{216}Fr lie in the transitional region where octupole correlations just start emerging. The absence of regular E vs I pattern, on the other hand, indicates near absence of quadrupole deformation. These observations, in addition to large values of experimental $B(E1)/B(E2)$ ratios, suggest dominance of octupole correlations over quadrupole collectivity in ^{216}Fr . The details results will be presented at the conference.

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