3 - 7 Signature Splitting of $g_{\frac{7}{2}}[404]7/2^+$ Bands in ^{131}Ba and ^{133}Ce*

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The structure of an odd-A nuclei can be described as even-even core plus an odd number of quasiparticles. In axially deformed odd-A nuclei, strongly coupled rotational bands can be formed when the only quasiparticle occupies high-j, $\Omega = j$ Nilsson orbitals. Rotational bands associated with such configurations have been found in A ~100[1], 120[2], 160[3] and 180[4] mass regions. As an example shown in Fig. 1, $\pi g_{\frac{7}{2}}[404]7/2^+$ bands have been systimatically observed in $Z = 73$ and 75 isotopes and all are with negligible signature splittings. However, the splitting amplitudes of the $\nu g_{\frac{7}{2}}[404]7/2^+$ bands in $N = 73$ isotones are larger than that of $\pi g_{\frac{7}{2}}[404]7/2^+$ bands observed in $Z = 73$ and 75 isotopes.

To futher investigate the signature splittings of these bands, high-spin states in ^{131}Ba and ^{133}Ce were investigated respectively in Ref. [5]. Strongly coupled $\nu g_{\frac{7}{2}}[404]7/2^+$ bands have been also identified in both nuclei. The splitting amplitudes of associated bands in $N = 75$ isotones of ^{131}Ba and ^{133}Ce are considerably large as compared with those in $N = 73$ isotones and $Z = 73, 75$ isotopes (see Fig. 1).

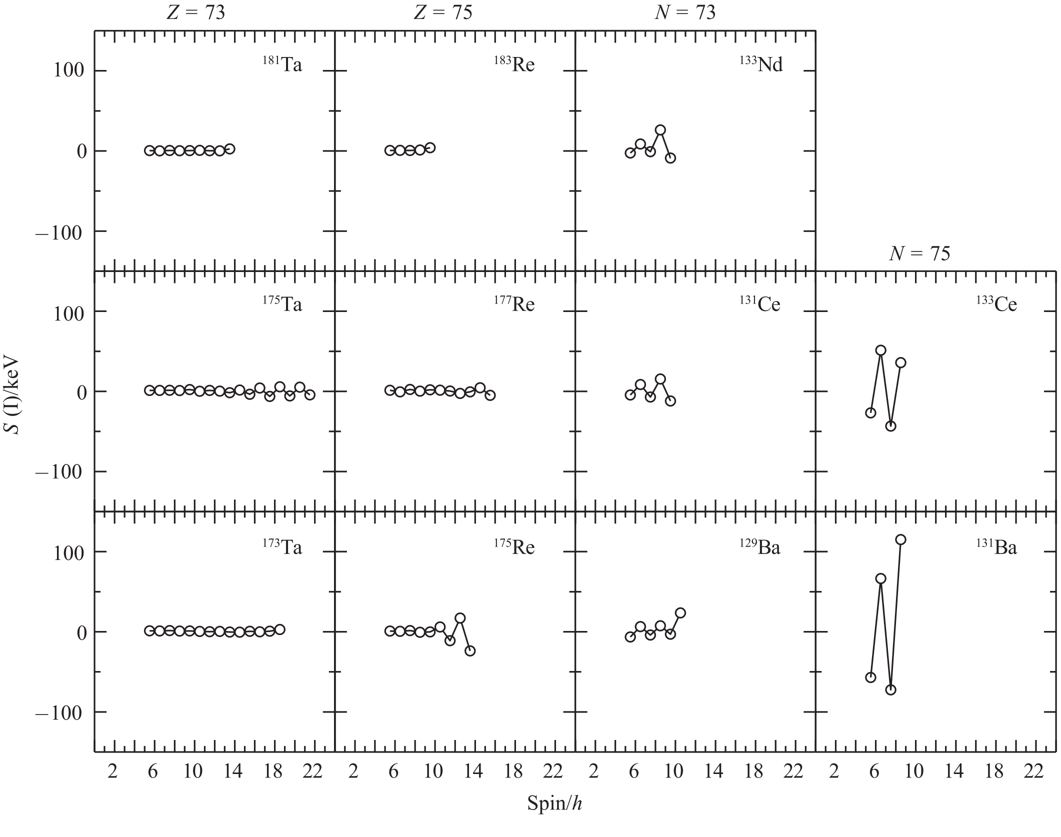

Fig. 1 (color online) Signature splittings of $\pi g_{\frac{7}{2}}$ and $\nu g_{\frac{7}{2}}$ bands in $Z = 73, 75$ isotopes and $N = 73, 75$ isotones.

The cranked shell model(CSM) and quasiparticle-plus-triaxial-rotor(QTR) model caculations are applied to investigate the origin of relatively large signature splittings observed in $\nu g_{\frac{7}{2}}$ bands in ^{131}Ba and ^{133}Ce. The caculations show that not only the triaxiality but also the Coriolis interaction generated by the mixing with low- j orbitals are responsible for the observed signature splittings(see Ref. [5] for details).

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3 - 8 β-decay Feeding Intensities of ^{88}Rb and ^{88}Kr Determined by Using the Modular Total Absorption Spectrometer*

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Precise determination of ground-state feeding in the β decay of fission products is an important but challenging task in modeling reactor anti-neutrino flux and reactor decay heat. The Modular Total Absorption Spectrometer (MTAS) is a versatile NaI(Tl) detector array that determines the accurate β-decay pattern and precise ground-state feeding intensities by avoiding the Pandemonium effects. The β feeding intensities of ^{88}Rb and ^{88}Kr, which are two main fission products with large cumulative yields in nuclear reactors, has been determined using MTAS with improved precision. The MTAS ability to determine ground-state feedings in β decays has been validated by remeasuring the well known data of ^{88}Rb. The MTAS results of the ^{88}Kr ground-state feeding is improved when compared with the Evaluated Nuclear Structure Data File (ENSDF). The sources that contribute to β feeding branching uncertainties in MTAS experiments have been investigated. It turned out that the largest uncertainty comes from geant4 simulation, whose contribution is at the magnitude of 2% assuming the MTAS spectra was not contaminated by other radioactive sources(Fig. 1). The de-convolution of ^{88}Rb β-decay spectra suggests that MTAS can distinguish an allowed β spectral shape from a unique first forbidden β spectral shape, see Fig. 1. Moreover, the de-convolution algorithm has been extended to multiple $\gamma\gamma$ correlation spectra, which greatly reduce the uncertainty of the determination of γ-cascade multiplicity. Detailed results can be found in Ref. [1].

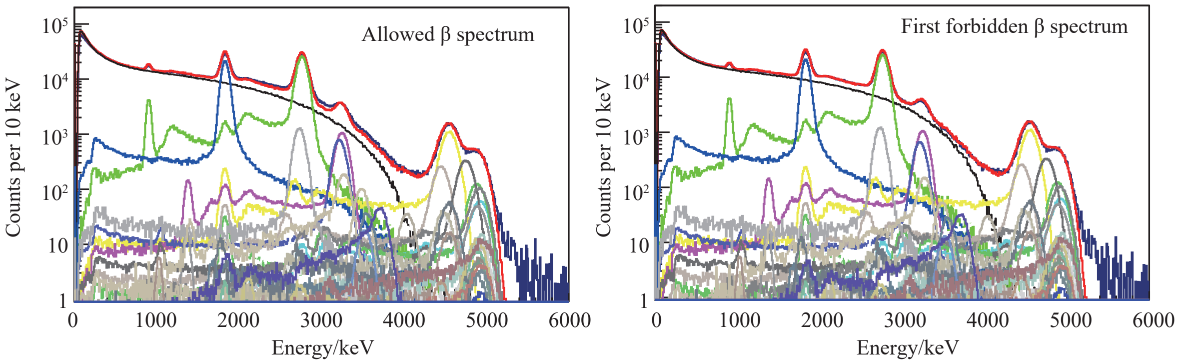

Fig. 1 (color online) De-convolution results of the center-module-only β spectra using two different simulated response functions. The I, M, O modules in MTAS are used as an active veto. In the left figure, the response function of ground-state feeding is simulated as an allowed transition. In the right figure, the response function of ground-state feeding is simulated as a first forbidden unique transition. By comparing the two figures, we conclude that MTAS spectra is described better if ground-state feeding is assumed as a unique first forbidden transition.

Reference

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