

Multiple band structures of $^{131,133}\text{Cs}$ isotopes

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The nuclei in the mass $A \sim 130$ region below $N = 82$ shell closure are soft to gamma-deformation at low and medium spins, and exhibit various intriguing phenomena. Depending upon the coupling of the angular momenta of valance neutrons and protons with that of the even-even core different types of excitations [1 - 4], namely, magnetic rotation, chiral twin bands and recently predicted chopstick configurations have been discussed for these nuclei. The structure of $^{131,133}\text{Cs}$ isotopes at moderate and high spins were investigated in the present work in search of $\Delta I = 1$ doublet bands and quasi-vibrational structures. The excited states of ^{131}Cs and ^{133}Cs were populated in through the $^{124}\text{Sn}(^{11}\text{B},4n)^{131}\text{Cs}$ and $^{130}\text{Te}(^7\text{Li},4n)^{133}\text{Cs}$ reactions, respectively. Ion beams of ^{11}B and ^7Li were obtained from the 14-UD pelletron accelerator at T.I.F.R., Mumbai. The experimental set up consisted of 8 Compton-suppressed Clover detectors placed in the horizontal plane at 60° , 90° , 120° , 150° , 210° , 250° , 285° , and 325° with respect to the beam direction [2]. A 14-element NaI(Tl) multiplicity filter in the form of two clusters were also placed above and below the horizontal plane. The master trigger for collecting gamma-gamma coincidence data was generated with the condition that at least two Clover detectors and two NaI(Tl) detectors fired in coincidence. The present level scheme of ^{131}Cs consisting of fifteen bands has been found to exhibit a variety of collective structures in this nucleus at intermediate spin [5]. Apart from the rotational bands based on $\pi g_{7/2}$, $\pi d_{5/2}$, and $\pi h_{11/2}$, dipole bands with strong M1 transitions and gamma vibrational bands have been established. The excitation energies of the observed levels in different bands and the corresponding ratios of various transition strengths have been compared with the results of projected deformed Hartree-Fock (PHF) calculations based on various quasiparticle configurations [6].

Based on comparison of the experimental data with the theoretical model calculations, a strongly coupled band has been reassigned a high-K three quasiparticle configuration. This band is found to be fed by another weakly populated side band with similar excitation energy. There are indications of strong $\pi h_{11/2} \otimes \nu h_{11/2}$ component in these two bands. Gamma vibrational bands coupled to the $\pi h_{11/2}$ and $\pi g_{7/2}$ single particle configurations have also been observed in this nucleus. New bands based on different quasiparticle structures have been identified in ^{133}Cs . Observed features of the other new bands in these nuclei will be discussed. Future possibilities of investigation of moderate and high spin states of neighbouring nuclei with the upgraded Indian National Gamma array consisting of 24 Clover detectors coupled with a charged particle detector array will be discussed.

References:

1. S. Frauendorf, Rev. Mod. Phys. **73**, 463 (2001).
2. S. Lakshmi, *et al.*, Nucl. Phys. **A761**, 1 (2005).
3. K. Starosta, *et al.*, Phys. Rev. Lett. **86**, 971 (2001).
4. K. Higashiyama, N. Yoshinaga, and K. Tanabe, Phys. Rev. C **72**, 024315 (2005).
5. S. Sihotra, R. Palit, *et al.*, (submitted).
6. Z. Naik, and C. R. Praharaaj, Phys. Rev. C **67**, 054318 (2003).

Primary author: Dr PALIT, Rudrajyoti (Tata Institute of Fundamental Research)

Co-authors: Mr RAGHAV, A. (Tata Institute of Fundamental Research); Dr DEO, A.Y. (Tata Institute of Fundamental Research); Prof. PRAHARAJ, C.R. (Institute of Physics, Bhubaneswar-751005, INDIA); Dr MEHTA, D. (Department of Physics, Panjab University, Chandigarh-160014, INDIA); Prof. JAIN, H.C. (Tata Institute of Fundamental Research); Dr GOSWAMY, J (Department of Physics, Panjab University, Chandigarh-160014, INDIA); Dr SINGH, K. (Department of Physics, Panjab University, Chandigarh-160014, INDIA); Prof. SINGH, N. (Department of Physics, Panjab University, Chandigarh-160014, INDIA); Dr JOSHI, P.K. (Tata Institute of Fundamental Research); Mr SIHOTRA, S. (Department of Physics, Panjab University, Chandigarh-160014, INDIA); Dr MALIK,

S.S. (Department of Physics, Guru Nanak Dev University, Amritsar-143005, INDIA); Dr NAIK, Z. (Tata Institute of Fundamental Research)

Presenter: Dr PALIT, Rudrajyoti (Tata Institute of Fundamental Research)

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