FIRST EVIDENCE OF COLLECTIVE VIBRATIONS OF SUPERDEFORMED NUCLEI

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Following the recent observation of a second superdeformed band in ^{190}Hg, an experiment was performed using the Eurogam Phase 2 spectrometer in order to investigate the apparent feeding from the new band to the yrast states within the second minimum. This feeding had been seen to take place over three to four transitions and is evidence for the presence of collective vibrational modes in the superdeformed well [Cro 94]. Recent theoretical RPA calculations [Miz 93] give the energies of the octupole phonons in the superdeformed well in both the $A \approx 150$ and the $A \approx 190$ regions. One of the predicted signatures of these states is the existence of large E1 matrix elements connecting them to the yrast states. Thus if the electromagnetic nature of the connecting transitions between the two bands in this nucleus could be established, the question of the excited band's nature could be decided upon. The data obtained in the experiment using the Eurogam array allowed the transitions linking the two bands to be firmly identified in the range between 0.8 MeV and 0.9 MeV. This energy is reproduced to within 100 keV by the RPA calculations. The results of DCO ratios measured for the linking transitions suggest that they are stretched dipoles. Using the strengths of transitions belonging to the excited band seen in spectra gated on the yrast band, a measure of the strength of the interband transitions has been extracted. The magnitude of these implies that if the transitions are dipoles, then they are most likely to be E1s. The B(E1)s are of a comparable magnitude to those associated with actinide nuclei exhibiting strong octupole collectivity in the normal deformed region. These observations constitute the first good evidence for collective vibrational modes occurring in the superdeformed well.

References:

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