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Title: **Discrete Line Spectroscopy at $\sim 60\hbar$ in the Light Er Isotopes, and Global Lifetime Measurements of Highly-Deformed and Other Rotational Structures in the A$\sim$135 Light Rare-Earth Region.**

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The quest to observe increasingly high angular momentum states in atomic nuclei has driven the field of high spin nuclear spectroscopy for many years. It is in the light mass A $\sim$ 160 Dy and Er nuclei that the highest spin states in normal deformed nuclei have been observed (spin I $\sim 60\hbar$ and $E_{excit} \sim 30$ MeV) [1, 2]. Aside from the question of the limiting spin at which discrete states in nuclei exist, other fundamental issues concern the effect of rotation on the nuclear equilibrium shape, on the nuclear pairing correlations and charting the correct single-particle spectrum of states at ultra-high spins. We have performed two recent experiments using the Euroball γ-ray spectrometer to explore the $N = 91$ - 94 erbium isotopes ($^{159-162}$Er) in order to shed light on these important questions. Several key systematic trends have been identified and will be discussed.

GAMMASPHERE coupled with the Microball charged-particle detector has made possible a new class of nuclear lifetime measurements. For the first time, it has been possible to extract differential lifetime measurements free from common systematic errors for over 15 different nuclei (various isotopes of Ce, Pr, Nd, Pm, and Sm) at high spin from a single experiment [3]. This comprehensive study establishes Z, N, and configuration dependent quadrupole moment trends in the A$\sim$135 light rare-earth region. Detailed comparisons are made with theoretical calculations using the Cranked Skyrme Hartree-Fock framework which lead to theoretical estimates for the effective deformation parameters of the single-particle orbitals in this region.

References

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Invited talk.