High-spin Structure of Neutron-rich $^{248\text{-}250}$Cf (N=150-152)*

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Experimental studies of the excitations of the heaviest elements around Z ~ 100, A ~ 250, whose unexpected stability is attributed to shell effects, provide important checks of theoretical model predictions, in particular for the location of the next higher spherical shell gaps. While fusion- evaporation reactions have led the way for the spectroscopy of the heaviest elements with $Z \geq 100$, complementary information gathered from $Z < 100$ nuclei via deep-inelastic and transfer reactions provides a more comprehensive template for understanding both collective and single-particle behavior in this region, where proton and neutron orbitals in the highest oscillator shells are active participants. In our quest for understanding the structures of transplutonium elements [1], we report here on new spectroscopic observations in the relatively neutron-rich nuclei $^{248\text{-}250}$Cf (Z=98, N=150-152).

High-spin states in $^{248\text{-}250}$Cf nuclei were populated via deep-inelastic and transfer reactions using a ^{208}Pb beam incident on a radioactive ^{249}Cf target. Prompt γ rays were detected with the Gammasphere array. The ground-state bands of ^{248}Cf and ^{250}Cf [2] have been extended to high-spins and the $K^{\pi} = 2^{-}$ octupole band in ^{248}Cf has been observed for the first time. In addition to the previously observed ground-state bands of ^{249}Cf [1], a new pair of bands built on a neutron single-particle orbital has been identified. These spectroscopic studies bridge a gap that existed in the systematics for N = 150, 151 and 152 isotones. The complete alignment systematics for isotopes and isotones of $^{248\text{-}250}$Cf show interesting variations. Possible connections to non-axial octupole collective effects that have been shown to be important in this region [3] will be discussed. The new data will be presented in the context of the extended systematics of this region and available theoretical predictions for the neutron-rich, transplutonium $N \geq 150$ nuclei.

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References

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