Measurement of spin and parity of high spin rotational bands and the de-orientation effect in $^{178}$Hf

CHENGZHE ZHOU, University of Rochester, Rochester, NY 14627, USA, DOUGLAS CLINE, University of Rochester, ADAM HAYES, University of Rochester, Rochester, NY 14627, USA, CHICO-GAMMASPHERE COLLABORATION — Coulomb-excited rotational bands including the high K-isomer $K=16^+$ ($\tau_{1/2}=31\text{yr}$), have been populated in $^{178}$Hf. The excitation mechanism, which requires 14 times K-forbidden transitions from the ground state band, is not understood. A 0.5 mg/cm$^2$ $^{208}$Pb target was bombarded by a $^{178}$Hf beam at 985 MeV to investigate how the 16+ isomer is Coulomb-excited. Particles in coincidence with $\gamma$-rays were detected by CHICO and Gammasphere. Several new bands, including an a-band and t-band, were seen to high spins. These could contribute to the population of the K=16+ band. The spins, parities, as well as the mixing ratios of decaying transitions (E2/M1 or E1/E3), were deduced for the a-band and t-band based on the particle-$\gamma$ angular correlation. The Coulomb excitation code GOSIA was used to fit to the experiment data. In this experiment, the ground-state band angular distribution of E2 decays was accurately reproduced by GOSIA. Best $\chi^2$ fits of $\gamma$-$\gamma$ angular correlation led to the assignment of positive parity for both the a-band and t-band. The spin assignments of both bands were confirmed with reasonable measurements on the mixing ratio of their decaying transitions to the ground state band.

Chengzhe Zhou
University of Rochester

Date submitted: 01 Aug 2012

Electronic form version 1.4