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MULTIPLE COULOMB EXCITATION OF ^{156}Gd

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In the deformed even-even Sm and Gd isotopes, the octupole $K=0^-$, 1^-, 2^-, 3^- bands have been theoretically expected to appear[1] as well as the ground-, β- and γ-bands. The γ-band and the $K=0^-$ octupole band in the deformed Gd isotopes have been observed at rather constant excitation energies. However, other octupole bands are not well established except for the $K=1^-$ band in 158Gd. The experimental research of the octupole bands in 156Gd is strongly desired to establish the existence of the octupole $K=0^-$, 1^-, 2^-, 3- bands. This is one of the fundamentally important subjects in the nuclear collective model. It is also very interesting to note that the $K=1^-$ octupole band suddenly comes lower than the $K=0^-$ band only in the case of 158Gd. It is desired to investigate the existence/feature of $K=1^-$ band in the neighboring nucleus ^{156}Gd. It was also suggested that the E1 matrix element was important as well as the E3 matrix element to reproduce the population

probabilities of the octupole bands both in ^{154}Sm and ^{154}Gd[2][3]. A new band crossing the β-band in ^{154}Sm was identified in the Coulomb excitation experiment[2]. Since ^{156}Gd is a neighboring isotone of ^{154}Sm, we may expect to observe such a new band also in ^{156}Gd.

In order to elucidate the structures of the several bands of ^{156}Gd, multiple Coulomb excitation of this nucleus was employed at Nordball. The target was an isotopically-enriched self-supporting foil of ^{156}Gd and 1.0 mg/cm^2 in thickness. Two kinds of beams of 118 MeV ^{32}S and 225 MeV ^{58}Ni were used. Backscattered ^{32}S or ^{58}Ni particles were detected with five large PSDs of multi-stripe type for Doppler-shift correction of measured γ-ray energies. These PSDs were specially designed, and the solid angle for particle detection was 65% of the backward hemisphere. Events of coulomb excitation were registered in the list mode of particle-γ or particle-γ γ. About 62 million events for the ^{32}S beam and 84 million events for the ^{58}Ni beam were collected.

The preliminary result of the ^{32}S + ^{156}Gd experiment has been presented in refs. [3]. In the ^{58}Ni + ^{156}Gd experiment, the members of the ground-band, the γ-band, the β-band and the octupole-bands were multiple-Coulomb excited. The data analysis to get transition matrix elements is in progress.

References

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