g-Factor Measurements on Coulomb Excited Radioactive ^{138}Xe Beams of 2.87 MeV/A at REX-ISOLDE ◇

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We report here on preliminary results of a second run for measurements of magnetic moments of short-lived nuclear states of radioactive beams at the REX-ISOLDE facility. The ultimate goal is to determine g factors of ^{132,134,136}Te and ^{138}Xe isotopes (close to doubly-magic ^{132}Sn) based on rather intriguing shell model predictions [1]. Due to current technical constraints a beam of ^{138}Xe was selected as a first case for determining the g factor of the 2_1^+ state at 0.589 MeV and lifetime $\tau = 15$ ps.

A pulsed isotopically pure ^{138}Xe beam of 2.87 MeV/A was provided with intensities of $\sim$ 106 ions/s. Projectile Coulomb excitation in inverse kinematics was combined with transient fields in gadolinium. Two different targets were used with excitation layers of pure ^{50}Ti or ^{nat}Mg on ferromagnetic Gd with Cu backings. The latter served as a stopper for the excited Xe nuclei. Targets were cooled to LN temperature and magnetized to saturation in an external field of 0.06 Tesla. De-excitation γ rays were detected by four modules of MINIBALL detectors in coincidence with forward scattered target ions, either ^{50}Ti or ^{nat}Mg, which were registered in a four-fold Si detector array located symmetric to the beam axis. A 12 mm hole in the detector plate allowed to pass the emerging beam to a downstream Faraday cup. Both the entrance and the exit area of the target chamber were heavily shielded against background radiation arising from deposited beam ions. A Ta foil in front of the Si detectors served as a stopper for scattered beam ions.

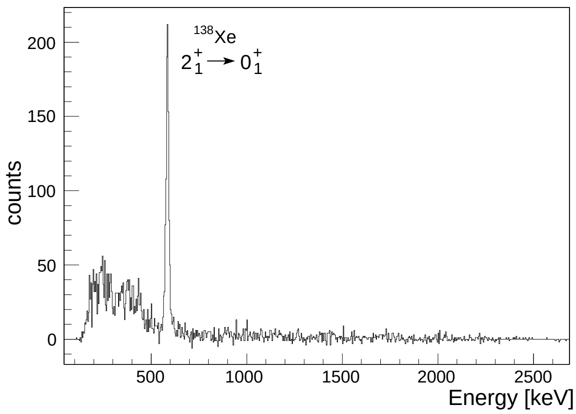

Fig. 1: *Coincident γ sum spectrum of all cores from the MINIBALL cluster detectores*

Fig. 1 shows a γ-coincidence spectrum obtained with the ^{50}Ti target. The extreme low-background spectrum exhibits after random subtraction only the γ line of the $(2_1^+ \rightarrow 0_1^+)$ transition of Coulomb excited and stopped ^{138}Xe ions. An anisotropic γ-angular correlation of this γ line was obtained from the elaborate analysis of all 12-crystal spectra of the four modules of the MINIBALL detector array placed symmetric to the beam axis at fixed angles (with high sensitivity to the spin precessions) implying different angles of γ emission. The experimental data based on the measured relative photopeak efficiency for each crystal are shown with a least-squares fit to the data points in Fig. 2. It is noteworthy that the observed anisotropy is as large as expected from the spin alignment under the experimental conditions in the geometry of the particle- and γ- detectors used. Spin precession results from external field up and down directions are currently in the process of analysis.

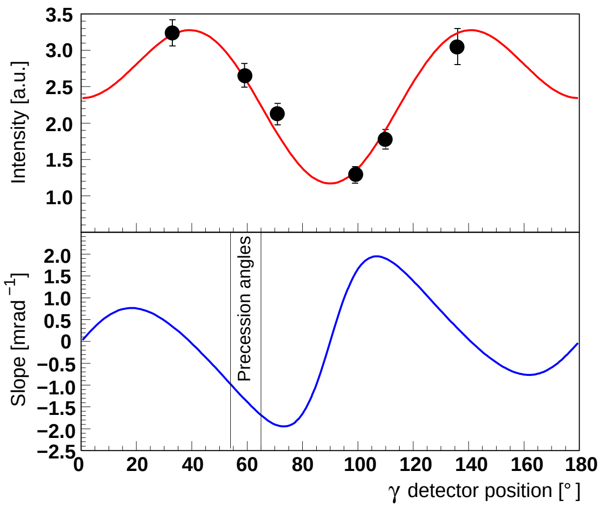

Fig. 2: *Measured γ-angular correlation of the $(2_1^+ \rightarrow 0_1^+)$ transition in ^{138}Xe by using the different θ positions of single crystals*

References

[1] J. Terasaki *et al.*, Phys. Rev. **C66** (2002) 054313

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