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The first TDRIV g-factor measurement on a radioactive ion beam: ^{28}Mg

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The Island of Inversion in the neutron-rich $N = 20$ region arises in part due to a significant reduction in the energy gap between the sd and fp shells. Recent theoretical calculations [1] and experimental results in ^{30}Mg [2] favor a much smoother transition towards the Island of Inversion than previously thought, with considerable fp admixtures in the ground state of ^{30}Mg and small fp admixtures down to ^{28}Mg. The gyromagnetic factors of nuclear states are very sensitive to the underlying single-particle structure. The predictions for the g factors of the 2_1^+ states in even-even Mg isotopes in the sd and sdpf valence spaces begin to diverge approaching ^{32}Mg under the influence of the np-nh excitations to the fp shell.

An experiment to measure the g factor of the first 2_1^+ state in ^{28}Mg was performed at HIE-ISOLDE using the MINIBALL array and the newly installed MINIBALL plunger device. The state of interest was populated via Coulomb excitation of the ^{28}Mg beam and the technique used to obtain the g factor was the Time Differential Recoil In Vacuum (TDRIV) method in its modified version for radioactive ion beam experiments [3,4]. The TDRIV method is based on observing the Larmor frequency, proportional to the g factor, at which the nuclear and atomic spins precess around the total spin of the projectile as it recoils between the target and a secondary foil within a plunger device. In the same experiment a TDRIV measurement of the supposedly well-known g factor of the 2_1^+ state in ^{22}Ne was also performed as a test of the system and in order to determine the plunger zero-offset distance, needed for the ^{28}Mg TDRIV analysis.

The results obtained from the ^{22}Ne measurement showed a surprising disagreement with the adopted g-factor value which impacts the ^{28}Mg g-factor result. The obtained g factors for both isotopes will be presented and compared to shell-model calculations.

[1] N. Tsunoda et al., Phys. Rev. C 95 021304 (2017).

[2] B. Fernández-Domínguez et al., Phys. Lett. B 779 (2018) 124.

[3] A. E. Stuchbery, P. F. Mantica and A. N. Wilson, Phys. Rev. C 71 047302 (2005).

[4] A. Kusoglu, A. E. Stuchbery, G. Georgiev et al. Phys. Rev. Lett. 114 062501 (2015).

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