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Can we measure g factors of short-lived excited states at GSI/FAIR?

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Nuclear g factors are highly sensitive to single-particle aspects of the wave function and serve as a particularly potent probe of nuclear structure in regions where the nuclear shell model holds. The sd shell has been studied for many years, giving rise to "universal"sd (USD) shell model Hamiltonians [1]. An M1 operator tailored for the sd shell has also been developed, strongly based on fits to the ground-state magnetic moments of odd-A nuclides [2]. For odd-A ground states, the g factor is predominantly influenced by the odd nucleon and is less sensitive to configuration mixing of the core. However, there is a lack of precise experimental g-factor data on excited states that could challenge this theory. Recently, a new level of accuracy in excited-state g-factor measurements in the sd shell was achieved using an innovative form of the Time Differential Recoil In Vacuum (TDRIV) method [3]. This experimental technique, conceived for applications involving radioactive beams [4], was demonstrated with the stable isotope ^{24}Mg [3]. The resulting measurement, g(2_1^+) = 0.538(13), boasts exceptional accuracy for excited-state g-factor measurements on picosecond states. The present work prepared the way for a future measurement on the neutron-rich nucleus ^{32}Mg in the "island of inversion", where the $N = 20$ shell closure breaks down, and will also assess the M1 operator. In this talk, the possibility of measuring short-lived excited states at GSI/FAIR will be discussed.

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