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The ARTEMIS Experiment: G-Factor Measurement Through Precision Spectroscopy of Heavy Highly Charged Ions

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The ARTEMIS experiment at the HITRAP facility situated at GSI, Darmstadt, focuses on precision measurements of electron magnetic moments in highly charged ions as a benchmark QED test in extreme fields. The experiment utilises a homogeneous magnetic field of 7 T with a harmonic electrostatic field which enables ion densities of up to 10e6 cm−3 to be stored for several days. The trap is equipped for the in-situ production of ions thus acting as a mini-EBIT. Ions are currently produced within the cryogenic Penning trap [1] and are stored, prepared and cooled using electronic, non-destructive techniques [2].

The experimental setup is connected to the low energy HITRAP beamline [3], thereby facilitating online/offline beam delivery, dynamic capture and injection into the trap. Upgrades are ongoing to perform g-factor measurements on hydrogen-like heavy species such as bismuth Bi82+ and other lighter species such as sulfur S11+. Laser-microwave double-resonance spectroscopy enables microwave probing of the Larmor frequency through laser spectroscopy of fine/hyperfine structure of the ions. The induced Zeeman transition is determined through a difference in intensity of the fluorescence produced in a closed optical cycle. We present a general overview along with the current status of the experiment.

References:
[1] Kanika et al., J. Phys. B 56, 175001 (2023)
[2] Ebrahimi et al., Phys. Rev. A 98, 023423 (2018)
[3] Klimes et al., Rev. Sci. Instrum. 94, 113202 (2023)

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