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Measurement of the Neutron Electric Charge using Grating Interferometry

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We report on a precision measurement of the neutron electric charge using the QNeutron apparatus. It consists of a Talbot-Lau interferometer for cold neutrons in the ballistic regime. The setup employs three identical absorption gratings and a differential two-beam geometry to detect potential beam deflections induced by a strong transverse electric field. During an 84-hour data-taking campaign in 2024 at the PF1B beamline at ILL, we successfully demonstrated the feasibility of this experiment with a first measurement yielding $Q_n = (0.11 \pm 1.06) \times 10^{-19} e$, where e is the elementary charge. The experiment establishes a new strategy for probing the neutron charge neutrality. It sets the stage for a future improved apparatus aiming to surpass the current experimental limit at the European Spallation Source.

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