The g-factor of hydrogen-like silicon: The most stringent test of BS-QED in strong fields

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Today quantum electrodynamics (QED) is considered our most successful theory in physics, ruling all electromagnetic interactions, making it a cornerstone of our understanding of physics from atomic systems to astrophysical processes. However, although no discrepancy has been found between theory and experiment, QED is expected to fail in the limit of strong fields, triggering large interest in precision tests of this theory, hoping to find evidence for physics beyond the standard model.

The measurement of the g-factor of the electron bound in highly charged ions constitutes a very promising handle for testing the predictions of QED in the presence of the strongest electric fields attainable in laboratories. We have measured the g-factor of 28Si13+ with a precision of 0.28 ppb, yielding the most stringent test of bound-state QED predictions in strong fields to date. Furthermore new techniques have been developed allowing for measurements with 10 ppt precision. The according measurements will open access to fundamental constants with unrivaled accuracy.