universität innsbruck
Forschungsschwerpunkt Physik

Innsbruck
Physics Colloquium

Spectroscopy of HD^+, fundamental physics and constants, and networked atomic super flywheels

Colloquium talk
by

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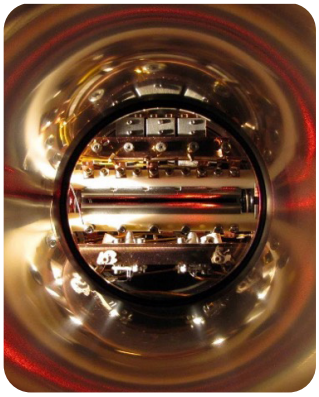
Over the past decade, high-precision laser spectroscopy of HD^+ has seen a remarkably steep improvement in accuracy, accompanied by a similar advance in the theoretical description of the molecular hydrogen ions. As a prominent result of this development, the 2022 CODATA value of the mass of the electron, expressed in atomic mass units, is now primarily determined by spectroscopic measurements of vibrational overtones in HD^+. In my colloquium I will briefly explain how measurements and theory of HD^+ are used for the determination of fundamental constants. I will furthermore touch on a puzzling 9σ discrepancy between the experimental and theoretical hyperfine structure of HD^+, and reflect on searches for physics beyond the standard model at the keV scale using HD^+. We found that such searches for 'new' particle masses and coupling constants must be done together with the determination of fundamental constants, to prevent blind spots in the search for new physics. On a different topic, I will present progress in the field of fiber-optic time and frequency distribution of a single reference clock using CERN's White Rabbit Ethernet, which has been used to build enhanced positioning systems and to improve radio astronomy, ending with the remarkable insight that efforts to build in redundancy (in the form of additional atomic reference clocks) lead to the creation of a 'networked atomic super flywheel' – a concept that foreshadows the picosecond-era of timekeeping, sufficiently precise to support quantum networking and terrestrial centimeter-level positioning systems.



Tuesday, 4 November, 16:30

HS C, Victor-Franz-Hess-Haus

Organizers: Katrin Erath-Dulitz, Hanns-Christoph Nägerl, Francine Marleau