Towards extreme ultraviolet frequency comb spectroscopy of helium ions

Jonas Morgenweg, Tjeerd Pinkert, Itan Barmes, Christoph Gohle, Dominik Kandula, Anne Lisa Wolf, **Kjeld Eikema** (Vrije Universiteit)

By employing nonlinear optics, the wavelength coverage of frequency combs has expanded dramatically over the past few years. Comb generation is now possible from infrared to extreme ultraviolet wavelengths, which e.g. provides interesting possibilities for precision spectroscopy in helium and helium+ ions to test quantum-electrodynamic and nuclear size effects. At LaserLaB Amsterdam direct full-repetition-rate frequency comb spectroscopy has been performed at near-infrared and UV wavelengths in Ca+ ions, and two-pulse frequency comb spectroscopy has been demonstrated in neutral argon, neon and helium atoms at extreme ultraviolet wavelengths ranging from 85-51 nm. The two-pulse method is based on selective amplification and high-harmonic generation of near-infrared frequency comb laser pulses, which was used to determine the ground state of helium with an accuracy of 6 MHz. In the presentation the latest developments will be discussed aimed towards improving this accuracy by several orders of magnitude, and extension to He+ ions. This includes a new laser system to reach kHz-level accuracy in the XUV, and spatial coherent control for improved two-photon spectroscopy with frequency comb lasers.