Physikalisches Kolloquium

Institut für Optik und Atomare Physik

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"A dual-comb MIXSEL enables dual-comb spectroscopy with one unstabilized semiconductor laser"

A fully stabilized optical frequency comb (OFC) consists of equally spaced frequencies and can serve as a very precise ruler for optical frequency measurements. Many applications require frequency combs in the 100-MHz to 10-GHz regime, where frequency-stabilized quantum cascade lasers (QCLs) and microcombs are still much more challenging. Optically pumped vertically emitting semiconductor lasers have successfully been modelocked over a wide spectral region from the visible to the mid-IR. Continuous-wave operation of these lasers has been successfully commercialized and have gained a strong interest for power scaling with optical pumping. A modelocked integrated external-cavity surface-emitting laser (MIXSEL) integrates both the gain and the saturable absorber layer within the same semiconductor wafer. The MIXSEL generates a modelocked pulse train from a linear straight cavity defined by the MIXSEL chip and the output coupler as the two end mirrors. The cavity length sets the pulse repetition rate and therefore the comb spacing, i.e. for example a 3 GHz OFC requires an optical cavity lengths of 5 cm. In dual-comb operation, the initially unpolarized beam is split towards the semiconductor MIXSEL chip with an intracavity birefringent crystal. In this talk I will review the operation of such semiconductor lasers and report on our latest dual-comb spectroscopy on acetylene using such a single-source dual-comb semiconductor laser without active stabilization or external amplification.

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