PHYSIKALISCHES KOLLOQUIUM

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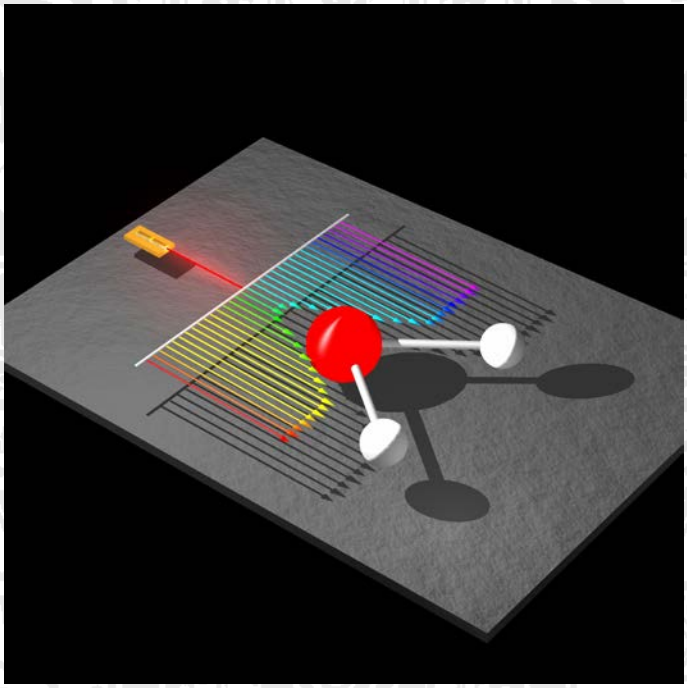
IM GROßEN HÖRSAAL



MID-INFRARED AND THZ QUANTUM CASCADE LASER FREQUENCY COMBS

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The quantum cascade laser has demonstrated the ability to provide gain over a very broad wavelength range. Recently, we have shown that such broadband devices, when operated in continuous wave, emit as a coherent optical comb[1] in which the phase relation between the comb modes corresponds approximately to a FM modulated laser. By combining a Maxwell-Bloch equations and a modal decomposition, the nature of this mode-locking has been elucidated[2]. We have also recently shown that these combs can also be produced in the THz region of the spectrum, and even covering a full octave in bandwidth. These new comb lasers enables the fabrication of a dual comb spectrometer based on a quantum cascade laser that offers a broadband, all solid-state spectrometer with no moving parts and a ultrafast acquisition time. We demonstrate a spectrometer and its first proof-of-principle applications on the measurement of water vapor.

1. A. Hugi, G. Villares, S. Blaser, H. C. Liu and J. Faist, Nature **492** (7428), 229-233 (2012).
2. J. B. Khurgin, Y. Dikmelik, A. Hugi and J. Faist, Applied Physics Letters **104** (8), 081118 (2014).
3 A. Hugi, S. Blaser, G. Villares, and J. Faist, *Nature Communications*, vol. 5, pp. 1–9, Oct. 2014.