Microresonator optical frequency combs

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Femtosecond-laser frequency combs have revolutionized metrology at optical frequencies and have introduced or advanced numerous applications from precision spectroscopy to quantum information. A new direction in experiments is to create frequency combs using parametric-nonlinear optics in microresonators. Such micro-combs offer a range of advantages including miniature size, low turn-on power, broadband spectra, and ultimately the potential for a fully integrated frequency comb system-on-a-chip.

I will report on experiments that explore the microcomb generation process, including modelocking dynamics and phase noise of the comb teeth, and that demonstrate applications of microcomb devices, including self-referenced optical frequency metrology. Microcombs are governed by the balance of intracavity power, microcavity mode dispersion, and Kerr-nonlinear optical mode interactions apart from a saturable absorber mechanism. Our work characterizes the rich phase diagram that describes the interplay between these physical parameters.