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Femtosecond laser frequency combs and their applications in AMO physics[1]

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A femtosecond laser frequency comb (FLFC) is the broadband, evenly-spaced array of optical frequencies that is present in the output of a femtosecond mode-locked laser. Such frequency combs have found wide-spread use in optical frequency metrology and optical atomic clocks, and now their role in other precision measurements is beginning to emerge. Beyond a general overview of FLFC's, in this talk we will cover the following topics: (1) Recent advances in the generation of octave-spaning combs directly from Ti:sapphire lasers as well as our efforts to produce more energy efficient and robust frequency combs that should be useful for transportable instruments. (2) Highly dispersive elements, like the so-called VIPA (Virtually Imaged Phased Array), that now permit the spatial separation of the frequency comb elements with a resolution approaching 1 GHz. This provides access to the individual comb elements and opens new possibilities in arbitrary waveform generation, spectroscopic sensing, and secure optical communications. (3) The use of optical frequency combs for direct atomic spectroscopy, as well as the comparison of microwave and optical frequency standards with uncertainty below 1e-15.

[1]Collaborative effort with T. Fortier, K. Kim, M. Kirchner, V. Mbele, S. Meyer, Q. Quraishi, J. Stalnaker and L. Hollberg