Modelocked thin-disk lasers as compact drivers for high-power XUV to THz sources

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The amazing progress in the performance of high-power ultrafast laserystems continues to give momentum to many fields of science and technology. Nowadays, ultrafast laser systems delivering hundreds of watts of average power with pulse energies ranging from hundreds of microjoules to hundreds of millijoules start to be even commercially available. In particular, disk lasers have consistently been at the forefront of this progress in the last decade: their geometry is particularly well-suited for power and energy scaling of ultrashort pulses: the thin, disk-shaped gain medium combined with large mode areas, results both in nearly unrestricted power scalability, and low accumulated nonlinearities. Among these laser systems based on the disk technology, one particular technology has attracted attention as a potential path to achieve the desired level from a simple, one-box, multi-MHz repetition rate oscillator: modelocked thin-disk oscillators can reach hundreds of watts of average power with femtosecond pulses at multi-MHz repetition rate. Exponential progress in the achievable levels is only an illustration of their enormous potential. So far, these oscillators reach up to 275 W average power, and pulse energies up to 80 µJ, both based on Yb:YAG thin-disk lasers. This talk will review latest progress achieved with this technology and next steps and challenges towards further scaling, as well as their prospect as driving sources for the generation of high-power sources ranging from the XUV to the THz spectral regions.