

New frontiers in ultrafast laser oscillators and intra-laser HHG



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APERO
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colloquium

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Ultrafast Yb-based oscillators have recently entered a new regime, combining high average power, high peak power and few-cycle pulse durations in compact, efficient systems. In this talk, I will present our latest progress on power and pulse-duration scaling of Yb-based thin-disk and bulk oscillators, and how this enables intra-oscillator high harmonic generation (HHG) up to 100 eV at MHz repetition rates.

I will first focus on compact Yb oscillators, which provide an excellent combination of ultrashort pulse duration, high output power and low-noise frequency-comb performance. I will present the state-of-the-art and recent work on reducing the pulse duration into the few-cycle regime directly in the oscillator.

In the second part, I will discuss a 50-fs-class Yb:YAG thin-disk oscillator delivering about 100 W average power and 100 MW peak power with ~26% optical-to-optical efficiency. This system serves as the basis for an intra-oscillator HHG source generating photons between 60 and 100 eV, covering an attractive spectral region for XUV spectroscopy and frequency-comb metrology. Importantly, this includes the highly relevant wavelength of 13.5 nm for the silicon industry, at which our source delivers 60 nW of outcoupled average power per harmonic order.