

Precision high average power ultrashort pulse lasers

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Joule-class femtosecond lasers are being developed to increase repetition rates from current values of a few Hertz to kiloHertz rates and beyond with multi-kW average power. This is critical to enable precision feedback and control required to make the next steps in performance and to enable applications of accelerators, photon sources and future particle colliders. Coherent combination of many fiber laser pulses - in space, time and wavelength - is being developed to combine the high average power and high efficiency of fiber lasers with high peak powers. A 100mJ-class spatially combined 100-fs-class and a 200 mJ-class, 30 fs spatially and spectrally combined multi-kHz demonstrator are in progress. The technology path from current systems to a near-term kHz facility and to efficient technologies capable of tens of kiloHertz at tens of Joules using these and related paths will be discussed.

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