

Oddělení diodově čerpaných laserů a realizační tým projektu HiLASE
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High average power, short pulse solid state lasers for compact X-ray sources via Compton scattering and plasma emission

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High average power is the key requirement for a laser driver, employed in a compact X-ray generation device. Three different types of high average power, short pulse Yb doped solid state laser technologies are compared each other, namely fiber, thin disc and bulk, on the thermal management to scale its average power more than 1kW at various repetition pulse rate.

Laser Compton X-ray generation was intensively studied in a research program "Femtosecond Technology" in Japan in 1995-2004, and its basic characterization was successfully performed with various component technologies like RF Photocathode together with a compact ps UV laser, precise synchronization, pulse train generation, and bio imaging with a phase contrast method. The image is much clear than conventional compact X-ray sources, and its commercialization needs the laser power increase from 1W today to 1kW.

EUV lithography is now going into the real world application after long global research competition. The power requirement is a clean light of 13.5nm at 400W. Laser produced plasma uses a micro Tin liquid droplet to supply a mist target for 20 ns, 200mJ, 100kHz CO₂ laser irradiation (20kW). EUV mask inspection is the last task for the whole integration. A compact, higher brightness source is required for this application, with a smaller source size. A solid state laser is the best driver around 1kW average power at higher repetition rate. Technical feasibility of a pulsed thin disc laser is discussed based on an experience in a research program "EUV lithography" in Japan in 2002-2010.

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