# X-ray generation at intensities approaching $10^{22}$ W/cm$^2$

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Generation of bright sources of hard and soft x-rays is one of the most promising applications of high-power lasers. We report on our first experiment on achieving ultra-high on-target intensities, reaching efficient conversion of laser radiation to hard x-rays (towards the "Gamma Flash" regime [1-3]), and generating intense high-order harmonics [4]. Our international team (Japan, Czech Republic, Russia, UK) used the J-KAREN-P laser facility at KPSI QST, Japan [5-8] and irradiated solid targets with intensities close to $10^{22}$ W/cm$^2$. We employed a broad range of diagnostics, including laser, plasma, secondary radiation (from NIR to MeV x-rays) and particle (e-, p+) diagnostics, and controlled the preplasma scale length, which is a critical parameter for both hard x-ray [1,3] and harmonic generation [4]. Here we overview the experiment and dedicated simulations, and show first results on hard x-ray and harmonic generation, x-ray spectroscopy, and preplasma analysis.

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