

O2.203 High resolution imaging of transition radiation emitted from resonantly accelerated electrons from relativistic laser matter interaction

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See the full abstract here <http://ocs.ciemat.es/EPS2019ABS/pdf/O2.203.pdf>

At focused intensities above 10^{18} W/cm², a laser pulse accelerates bunches of electrons into a solid target by the $v \times B$ component of the Lorentz force. These bunches are separated by half the laser period and hence emit visible light by coherent transition radiation (CTR) at twice the laser frequency (2ω) as they escape the rear surface of the target. CTR was measured in a previous experiment using short pulse lasers focused to relativistic intensities of the order of 6×10^{19} W/cm²[1]. The results indicated that about 1% of laser energy is converted into the kinetic energy of these resonantly accelerated electrons and that the resonantly accelerated electrons are highly collimated as they traverse the solid target.

Recent experiments at the PEARL laser facility at Nizhny Novgorod (10 - 20 J, 60 fs, $I > 10^{20}$ W/cm²) extended previous results to higher intensities. CTR emission at 2ω was measured from the rear side of Al foils of thickness ranging from 10 - 100 μ m using an $f/2$ off-axis parabola imaging mirror which provided a spatial resolution of about 2 μ m. The results from the CTR diagnostic indicate that the resonantly accelerated electrons are highly collimated and have a mean energy of about 30 MeV. In situ measurement of K-shell spectra from Al ions revealed that the plasma at the focus is extremely dense and hot ($n_i 10^{22}$ /cm³, $T_e 400$ eV).

Understanding the generation and transport of these collimated bunches of high energy electrons is important for laser driven ion acceleration schemes. Additionally, these collimated electrons can be harnessed to develop hard X-ray sources from table top lasers.

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References

[1] J. J. Santos, A. Debayle, Ph. Nicolai et al, Phys Plasmas 14, 103107 (2007)

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