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Electron acceleration and high harmonic generation by relativistic surface plasmons GIADA CANTONO, CEA - Saclay (France), CNR/INO - Pisa (Italy), LUCA FEDELI TEAM, ANDREA SGATTONI TEAM, ANDREA MACCHI TEAM, TIBERIO CECCOTTI TEAM — Intense, short laser pulses with ultra-high contrast allow resonant surface plasmons (SPs) excitation on solid wavelength-scale grating targets, opening the way to the extension of Plasmonics in the relativistic regime and the manipulation of intense electromagnetic fields to develop new short, energetic, laser-synchronized radiation sources. Recent theoretical and experimental studies have explored the role of SP excitation in increasing the laser-target coupling and enhancing ion acceleration, high-order harmonic generation and surface electron acceleration. Here we present our results on SP driven electron acceleration from grating targets at ultra-high laser intensities ($I = 5 \times 10^{19}\mathrm{W/cm^2}$, $\tau = 25\mathrm{fs}$) [Fedeli et al., PRL 116, 5001 (2016)]. When the resonant condition for SP excitation is fulfilled, electrons are emitted in a narrow cone along the target surface, with a total charge of about 100 pC and energy spectra peaked around 5 MeV. Distinguishing features of the resonant process were investigated by varying the incidence angle, grating type and with the support of 3D PIC simulations, which closely reproduced the experimental data. Open challenges and further measurements on high-order harmonic generation in presence of a relativistic SP will also be discussed.

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