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Reflection of single cycle THz pulses by ionization fronts FREDERICO FIUZA, JOAO DIAS, RICARDO FONSECA, TITO MENDONCA, LUIS SILVA, GoLP/CFP, Instituto Superior Tecnico, Portugal, DINO JAROSZYNSKI, Department of Physics, University of Strathclyde, United Kingdom — The propagation of short intense laser pulses in gas targets can generate relativistic ionization fronts via tunneling ionization of the background gas. The interface gas/plasma can act as a relativistic mirror, reflecting, up-shifting and compressing incident electromagnetic waves. The cut-off condition for reflection, in a gas target, limits the frequencies of the incoming radiation to the THz range. Recent developments in THz sources have opened the way to observe the relativistic mirror effect with single cycle pulses colliding with ionization fronts. We have performed detailed fully relativistic one-dimensional particle-in-cell simulations with Osiris 2.0. Our study relies on the systematic use of the Wigner transform for the electromagnetic field, thus allowing for a complete diagnostic of the frequency modulation in the probe pulse. We demonstrate controlled tunability and strong pulse compression. Relativistic ionization fronts imprint a chirp on the reflected pulse due to the finite rise time of the front, while maintaining the bandwidth required for single cycle generation in UV range. Control of this chirp is possible by a careful choice of the gas.

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