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**Probing the onset of laser-induced relativistic transparency in massive targets**[1] TAO WANG, CRAIG WAGNER, CHEDS, Univ. of Texas, Austin, TOMA TONCIAN, Helmholtz-Zentrum Dresden-Rossendorf, Germany, GILLISS DYER, CHEDS, Univ. of Texas, Austin, ALEXEY AREFIEV, University of California, San Diego, TODD DITMIRE, CHEDS, Univ. of Texas, Austin — We have investigated a novel approach of using harmonics of the laser frequency generated in the plasma to detect the onset of relativistic transparency induced by an intense laser pulse. The onset of the transparency is directly associated with a forward motion of a relativistically adjusted critical surface. The corresponding velocity is relativistic, so the harmonics generated at this critical surface are noticeably shifted. Using particle-in-cell simulations, we have confirmed that the resulting shift greatly exceeds the shift produced during a hole-boring process when the relativistic transparency plays no role, which allows us to clearly identify the onset of the relativistic transparency. Experiments that we have carried out at the Texas Petawatt laser showcase this approach. The 3rd harmonic signal detected in experiments with massive targets irradiated at laser intensities around $10^{20}$ W/cm$^2$ has a pronounced shift associated with the relativistic transparency. The shift represents a recession of the relativistically adjusted critical surface with a velocity close to 0.2 c. This approach opens a new possibility of detecting changes in the optical properties of matter induced by intense laser pulses even when no transmission of the laser pulse takes place.

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