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Terahertz source development for studying Warm Dense Matter and High Energy Density Plasmas

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After decades of being referred to as the terahertz gap, terahertz radiation is now routinely used in spectroscopic and imaging applications. Further advancement, however, has been limited by the lack of high-energy sources. New studies indicating higher terahertz conversion efficiencies [1] open up the possibility of novel applications in high energy density physics. One such application utilizes a terahertz beam to probe an optically excited system. A high-energy terahertz source is currently in development at SLAC National Accelerator Laboratory using optical rectification in lithium niobate with a 20 mJ, 800 nm, 40 fs Ti:Sapphire laser system. A pyroelectric camera is used to obtain the spatial profile of the generated terahertz beam while electro-optic detection is used to measure the full terahertz waveform. We will present the characterization of this source, as well as its potential use in future studies of the electrical conductivity of warm dense matter.

[1] S. -W. Huang et al. (2013). High conversion efficiency, high energy terahertz pulses by optical rectification in cryogenically cooled lithium niobate. Optics Letters, 38(5), 796–798.

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