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High Energy Narrowband Terahertz Generation with Broadband Chirped Pulse Trains in Periodically Poled Lithium Niobate

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We generate narrowband terahertz (THz) radiation in periodically poled lithium niobate (PPLN) crystals using chirped-and-delayed driver pulse trains from a broadband high-energy Ti:Sapphire laser. We achieve higher conversion efficiencies via cryogenic cooling, and produce multicycle THz pulses with record energies of 40 μJ at 0.544 THz and above 100 μJ at 0.361 THz using crystals with different length, aperture, and poling period. Limitations based on the effect of higher order phase and the pump pulse format are discussed for different potential driver lasers, along with scaling and compensation towards even higher pulse energies. These high energy narrowband THz pulses are useful for high-gradient particle acceleration within miniaturised acceleration structures, and also for pump-probe studies with modern ultrafast light sources.

Primary author: JOLLY, Spencer (Center for Free-Electron Laser Science & Department of Physics, Hamburg University, Hamburg, Germany)

Co-authors: MAIER, Andreas (CFEL/UHH); Prof. KAERTNER, Franz (DESY, Center for Free-Electron Laser Science); AHR, Frederike (DESY); ISHIZUKI, Hideki (Institute for Molecular Science); RAVI, Koustuban (Center for Free Electron Laser Science); Dr MATLIS, Nicholas (DESY (Deutches Elektronen Synchrotron)); TAIRA, Takunori (Institute for Molecular Science)

Presenter: JOLLY, Spencer (Center for Free-Electron Laser Science & Department of Physics, Hamburg University, Hamburg, Germany)

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