Reaching for efficient, high-energy THz generation by nonlinear down-conversion in lithium niobate: successes and limitations.

Nonlinear down-conversion of lasers has become a ubiquitous approach for generating THz-frequency electromagnetic radiation due to its flexibility and accessibility. The demand for high THz pulse energies in many applications has motivated a great deal of research into optimization of conversion efficiencies and scaling of techniques to high-energy laser drivers. Nevertheless, despite a large body of work, conversion efficiencies typically remain in the few- to sub-percent level stemming from the orders-of-magnitude mismatch in photon energies of the pump and product radiations. In this talk, I will review efforts in our group to optimize the conversion efficiency by fine-tuning the optical properties of the drive laser, with the perspective of making every photon count, and discuss effects that arise from the high laser intensities in the conversion process and the resultant appearance of parasitic nonlinear processes which can severely limit the efficiency.