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GFA and SwissFEL Accelerator Seminar

High Efficiency Terahertz Generation in Novel Organic Nonlinear Optical Crystals

Monday, 17 January 2011, 16.00 h, WBGB/019

Prof. Peter Guenter
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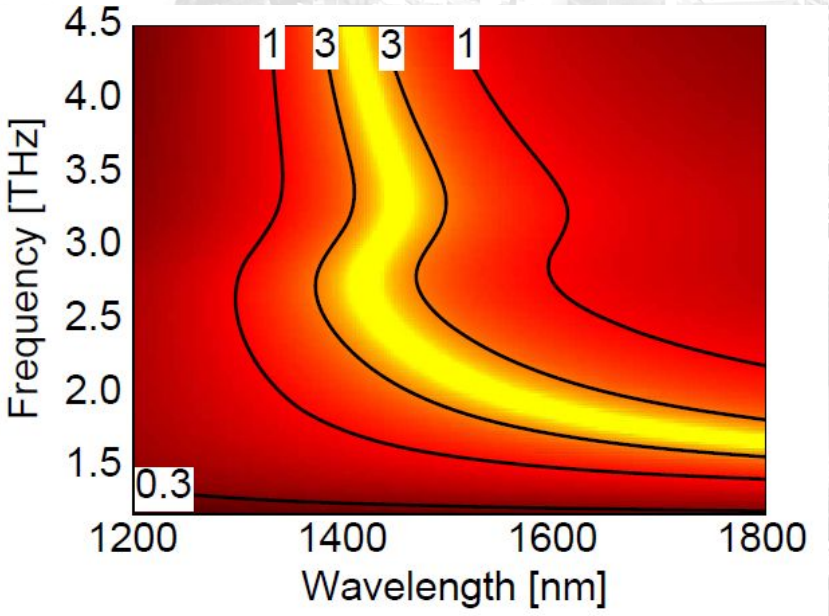

Nonlinear optical techniques are widely used for the generation of THz radiation. Materials used for this purpose are on one hand inorganic semiconductors, e.g. ZnTe and GaP, and on the other hand most recently developed organic crystals, e.g. 4-N,N-dimethylamino-4'-N'-methyl stilbazolium tosylate (DAST), and the recently developed new materials DSTMS (4-N, N-dimethylamino-4′-N′-methyl-stilbazolium 2,4,6-trimethylbenzenesulfonate) and OH1 (2-{3-(4-hydroxystyryl)-5,5-dimethylcyclohex-2-enylidene}malononitrile). The much larger nonlinear optical susceptibilities of up to 560 pm/V observed in these materials make them much more efficient than ZnTe and GaP and the ultrafast electronic response allows the generation of frequencies up to 20 THz and more.

We will give an overview of the physics and chemistry of these novel materials and of the nonlinear optical properties relevant for the generation of THz waves. We show that highly efficient generation and detection of both broadband pulses and tuneable THz frequencies in the novel organic nonlinear optical crystal OH1 and DSTMS has been realized and describe the generation and detection of THz waves using these materials. It is shown, that THz electrical fields of more than 100 kV/cm and frequencies as high as 20 THz can be generated in these organic crystals and that telecom fiber lasers can be efficiently used to generate these THz waves

The high conversion efficiencies observed in these materials allowed the first realization of a compact turn key THz spectrometer. The performance of this instrument and some applications in spectroscopy and materials testing will be described.

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