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Broadband Terahertz Generation from Metamaterials LIANG LUO, IOANNIS CHATZAKIS, JIGANG WANG, Dept. of Phys. and Astron., Iowa State Univ. and Ames Lab.-U.S. DOE, FABIAN NIESLER, MARTIN WEGENER, Inst. of Applied Phys., Inst. of Nanotech., and DFG-Center for Functional Nanostructures, Karlsruhe Inst. of Tech., Karlsruhe, Germany, THOMAS KOSCHNY, COSTAS SOUKOULIS, Dept. of Phys. and Astron., Iowa State Univ. and Ames Lab.-U.S. DOE, DR WANG TEAM, DR WEGENER TEAM, DR SOUKOULIS TEAM — The Terahertz spectral regime ranging from about 0.1 to 15 THz is one of the least explored yet most technologically transformative spectral regions. One key current challenge is to develop efficient and compact THz emitters/detectors with a broadband and gapless spectrum that can be tailored for various pump photon energies. Recently, the development of metamaterials composed of split ring resonators (SRRs) has enabled researchers to tailor resonant optical nonlinearities from THz to infrared and visible regions. Here we demonstrate efficient single-cycle, broadband THz generation, ranging from about 0.1 to 4 THz, from a thin layer of SRRs with tens of nanometers thickness by pumping at 1.5 μm wavelength of the ultrafast laser pulses. The THz emission arises from exciting the magnetic-dipole resonance of SRRs. This, together with pump polarization dependence and power scaling of the THz emission, identifies the role of optically induced nonlinear currents in SRRs. We reveal a giant sheet nonlinear susceptibility in the order of 10^{-16} m^2/V that far exceeds thin films and bulk non-centrosymmetric materials such as ZnTe.

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