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Broadband THz Generation and Detection at 10 nm Scale[1] YANJUN MA, MENGCHEN HUANG, JEREMY LEVY, U. of Pittsburgh, SANGWOO RYU, CHUNG WUNG BARK, CHANG-BEOM EOM, U. of Wisconsin-Madison —
The terahertz region of the electromagnetic spectrum (0.1 THz-10 THz) probes a wealth of information relevant for material, biological, medical and pharmaceutical sciences, as well as applications in chemical sensing and homeland security. To date, there have been no methods capable of controlling THz radiation at scales relevant for single molecules. Here we report the generation and detection of broadband terahertz radiation from 10-nm-scale nanojunctions which are "sketched" at the interface of $LaAlO_3/SrTiO_3$ (LAO/STO) heterostructure with a conductive atomic force microscope (c-AFM) tip. The nonresonant $\chi^{(3)}$ process is characterized for a single nanojunction structure, which is nonlienar electronic response to both the static field cross the junction and the optical field illuminated the junction. The same mechanism can result in the generation and detection of broadband THz radiation. This unprecedented control of terahertz radiation, on a scale of four orders of magnitude smaller than the diffraction limit, creates a pathway toward ultra-high-resolution THz imaging, single-molecule fingerprinting, spectroscopic characterization of catalysts, and other applications.

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