Abstract Submitted
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Nonlinear photothermal Mid-Infrared Microspectroscopy with Superresolution[1] SHYAMSUNDER ERRAMILLI, Physics department & the Photonics Center, Boston University, ALKET MERTIRI, Department of Biology, Boston University, HUI LIU, ATCHA TOTACHAWATTANA, Electrical and Computer Engineering, Boston University, MI HONG, Physics department, Boston University, MICHELLE SANDER, Electrical and Computer Engineering, Boston University — We describe a nonlinear method for breaking the diffraction limit in mid-infrared microscopy using nonlinear photothermal microspectroscopy. A Quantum Cascade Laser (QCL) tuned to an infrared active vibrational molecular normal mode is used as the pump laser. A low-phase noise Erbium-doped fiber (EDFL) laser is used as the probe. When the incident intensity of the mid-infrared pump laser is increased past a critical threshold, a nanobubble is nucleated, strongly modulating the scatter of the probe beam, in agreement with prior work. Remarkably, we have also found that the photothermal spectral signature of the mid-infrared absorption bifurcates and is strongly narrowed, consistent with an effective "mean-field" theory of the observed pitchfork bifurcation. This ultrasharp narrowing can be exploited to obtain mid-infrared images with a resolution that breaks the diffraction limit, without the need of mechanical scanning near-field probes. The method provides a powerful new tool for hyperspectral label-free mid-infrared imaging and characterization of biological tissues and materials science and engineering.

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