Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Direct Writing of Metamaterials Using Atomic Calligraphy[1]
THOMAS STARK, JEREMY REEVES, LAWRENCE BARRETT, RICHARD LALLY, DAVID BISHOP, Boston University — The trend toward creating metamaterials with spectral features at shorter wavelengths demands a concomitant decrease in the minimum feature size. Many fabrication techniques have been developed to meet this challenge, all of which must address competition between resolution and throughput [1]. We fabricate metamaterials using atomic calligraphy, a technique that tackles both the throughput and resolution challenges, and present optical characterization of the metamaterials we fabricate [2]. Atomic calligraphy is a microelectromechanical systems (MEMS) based moveable stencil used to fabricate nanostructures. We increase the throughput of this technique by using many stencils in parallel and work toward further enhancing throughput by using a stage system to step the MEMS and repeat fabrication over large areas. Finally, we characterize the infrared response of the metamaterials that we fabricated. This technology can be used to fabricate metamaterials on a host of substrates, including those that are chemically incompatible with or have topological features that preclude them from use with conventional nanofabrication techniques, such as mechanical scaffolds that enable tuning of the metamaterial spectral response. [1] Imboden, M. and Bishop. D. *Physics Today.* **2014**, *67* (12), 45-50. [2] Imboden. M. et. al. *Nano Letters.* **2013**, *13* (7), 3379-3384.

[1]This work is funded by the DARPA A2P Program.

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Date submitted: 06 Nov 2015 Electronic form version 1.4