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Neutral Atom Lithography Using a Bright Metastable Helium Beam[1] CLAIRE V. SHEAN, JASON REEVES, MICHAEL KELLER[2], MATTHIAS RIEDMANN[3], HAROLD METCALF, Physics, Stony Brook University, NY 11794-3800 USA — We have performed neutral atom lithography using a beam of metastable $2\,^3S$ Helium (He*) that is brightened sequentially by the bichromatic force and then optical molasses[4]. We have successfully demonstrated this technique using a physical mask of fine mesh covering a self assembled monolayer (SAM) of nonanethiol over a 20 nm evaporated film of Au on a Si wafer substrate[5]. The 20 eV internal energy of He* damages the SAM so that those damaged molecules and the underlying Au layer can be removed using a wet chemical etch[5]. Samples created this way have an edge resolution of ~ 63 nm that we measured with an atomic force microscope. This technique has promise for creating nano-structured meta-materials with unusual optical properties.

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