Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Cryogenic Nano-Fabrication using the Fab on a Chip approach
MATTHIAS IMBODEN, HAN HAN, THOMAS STARK, EVAN LOWELL, JACKSON CHANG, Boston University, FLAVIO PARDO, CRISTIAN BOLLE, Alcatel-Lucent, Bell Labs, PABLO DEL CORRO, Centro Atómico Bariloche, DAVID BISHOP, Boston University — The Fab on a Chip approach is a novel fabrication technique that leverages the control and stability of MEMS machines to fabricate structures on the nano-scale. This contrasts to standard deep-UV and e-beam lithography methods typically used today. We present how a fully functional nano-fabrication system can be operated in a cryostat to enable novel physics experiments. To this end MEMS based machines are built that mimic typical macroscopic tools found in a modern nano-fabrication facility. We demonstrate functioning film thickness monitors, heaters, shutters and atom flux sources that can all be integrated on a single silicon chip. At the heart of the fab is a dynamic shutter-aperture system that functions as a programmable stencil which guides atoms to specific locations at precise times. It is argued that this method has the potential to obtain single atom control of the deposited materials. The low power and small footprint enables the setup to function in a cryogenic environment. We demonstrate basic functionality of the elements at liquid helium temperatures. The advantage of resist free lithography and the deposition being the final fabrication step is the ability to pattern materials incompatible with standard techniques. Furthermore, the ultra-clean environment is suited for high purity fabrication of structures made of exotic materials such as lithium, with the intent to enable novel electron transport experiments.

Matthias Imboden
Boston University

Date submitted: 14 Nov 2013 Electronic form version 1.4