

Laser-Cooled Lithium Atoms: A New Source for Focused Ion Beams

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GOAL

To adapt NIST's patented, laser-cooled Magneto-Optical Trap Ion Source (MOTIS) to provide ions for a focused ion beam (FIB) capable of non-destructive imaging.

KEY ACCOMPLISHMENTS

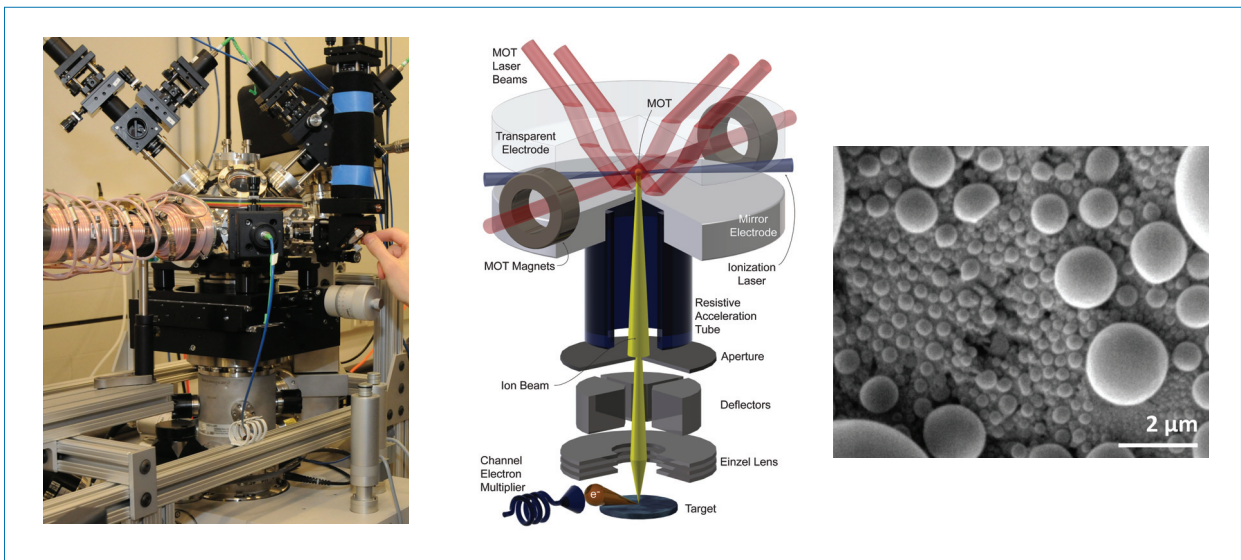
Designed and constructed a laser-cooled, magneto-optical trap-based lithium ion source mounted on a commercial focused ion beam system, creating the world's first lithium ion microscope.

Demonstrated that the light mass and low surface sputtering rate of laser-cooled lithium allows for non-destructive imaging with a characteristic focal spot size of < 30 nm.

NEW MEASUREMENT CAPABILITY

A new measurement technique that offers non-destructive imaging with new contrast mechanisms at a resolution competitive with the liquid metal ion sources used in most FIBs.

Left: Photograph of the Magneto-Optical Trap Ion Source (MOTIS) mounted on a commercial focused ion beam system. **Middle:** Schematic of the lithium MOTIS. **Right:** Secondary electron image of tin spheres on carbon generated by a lithium focused ion beam.



REFERENCE

Nanoscale focused ion beam from laser-cooled lithium atoms, B. Knuffman, A. V. Steele, J. Orloff, and J. J. McClelland, *New Journal of Physics* **13**, 103035 (2011).