

CNST collaboration demonstrates nanoscale focused ion beam employing laser-cooled lithium atoms

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(PhysOrg.com) -- A team of researchers from the NIST Center for Nanoscale Science and Technology and FEI Company have adapted a commercial focused ion beam (FIB) column to use photoionized laser-cooled lithium atoms as an ion source, and demonstrated that NIST's patented [Magneto-Optical Trap Ion Source](#) (MOTIS) offers imaging performance competitive with the liquid metal ion sources used in most FIBs.

In a MOTIS, a gas of atoms is laser-cooled to $\approx 100 \mu\text{K}$ and then photoionized. The ions are accelerated to the desired energy, forming a highly monochromatic beam that is amenable to nanoscale focusing when provided as input to a commercial focused [ion](#) beam column. The light mass and low surface sputtering rate of laser-cooled [lithium](#) allowed the researchers to demonstrate non-destructive imaging with a characteristic focal spot size of $26.7 \text{ nm} \pm 1.0 \text{ nm}$ at 2 kV.

As predicted theoretically, the focal spot size was shown to depend on the temperature of the laser-cooled atoms and on the [ion beam](#) energy. The researchers anticipate further improvements to the system spot size for enhanced imaging. These results demonstrate that NIST's new ion source may enable a wide range of new applications — from nanoscale imaging and defect metrology to ion implantation and material modification.

More information: 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).
iopscience.iop.org/1367-2630/13/10/103035/

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