

# Cold Ion Source Technologies: History and Outlook

EIPBN 2018 Short Course

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A new class of ion sources featuring laser-cooled particles have recently been developed that offer enhanced performance and new capabilities for focused ion beam instruments. The first generation of systems using this technology are currently poised for commercial deployment. In this short course we will first compare and contrast the mechanisms of action for these ion sources with the more traditional GFIS, LMIS, and Plasma-based sources. This new class of ion source employs laser-cooling to bring gaseous atoms to very low (micro-Kelvin) temperatures; we will review the physics, history, and limitations of laser-cooling techniques. Subsequently we will show how the application of laser-cooling enables the creation of ion beams of high brightness, low-energy spread, or those that possess other exotic properties. The present and projected performance of prototype systems employing cold-atoms will be reviewed, and followed by a discussions of the anticipated applications where this technology will yield immediate benefits; these include nanomachining, semiconductor circuit edit and failure analysis, lithium battery research, and secondary ion mass spectrometry (SIMS).