

Einladung zum Laser- und Quantenoptikseminar

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ColdFIB – a FIB column with a laser cooled source

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Charged particle beams of controlled energy and strong focusing are widely used tools in industry and science. Focused Ion Beam (FIB) column combine with a Scanning Electron Microscope (SEM) provide full control of nanofabrication or nanolithography processes. Ion energy can be varied typically in the 1–30KeV range, with an energy-dependent resolution attaining the nanometer range. State-of-the-art FIBs commercially available are based mainly on plasma, liquid metal tip or helium ion sources for large, intermediate, and low currents, respectively. Despite the very high technological level of the available machines, research of new ion sources allowing even higher resolution and a wider choice of atomic or molecular ions for new and demanding application is very active.

As an example, the world of electronic components evolves regularly towards the miniaturization by integrating a number of transistors more and more important. The dimensions being smaller and smaller (technology 10 nm, 7 nm even 5 nm), nowadays the instruments of analysis used, like the conventional FIB, reach their limit. Thus it's necessary to realize a technological breakthrough to be able to observe, analyze and modify components and structures on the scale of the nanometer.

In this objective we are developing a new source, based on a laser cooled cesium beam, that offers a really low divergence and energy dispersion with a two steps ionisation (Rydberg excitation + field ionisation) able to keep, as best as possible, this properties. This new technology offers a resolution, for example at 5KeV, 10 times better than the LMIS one, and reaches the nanometer at 30keV (*Figure 1*). We'll present in this talk the integration on the SEM-FIB TESCAN instrument. In addition to the experimental¹ part and performances² will also show some first applications.

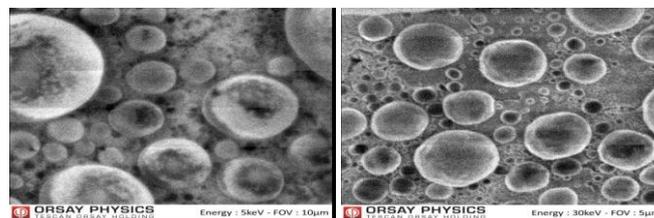


Figure 1: Tin on carbon sample: Example of images obtained with COLDFIB at 5keV and 30keV, with a different field of view, respectively 10 and 5µm.

References

- ¹ L. Kime, et al., *High-flux monochromatic ion and electron beams based on laser-cooled atoms*, Phys. Rev. A 88, 033424 (2013)
- ² M. Viteau, et al., *Ion microscopy based on laser-cooled cesium atoms*, Ultramicroscopy (2016)

Der Gast wird betreut von Prof. Dr. A. Widera
GÄSTE SIND HERZLICH WILLKOMMEN!