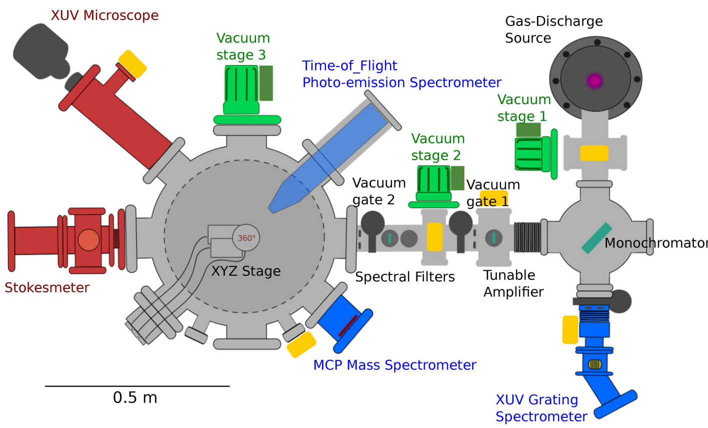
Short-Wavelength Plasma Radiation for Table-top Nano-Inspection

D. Bleiner, L. Masoudnia, M. Ruiz-Lopez, Y. Arbelo-Pena

Institute for Applied Physics, University of Bern, Bern, Switzerland,

e-mail:bleiner@iap.unibe.ch



The characterization and fabrication of nano-structured materials, such as those for plasmonics, nano-photonics, etc. demands "enabling tools" for nano-scale imaging or spectroscopy. The factor to boost R&D is that of having short-wavelength sources in the own lab. In fact, Extreme UV or X-ray (XUV, λ = 5—50nm) sources accessible on a beam-time basis, i.e. accelerator sources like synchrotrons or free-electron lasers, do bottleneck the research and impede any method-optimization within the approved beamtime shifts. Plasma-based XUV radiation combines a number of state-of-art figures-of-merit, such as high brightness, spectral purity, photon counts, and if needed also coherence, with a table-top footprint.

Fundamental and applied research thus contribute to the enabling of a lab-scale nano-inspection tool. The system integration of a facility with "EUV Light for Actinic Nano-inspection" ("ELAN") is an ongoing Swiss National Science Foundation project since 2012. Three main steps are required for demonstrating a competitive lab-scale EUV tool: (i) the integration of a table-top source, and (ii) front-end imaging/spectroscopy units, coupled to a table-top XUV plasma-source; (iii) the comparison of performance with state-of-art accelerator-sources to pinpoint scopes. The expected microscopy resolution is at a level of <10λ, limited by the optics aberration. Therefore further improvement is shown by means of "lensless" (coherent diffraction) imaging. Complementary spectroscopic inspection by means of photoelectron or photoion "time-of-flight" provides a "morpho-chemical" mapping of the nano-sample. A number of scientific cases in nano- ,science will profit from the availability of a lab-scale EUV source in the next few years.