Atom Eyes:
„The NEeutral helium MIcroscope NEMI”

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State of the art microscopy and imaging techniques are very powerful, in particular with respect to their high resolution, but there are some inherent challenging issues. Charged particle probe techniques like electron or ion microscopes as well as STM normally require the sample to be electrically conducting whilst scanning probe techniques in general are rather slow and can only be used on quite flat samples.

Recent years have shown big achievements in the field of scanning helium atom microscopy (SHeM) enabling the development of a new type of a matter wave microscopes which utilize neutral atoms as a probe beam. Here we present our focused neutral helium beam microscope NEMI and the first images.

The major advantage of the NEMI technique is that the neutral helium probe has a much lower beam-energy than other particle probe microscopes: less than 100meV for a de Broglie wavelength of less than 0.1nm. This energy is simply too low to cause any surface damage. At the same time the helium atoms are uncharged (neutral) and chemically inert. Thus, Nemi offers a completely non-destructive imaging technique that is chemically inert and equally suited to insulators, semiconductors, metals and delicate samples like organic materials.

Broadly speaking the imaging principle of NEMI is similar to that of other existing scanned beam techniques such as electron microscopy. The focused probe beam is scanned over a sample and the reflected particles are detected for the imaging process. With its focused neutral helium beam NEMI is unique in this field.