## Synchrotron X-ray Scanning Tunneling Microscopy: Elemental Fingerprinting of Materials with Sensitivity at the Atomic Limit

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### Abstract

The direct observation of the chemical composition and magnetic properties of nanoscale materials with high spatial resolution has been a long-standing goal. Scanning tunneling microscopy (STM) provides atomic resolution but fails to provide chemical sensitivity in complex situations. X-rays, however, provide that chemical sensitivity. In this talk we will discuss the development of a novel high-resolution technique, also known as synchrotron x-ray scanning tunneling microscopy (SX-STM). It combines the sub-nanometer spatial resolution of STM with the chemical, electronic, and magnetic sensitivity of synchrotron x-rays [1].

By using synchrotron x-rays as a probe and a nanofabricated smart tip of a tunneling microscope as a detector, we have recently achieved elemental fingerprinting of individual nickel clusters on a Cu(111) surface at 2 nm lateral resolution, and at the ultimate single-atomic height sensitivity (Fig.1.) [3]. Moreover, by varying the photon energy, we have succeeded to locally measure photoionization cross sections of just a single Ni nanocluster, which opens new exciting opportunities for chemical imaging of nanoscale materials.

The availability of direct chemical contrast in STM at the ultimate atomic limit is expected to find applications in nanoscience, material science, and chemistry.

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### References

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### Figures

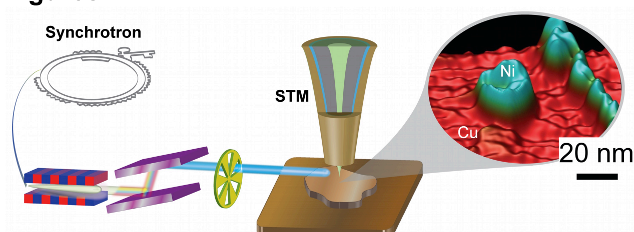


**Fig.1.** Synchrotron x-ray scanning tunneling microscopy (SX-STM) combines the high spatial resolution of STM with the chemical sensitivity of synchrotron x-rays [3].