# Magnetic-sensitive Atomic-scale Surface Analysis by Spin-Polarized Scanning Tunneling Microscopy and Spectroscopy

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The development of magnetic-sensitive surface analysis methods with atomic-scale spatial resolution, such as Spin-Polarized Scanning Tunneling Microscopy (SP-STM) [1-3] and Magnetic Exchange Force Microscopy [4], has become of significant importance in the fields of advanced magnetic materials and nano-scale spintronic devices. In particular, the atomic-resolution mapping of 3D spin textures by vector-resolved SP-STM [5] has led to the discovery of chiral magnetic domain walls [6], chiral spin spirals [7], and chiral magnetic skyrmions [8,9] in ultrathin magnetic films. Nano-scale magnetic skyrmions offer great potential for future magnetic data storage technologies, such as MRAM and racetrack-type memories [10]. Recent advances in the optimization of SP-STM probe tips offering 100% spin polarization have led to high spin-contrast mapping of artificially constructed arrays of magnetic atoms on surfaces of superconducting substrates [11]. Such magnet-superconductor hybrid systems were recently demonstrated to exhibit Majorana quasiparticles which offer great potential for robust topological quantum computation [12-15]. It will be shown how the optimization of the various materials platforms for novel types of quantum devices is guided by the unprecedented insight into the combined atomic-scale electronic, magnetic, and superconducting properties as revealed by spatially, energy- and spin-resolved scanning probe techniques.

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