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Origin of the spin-polarization of magnetic STM tips PAOLO FERRIANI, CESAR LAZO, STEFAN HEINZE, Institute for Theoretical Physics and Astrophysics, University of Kiel, Germany — Spin-polarized (SP-) STM is a powerful tool to resolve atomic scale magnetic structures that relies on the use of magnetic tips. A long debate developed about the origin of the tip spin-polarization in the vacuum region around the Fermi level, which is the crucial feature to achieve magnetic contrast. Whether it comes from the strongly spin polarized d-electrons or from the slowly decaying s-electrons is not yet settled. To clarify this issue, we performed density functional theory calculations of magnetic STM tips composed of Fe or Cu with a 3d transition-metal apex atom. Surprisingly, the local density of states in the vacuum region stems from majority s-electrons, resulting in positive spin-polarization, although minority d-electrons dominate at the apex atom. Interestingly, majority and minority states exhibit different orbital characters at the Fermi level. We interpret these findings as the consequence of reduced symmetry at the tip apex. This effect should also be observable on single magnetic atoms on a surface, which is confirmed by SP-STM measurements of a Co atom on Mn/W(110).

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