Importance of matrix element effects in the scanning tunneling spectra of \( \text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta} \)\(^1\) ARUN BANSIL, Northeastern University, JOUKO NIEMINEN, TUT, Finland and Northeastern University, ROBERT MARKIEVICZ, HSIN LIN, Northeastern University — Scanning tunneling microscopy/spectroscopy (STM/STS) techniques have entered the realm of high-Tc’s impressively by offering atomic scale real space resolution and meV resolution in bias voltages. STM/STS spectra, however, represent a complex mapping of electronic states of interest related to the CuO\(_2\) planes, since the tunneling current must reach the tip after being filtered through the overlayers (e.g. SrO and BiO in Bi\(_{2212}\)). We have developed a Green function approach for realistic modeling of STM/STS spectra of the cuprates, where the tunneling current is evaluated directly including the effect of overlayers, with all orbitals within a few eV’s of the Fermi energy \( E_F \) accounted for. Our computations show the presence of strong matrix element effects, which lead to significant differences between the \( dI/dV \) spectra and the local density of states (LDOS) of CuO\(_2\) planes. For instance, the \( d_{x^2-y^2} \) signal is found to be dominated by non-vertical hopping between the CuO\(_2\) and BiO layers. A substantial electron-hole anisotropy of the tunneling spectrum, which is in accord with experiments, is naturally explained by the contribution from \( d_{z^2} \) and other orbitals below \( E_F \).

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