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Evidence of strong correlations at the Van Hove singularity in the scanning-tunneling spectra of superconducting $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$ single crystals¹ ARUN BANSIL, Northeastern University, JOUKO NIEMINEN, ILPO SUOMINEN, Tampere University of Technology, Finland, TANMOY DAS, ROBERT MARKIEWICZ, Northeastern University — We present realistic multi-band calculations of scanning tunneling spectra in $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$ over a wide doping range. Our modeling incorporates effects of a competing pseudogap and pairing gap as well as effects of strong electronic correlations, which are included by introducing self-energy corrections in the one-particle propagators. The calculations provide a good description of the two-gap features seen in experiments at low energies. In particular, the Van Hove singularity (VHS) in the underlying electronic states is found to split into a prominent incoherent feature at high energies and a weaker coherent part near the Fermi level which is strongly involved in gap formation. The progressive hybridization of the localized VHS into the Fermi surface with increasing doping is suggestive of Kondo physics which has been proposed previously for cuprates and heavy fermion compounds.

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