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DYNAMICS OF ELECTRON INTERACTIONS AND THE ORIGIN OF FERMİ ARCS IN CUPRATE SUPERCONDUCTORS

We present a new type of ARPES spectrum that we call the ARPES Tunneling Spectrum or ATS. The ATS allows us to measure superconducting gaps and pseudogaps as a function of Fermi angle, a significant advantage over tunneling experiments, as well as the pair-breaking rate, which conventional ARPES analysis cannot separate from the non-pair-breaking processes. Furthermore, we find conventional ARPES techniques that were previously used to determine the gap magnitude fundamentally fail when the pair-breaking rate is larger than the local gap magnitude. This failure led to the previous interpretations of the Fermi arc as a true Fermi surface. Instead, we show that the Fermi arc is made of non-quasiparticle states that are scattered up to the Fermi energy.