Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Local quasiparticle lifetimes in a d-wave superconductor[1] S. GRASER, P.J. HIRSCHFELD, Physics Department, University of Florida, Gainesville, FL 32611 USA, D.J. SCALAPINO, Department of Physics, University of California, Santa Barbara, CA 93106-9530 USA — Recently, scanning tunnelling spectroscopy (STS) measurements have exhibited good fits to conductance spectra at the surface of Bi-2212 using a BCS-type model for a d-wave superconductor and assuming a local quasiparticle scattering rate varying linearly with energy. Employing a model of quasiparticle scattering by impurities and spin fluctuations we argue that the broadening of the local density of states is in general given by the self-energy of the system averaged over a small region. The size of this region at low energies is shown to be significantly larger than a gap "patch", a region over which the gap is roughly constant in this system; states measured by STS are therefore very homogeneous in this energy range. At energies above a scale determined by disorder, STS averages over states localized within a gap "patch", and lifetimes are correspondingly inhomogeneous. We show that the local self-energy in the impurity-plus-spin fluctuation model can explain the data as well as the phenomenological linear scattering rate extracted from experiment.

[1]Supported by DOE Grant DE-FG02-05ER46236.

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Date submitted: 02 Dec 2007 Electronic form version 1.4