Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Field-dependence of interlayer tunnelling in $Bi_2Sr_2CaCu_2O_8$ TIMOTHY BENSEMAN, JOHN COOPER, University of Cambridge, GEETHA BALAKRISHNAN, University of Warwick — Micron-scale 'mesa' structures fabricated on the surface of single crystals of strongly anisotropic high-temperature superconducting (HTS) compounds form stacks of 'intrinsic Josephson junctions' connected in series. Studying the current-voltage (I-V) characteristics of HTS mesas is now an established technique for obtaining important information regarding the electronic density of states (DoS) in these compounds, such as the magnitude Δ of the superconducting energy gap, and its symmetry in k-space. We have fabricated mesas on the HTS compound $Bi_2Sr_2CaCu_2O_8$ (Bi-2212) and studied these at a range of hole-doping levels, temperatures, and applied magnetic fields. Of particular interest is the field-dependent behaviour of the I-V characteristic at bias voltages much less than the sum-gap voltage $2\Delta/e$, corresponding to quasiparticles near the gap nodes. We compare our results with predictions for the field-dependent DoS made by Volovik [1] in which the local energy is assumed to be Doppler shifted by the local superfluid velocity. We also discuss features seen in our tunnelling characteristics at voltages above $2\Delta/e$, which may correspond to strong-coupling effects in Bi-2212.
[1] G. E. Volovik, JETP Lett., 58: 469-473, 1993.

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Date submitted: 03 Jan 2008 Electronic form version 1.4