Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Evidence of Electron Coupling to High Energy Excitations in a High Temperature Superconductor XINGJIANG ZHOU, WENTAO ZHANG, GUODONG LIU, LIN ZHAO, HAIYUN LIU, JIANQIAO MENG, XIAOLI DONG, WEI LU, ZHONGXIAN ZHAO, GUILING WANG, HONGBO ZHANG, YONG ZHOU, ZUYAN XU, Institute of Physics, Chinese Academy of Sciences, Beijing 100080, YONG ZHU, XIAOYANG WANG, CHUANGTIAN CHEN, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100080, J.S. WEN, Z.J. XU, GENDA GU, Brookhaven National Laboratory, Upton, New York 11973, T. SASAGAWA, Tokyo Institute of Technology, Yokohama Kanagawa, Japan
— We have carried out super-high resolution angle-resolved photoemission measurements on temperature evolution of the electron dynamics along the (0,0)-(π,π) nodal direction in an optimally-doped $Bi_2Sr_2CaCu_2O_8$ high temperature superconductor. The nodal photoemission spectra exhibit dramatic sharpening with decreasing temperature, with an obvious change in the scattering rate across T_c. New high energy features are found to develop at $\sim$115meV and $\sim$150meV, besides the prominent $\sim$70 meV one, in the nodal electron self-energy in the superconducting state. These observations provide evidence that, in addition to coupling with low energy excitations like phonons or magnetic resonance mode, there are high-energy excitations involved in the electron coupling.

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Date submitted: 12 Nov 2007 Electronic form version 1.4