The form and binding energy of $\delta_{\vec{k}}$ observed in the present ARPES study places a strong constraint on the possible bosonic modes involved in the de-excitation. Examination of published IR and Raman spectra[15][16–19] indicates the presence of a very few, nearly degenerate c-axis optical phonon modes in the appropriate energy range, the most likely of which is the Raman active A_{1g} mode previously observed between 58 and 65 cm^{-1}. In light of the theoretical work[14] and the observed behavior of $\delta_{\vec{k}}$ we assign this optical phonon mode to the 8 meV kink observed in the APRES experiment. This observation is consistent with recent temperature dependent work at the node alone[20] of optimally doped Bi2212. Clearly however a full theoretical understanding of the angle dependent dispersion of this kink requires more detailed work than was presented in[14] as the kink is clearly not pinned to the maximum d-wave gap but rather the "local" gap magnitude as a function of Fermi surface angle.

Taking $\Omega_0 = 8$ meV and $F(\omega)$ a Gaussian of full width at half maximum 1 meV from a fit to the Raman data we apply the standard Eliashberg equations[21] to calculate the mass enhancement factor λ and the scattering rate $\Gamma_{\vec{k}}(\omega)$ with α^2 as a fitting parameter such that

$$\lambda = 2\int_0^\infty \frac{\alpha^2 F(\omega)}{\omega} d\omega \tag{1}$$

$$\Gamma(\omega, T) = 2\pi \int_0^\infty \alpha^2 F(\omega')[2n(\omega') + f(\omega' + \omega) + f(\omega' - \omega)]d\omega' \tag{2}$$

where $n(\omega')$ and $f(\omega')$ are the Bose-Einstein and Fermi-Dirac distributions, respectively. The scattering rates calculated in this fashion, shown as fits to the data in Figure 2, agree well with the data once shifted to account for the angular dependence of $\delta_{\vec{k}}$. The fits include additional terms reflecting a small, constant impurity scattering component (here set to 5 meV) as well as the residual energy resolution. No attempt was made in this analysis to account self consistently for the presence of the superconducting gap or the presence of the kink at 70 meV though we expect these effects to be small, excluding the phenomenological shift in binding energy of the kink. From these fits we determine α^2 to be between 1.5 closest to the node and 1.15 further away yielding λ between 0.52 and 0.4, placing the interaction in the weak coupling regime and in good agreement with the average λ calculated in reference[5].

As an additional check to the fits of the scattering rates we have applied this kink to a simulated low temperature "nodal state". We take the lifetime to be Fermi liquid like with $\Gamma = \Gamma_{e-e} + \Gamma_{Imp} + \Gamma_{e-ph}$ and then calculate the self-consistent real part of the self energy by Kramers-Kronig transform. The bare dispersion is set to $E(k) = v_F(k - k_F)$ with