Magnetic-field dependence of the c-axis infrared response of underdoped (UD) $YBa_2Cu_3O_{7-\delta}$ (Y-123) interpreted in terms of the multilayer model and implications concerning superconducting fluctuations above T_c

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We report on results of our study of magnetic-field ($H \perp CuO_2$) dependence of the c-axis infrared response of UD Y-123, motivated by recent experimental observations [A. D. LaForge *et al.*, Phys. Rev. B **76**, 054524 (2007), ibid. **79**, 104516 (2009)] of spectacular field-induced changes of the transverse plasma mode (TPM) at ca $400\,\mathrm{cm}^{-1}$. The response has been analyzed using the multilayer model involving the conductivity of the spacing layers and that of the bilayer units. The two conductivities have been expressed as weighted averages of the superconducting state ones and the normal state (NS) ones representing contributions of the vortex cores, the weight of the latter increasing linearly with the field. For the input conductivities obtained by fitting the ($H = 0$) data of UD Y-123 with $T_c = 58\,\mathrm{K}$ [Dubroka *et al.*, Phys. Rev. Lett. **106**, 047006 (2011)], and the weight of the NS ($T \approx T_c$) component given by ($\mu_0 H/25\,\mathrm{T}$), the calculated field induced changes of the reflectivity around the TPM are in quantitative agreement with the data. This suggests that the response at $H = 0$ and $T \approx T_c$ is close to that at $H \approx 25\,\mathrm{T} << H_{c2}$ and $T << T_c$, in accord with theories attributing the above T_c state to a superconductor without the long range phase coherence, thus complementing indications based on the Nernst, magnetization, STM, infrared, specific heat and photoemission data.