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Investigation of the bosonic spectral density in highly under-doped $YBa_2Cu_3O_{6.35}$ JING YANG, THOMAS TIMUSK, Department of Physics and Astronomy, McMaster University, DOUGLAS BONN, RUIXING LIANG, WALTER HARDY, Department of Physics and Astronomy, University of British Columbia — We studied the doping dependence of the bosonic spectral function in nearly optimally-doped $La_{2-x}Sr_xCuO_4$, ortho-II $YBa_2Cu_3O_{6.35}$and highly under-doped $YBa_2Cu_3O_{6.35}$ single crystals by optical spectroscopy. With fixed oxygen content, the hole doping of the YBCO system can be fine-tuned by varying the degree of oxygen ordering. After annealing and quenching, we were able to make oxygen less ordered and obtain a highly under-doped $YBa_2Cu_3O_{6.35}$ sample with a very low transition temperature around 18K (about 20% of the optimal T_c). The a-axis reflectance data of this sample at nine temperatures between 30K and 295K were measured with an infrared spectrometer between 60 and 40 000 cm^{-1} with the aid of three different infrared and optical polarizers. The optical properties of the highly under-doped YBCO sample show dramatic changes compared to the ortho-II YBCO sample. The strong sharp mode in the bosonic spectral function $\alpha^2F(\Omega)$ in the ortho-II YBCO is absent in the highly under-doped sample.

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