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Optical Conductivity and Correlation Strength of the High T_c Cuprate Superconductors MASSIMO CAPONE, SMC, CNR-INFM and Dip. di Fisica, University of Rome "La Sapienza", Piazzale A. Moro 2, I-00185, Rome, Italy, ARMIN COMANAC, Department of Physics, Columbia University, 538 W. 120th Street, New York, NY, LUCA DE' MEDICI, Department of Physics, Rutgers the State University of NJ, 136 Frelinghuysen Road, Piscataway, NJ 08854, ANDREW MILLIS, Department of Physics, Columbia University, 538 W. 120th Street, New York, NY — High temperature copper-oxide-based superconductivity is obtained by adding carriers to insulating "parent compounds." It is widely believed the parent compounds are "Mott" insulators, in which the lack of conduction arises from anomalously strong electron-electron repulsion, and that the unusual properties of Mott insulators are responsible for high temperature superconductivity. This paper presents a comparison of optical conductivity measurements and theoretical calculations based on Dynamical Mean-Field Theory which challenges this belief: the analysis indicates that the correlation strength in the cuprates is not as strong as previously believed, that the materials are not properly regarded as pure Mott insulators, that antiferromagnetism is essential to obtain the insulating state and, by implication, that antiferromagnetism is essential to the properties of the doped metallic and superconducting state as well.

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