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Abstract

Energy Scale of the Charge Density Wave in Cuprate Superconductors †

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The cuprate high temperature superconductors develop spontaneous charge density wave (CDW) order below a temperature T_{CDW} and over a wide range of hole doping (p). An outstanding challenge in the field is to understand whether this modulated phase is related to the more exhaustively studied pseudogap and superconducting phases [1]. To address this issue, it is important to extract the energy scale Δ_{CDW} associated with the CDW order, and to compare it with the pseudogap (PG) Δ_{PG} and with the superconducting gap Δ_{SC}. However, while T_{CDW} is well-characterized from earlier work, little is known about Δ_{CDW} until now. Here, we report the extraction of Δ_{CDW} for several cuprates using electronic Raman spectroscopy [2]. Crucially, we find that upon approaching the parent Mott state by lowering p, Δ_{CDW} increases in a manner similar to the doping dependence of Δ_{PG} and Δ_{SC} [2]. This indicates that the above three phases have a common microscopic origin [2]. In addition, we find that Δ_{CDW} and Δ_{SC} have the same magnitude over a substantial doping range, which suggests that CDW and superconducting phases are intimately related [2], as reported for example by fractionalized pair density wave [3].

References

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