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A quantitative relationship between the Nernst effect and diamagnetism in the cuprates SUBROTO MUKERJEE, KINGSHUK SARKAR, Indian Institute of Science, Bangalore, SUMILAN BANERJEE, Weizmann Institute of Science, Israel, T. V. RAMAKRISHNAN, Banaras Hindu University, Varanasi
— The observed Nernst effect and diamagnetism appear to be strongly related in many classes of superconductors, especially the cuprates. However a complete understanding of this relationship across the entire phase diagram of the cuprates (i.e. as a function of all accessible values of doping, temperature and magnetic field) is lacking. Here, we quantify the relationship between the two quantities in terms of a single dimensionless parameter $M/(T\alpha_{xy})$, where M is the magnetization and α_{xy}, the off-diagonal Peltier coefficient. We calculate this quantity as a function of doping, temperature and field based on a phenomenological model of the cuprates proposed by two of us that has previously produced good agreement with several experimentally measured quantities. In particular, we show that we can interpolate between the Gaussian and strongly phase fluctuating XY limits of the cuprate superconductors and find agreement with previous calculations in those limits. We show that our results for the dependence of α_{xy} and $M/(T\alpha_{xy})$ on doping, temperature and field are in good quantitative agreement with experiments on the cuprates.

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