

Charging Effects of Vortex Core in High Temperature Superconductors Probed by Nuclear Quadrupole Interaction

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From high resolution measurements of the nuclear quadrupole frequencies we obtain experimental evidence that a vortex in high T_c superconductors (HTSC) traps a finite electric charge. In slightly overdoped $\text{YBa}_2\text{Cu}_3\text{O}_7$ the vortex is negatively charged by trapping electrons, while in underdoped $\text{YBa}_2\text{Cu}_4\text{O}_8$ it is positively charged by expelling electrons. The sign of the trapped charge is opposite to the sign predicted by the conventional BCS theory. Moreover, in both materials the deviation of the magnitude of the charge from the theory is significant. These features can be attributed to the novel electronic structure of the vortex in HTSC.

Key words: NMR; NQR; Quadrupole Interactions; Vortex Core; High- T_c Superconductors.