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Competition between charge and superconducting orders in underdoped YBCO

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We report nuclear magnetic resonance measurements (NMR) showing that high magnetic fields induce a static, unidirectional, modulation of the charge density in the CuO_2 planes of underdoped $YBa_2Cu_3O_y$ [T. Wu et al., Nature 477, 191 (2011)]. The appearance of the charge order coincides with the Fermi surface reconstruction inferred from quantum oscillation and other transport measurements. This charge order appears to be most probably the same $4a$-periodic stripe modulation as in La-214 cuprates. That it develops only when superconductivity fades away (no charge order is observed under strong fields parallel to the planes) and near the same 1/8 hole doping as in La-214 suggests that charge order, although visibly pinned by CuO chains in $YBa_2Cu_3O_y$, is an intrinsic propensity of the superconducting planes of high-Tc copper oxides. Since field induced stripe order is also compatible with neutron scattering data in La-214 and with STM data in Bi-2212, charge order could be a generic competitor of high Tc superconductivity.

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