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Broken symmetry in the cuprate phase diagram: Oxygen engineer- ing in electron doped cuprate superconductors and its impact on competing orders YOSHIHARU KROCKENBERGER, HIROSHI IRIE, OSAMU MATSUMOTO, KEITARO YAMAGAMI, MASAYA MITSUHASHI, NTT Basic Research Labs, AKIO TSUKADA, Tokyo University of Science, MICHIO NAITO, Tokyo University of Agriculture and Technology, HIDEKI YAMAMOTO, NTT Basic Research Labs — In high temperature superconductors, superconductivity is induced by chemical doping. This relation is one of the most studied in solid state physics since superconducting transition temperatures beyond the boiling point of nitrogen have been realized. So far, only doping stabilizes the superconducting ground state by destruction of the long-range antiferromagnetic order of the $3d^9$ Cu^{2+} moments and alternatives for an increase of the superconducting transition temperature are in great demand. We show that the conventional mechanism of doping for the induction of superconductivity does not apply to a class of materials characterized by square-planar coordination of copper. We prepared thin films of Pr_2CuO_4, a strongly correlated material with a magnetically driven insulating ground state - and show that annealing drives the localized charge carriers into motion, leading to the emergence of a superconducting ground state. This non-local switching of the electronic states is achieved by the application of an elaborate annealing method. The superconducting transition appears at temperatures higher than that induced by doping. Our results demonstrate a conceptually new tuning parameter for the induction of superconductivity, extending the concept of doping control.

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