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Stabilization of 3-dimensional charge order through interplanar orbital hybridization in $Pr_xY_{1-x}Ba_2Cu_3O_{6+\delta}$ BRANDON GUNN, ALEJANDRO RUIZ, University of California, San Diego, YI LU, Heidelberg University, KALYAN SASMAL, University of California, San Diego, HAI HUANG, JUN-SIK LEE, SLAC - Natl Accelerator Lab, FANNY RODOLAKIS, Argonne National Laboratory, TIMOTHY BOYLE, MORGAN WALKER, University of California, Davis, YU HE, Yale University, SANTIAGO BLANCO-CANOSA, Donostia International Physics Center, EDUARDO DA SILVA NETO, University of California, Davis, BRIAN MAPLE, ALEX FRANO, University of California, San Diego — In the copper oxides, two-dimensional (2D) charge order (CO) is a universal phase that competes with superconductivity but is only a short-range phenomenon primarily due to disorder. Three-dimensional (3D) CO can emerge by applying magnetic field or strain, but a 2D CO component remains present and the out-of-plane correlation lengths remain shortened by disorder. We report Cu-L_3 and Pr-M_5 resonant x-ray scattering experiments and band structure calculations on $Pr_xY_{1-x}Ba_2Cu_3O_{6+\delta}$ showing that, through the hybridization between the Pr $4f$ orbital and CuO_2 electronic states, 3D CO can be stabilized with the highest reported out-of-plane correlation length. Importantly, we do not detect any evidence of 2D CO. These results provide the first observation of a fully stabilized and isolated 3D CO phase that can be achieved by tuning the orbital character of the electronic structure.

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