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Electronic phase separation and dramatic inverse band renormalisation in the mixed valence cuprate $LiCu_2O_2$ SIMON MOSER, Lawrence Berkeley National Laboratory, Ecole Polytechnique Federale de Lausanne, YUSUKE NOMURA, Ecole Polytechnique, Paris, LUCA MORESCHINI, Lawrence Berkeley National Laboratory, GIANMARCO GATTI, HELMUTH BERGER, PHILIPPE BUGNON, ARNAUD MAGREZ, Ecole Polytechnique Federale de Lausanne, CHRIS JOZWIAK, AARON BOSTWICK, ELI ROTENBERG, Lawrence Berkeley National Laboratory, SILKE BIERMANN, Ecole Polytechnique, Paris, MARCO GRIONI, Ecole Polytechnique Federale de Lausanne — We measured by ARPES the electronic structure of $LiCu_2O_2$, a mixed valence cuprate where planes of formally Cu(I) ($3d^{10}$) ions are sandwiched between layers containing one-dimensional edge-sharing Cu(II) ($3d^9$) chains. We find that the Cu(I)- and Cu(II)-derived electronic states form separate electronic subsystems, in spite of being coupled by bridging O ions. The valence band, of Cu(I) character, disperses within the charge-transfer gap of the strongly correlated Cu(II) states. This anomalous electronic structure produces an unexpected and unprecedented 250% *broadening* of the valence band with respect to the predictions of density functional theory. Our observation is at odds with two widely accepted tenets of many-body theory, namely that correlation effects are weak in filled bands, and that they generally yield narrower bands and larger electron masses.

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