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Localization via exchange splitting in $NaFe_{1-x}Cu_xAs$ ALIAKSEI CHARNUKHA, University of California San Diego, ZHIPING YIN, Beijing Normal University, YU SONG, Rice University, CHONGDE CAO, Northwestern Polytechnical University, PENGCHENG DAI, Rice University, DIMITRI BASOV, Columbia University — Iron-based high-temperature superconductors have emerged as a distinct material family believed to bridge the wide gap in understanding between conventional low-temperature and unconventional high-temperature copper-based superconductors. And yet, compounds that bear close resemblance to strongly correlated superconducting cuprates have been hard to come by. Recently, copper substitution in a quintessential iron pnictide, NaFeAs, has been demonstrated to result in a semiconducting transport behavior, suggesting the possibility of a strongly correlated Mott insulating electronic state. Here we use optical spectroscopy and dynamical mean-field theory to demonstrate explicitly that the excitation spectrum of NaFe0.5Cu0.5As possesses a sizable gap below the Neel temperature and remains unchanged up to room temperature due to the persistence of short-range antiferromagnetic correlations. We show that all of the observed experimental properties can be explained remarkably well as a result of exchange splitting in the predominantly Fe-*d*–derived electronic band structure induced by local antiferromagnetic order. On-site repulsion, on the contrary, is insufficient to drive localization. Our results paint a fuller picture of the intermediate character of correlations in iron-pnictides.

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