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Visualizing Critical Spatial Correlations for Electronic States near the Metal-Insulator Transition in $Ga_{1-x}Mn_xAs$[1] ANTHONY RICHARDELLA, PEDRAM ROUSHAN, Princeton University, SHAWN MACK, UCSB, BRIAN ZHOU, DAVID HUSE, Princeton University, DAVID AWSCHALOM, UCSB, ALI YAZDANI, Princeton University — Semiconductors have long been used to study critical phenomena near the disorder-induced (Anderson) metal-insulator transition (MIT). We studied the dilute magnetic semiconductor $Ga_{1-x}Mn_xAs$ with dopings near the MIT using low temperature cross sectional scanning tunneling microscopy (STM). This allows us to visualize the electronic states near the Fermi level (E_F) which display unique critical properties. Suppression of the density of states (DOS) around E_F due to electron-electron interactions is observed. In this energy range, the electronic states show a diverging correlation length approaching E_F, where the suppression of the DOS is strongest. The distance dependence of the correlations at E_F is consistent with a power law decay, expected for states near criticality, while away from E_F the correlations fall off exponentially. These results highlight the importance of electron-electron interactions and represent some of the first experimental observations of states near the Mott-Anderson MIT, where both disorder and interactions are equally important for the localization of electronic states.

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