

Ultrafast electron localization in a correlated metal

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Ultrafast electron delocalization induced by a fs laser pulse is a well-known process in which electrons are ejected from the ions within the laser pulse duration.⁽¹⁾ However, the speed of electron localization on an atom by an excitation is unknown. Here, we demonstrate by means of x-ray absorption spectroscopy that an electron localization process into 4f states of a Eu-based correlated metal occurs within few-hundred femtoseconds. Our data suggests that the driving force for this process is either a reduction of the 4f states energy, a change of their bandwidth or an increase of the hybridization between the 4f/3d states. The observed ultrafast electron localization process raises fundamental questions for our understanding of electron correlations and their coupling to the lattice.

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