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STM/S study of the mid-gap impurity bound states in Fe(Te,Se)

JIAXIN YIN, Institute of Physics, Chinese Academy of Sciences (IOP, CAS); University of Houston (UH), ZHENG WU, JIHUI WANG, UH, ZHIYANG YE, JING GONG, XINGYUAN HOU, LEI SHAN, IOP CAS, ANG LI, Shanghai Institute of Microsystem and Information Technology, CAS, XUEJIN LIANG, XIANXIN WU, IOP CAS, JIAN LI, CHIN-SEN TING, UH, JIANGPING HU, IOP CAS, PEIHERNG HOR, UH, HONG DING, IOP CAS, SHUHENG H PAN, University of Houston; Institute of Physics, Chinese Academy of Sciences — In superconductors, the microscopic phenomenon of quasi-particles scattering off an impurity is sensitive to the symmetry of the order parameter. Therefore, it has been used to probe the pairing symmetry of the superconducting state. We use low temperature scanning tunneling microscopy/spectroscopy (STM/S) to study the scattering effects of single atomic impurities in Fe(Te,Se). The tunneling spectrum on the pristine sample exhibits two fully opened superconducting energy gaps, which are consistent with our photoemission results. On samples with impurities, we have found that an isotropic sharp peak of mid-gap states emerges in the tunneling spectrum at the impurity site within a short length scale of $\sim$ 10 Å. The results of the temperature dependence study indicate that this peak of impurity bound-states is intimately related to the state of superconductivity. We have also studied the response of this impurity induced spectrum feature to a magnetic field (up to 8 Tesla) and to impurity-impurity interactions. We will discuss the implication of our observations in the context of pairing symmetry.

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