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Interface enhanced superconductivity in one unit-cell FeSe films grown on SrTiO3

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Heterostructure based interface engineering has been proved an effective method for finding new superconducting systems and raising superconducting transition temperature (Tc). Recently discovered high temperature superconductivity in one unit-cell (UC) FeSe films on SrTiO3 (STO) substrate grown by molecular beam epitaxy has attracted intensive attention. In sharp contrast to FeSe films on graphene where a 2.2 meV superconducting gap is observed on thick films and no superconducting gap on 1-UC FeSe down to 2.3 K, 1-UC FeSe films on STO substrate exhibit unexpected large superconducting gaps of 15-20 meV. Interestingly, the anomalously large superconducting gap is only found in the first UC FeSe but not on 2-UC or thicker layers, indicating that interface plays a crucial role in the enhanced superconductivity in 1-UC FeSe films on STO substrate. Another interesting point of this system is its simple band structure that consists only of electron Fermi pockets at M points, which is different from that of bulk FeSe. In this talk, a comprehensive study of 1-UC FeSe films by in situ scanning tunneling microscopy/spectroscopy (STM/STS) and angle-resolved photoemission spectroscopy (ARPES) and ex situ transport measurements will be presented to discuss the possible superconducting mechanism in this well-defined heterostructure.

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