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Superconductivity in one-atomic-layer metal films TONG ZHANG, PENG CHENG, WEN-JUAN LI, YU-JIE SUN, GUANG WANG, XIE-GANG ZHU, KE HE, LILI WANG, XUCUN MA, XI CHEN, YAYU WANG, YING LIU, HAI-QING LIN, JIN-FENG JIA, QI-KUN XUE, Department of Physics, Tsinghua University — Two-dimensional (2D) superconducting state is a fragile state of matter susceptible to quantum phase fluctuations. It is still not known whether a single layer of ordered metal atoms, which represents the ultimate 2D limit of a crystalline film, could be superconducting. Here we report scanning tunneling microscopy measurements on single atomic-layer films of Pb and In epitaxially grown on Si(111), and demonstrate that superconductivity does exist at such 2D extreme. The superconducting transition temperature (TC) is found to be 1.83K for Pb film and 3.18K for In film. Occurrence of vortex lattice under magnetic field confirms that they are type II superconductor. To understand the mechanism of superconductivity transition, we performed high-resolution ARPES measurement. The result reveals that the interplay between the Pb-Pb (In-In) metallic and the Pb-Si (In-Si) covalence bondings may play a critical role.

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