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Superfluid density through 2D superconductor junctions. HYOUNGDO NAM, CHIH-KANG SHIH, Department of Physics, The University of Texas at Austin, Austin, TX 78712, USA. — As S. Qin et al. [1] reported, two monolayer (2 ML) lead film on a silicon (111) substrate has one of two different atomic structures on the silicon substrate: the unstrained 1x1 and the psedumorphically strained $\sqrt{3}$x$\sqrt{3}$ (i.e. the same lattice constant as the Si $\sqrt{3}$x$\sqrt{3}$ lattice). Most interestingly, although these two different regions show the same quantum well state features, they have different Tc's (5 K and 4 K). These two different regions of 2 ML film naturally form superconductor-superconductor (SS or SS') junctions along silicon step edges. Physical connection of the junction is only 1 ML thickness because of the step height difference of substrate. We will present this study of SS (or SS') junction system using scanning tunneling microscopy/spectroscopy and *in-situ* double-coil mutual inductance measurement. The transition of superconducting gaps across either SS or SS' junctions should show how to locally affect each other. Double coil measurement show a global Tc close to the lower Tc region with sizable superfluid density. We will discuss the phase rigidity and its relationship to the superfluid density in this ultra-thin Pb film that is only 2 ML thick. [1] 'Superconductivity at the two-dimensional limit' S. Qin, J. Kim, Q. Niu, and C. K. Shih, *Science* **324**, 1314 (2009).

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