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**Engineering Thin Film Superconductivity toward Single Quantum Channel Limit**[1] SHENGYONG QIN, JUNGDAE KIM, QIAN NIU, CHIH-KANG SHIH, University of Texas at Austin — Traditional studies of two-dimensional superconductors were limited to the regime where the superconducting order parameter behaves as a two-dimensional wave function but the underline electrons are still three dimensional. Recent advancement of materials synthesis have enabled one to grow epitaxial thin superconductor thin films (e.g. Pb) on semiconductor substrates (e.g. Si or Ge) with unprecedented control in crystallinity, atomic smoothness and the layer thickness, thus opening up new opportunities in investigations of two-dimensional superconductivities. Indeed, quantum oscillations of the superconducting order parameter as a function of film thickness have been observed. Moreover, it was found that superconductivity remains very robustness even for films as thin as 5 ML. An interesting question arises as to what extent the robustness of superconductivity remains in even thinner regime. This work presents the case of thin film superconductivity in extreme confinement limit when only one quantum channel is present (i.e. when $k_F L = \pi$).

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