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Superconducting tunneling on thin film gold nanowires – a platform for searching Majorana fermions[1] PENG WEI, PATRICK LEE, JAGADEESH MOODERA, MIT — The metallic surface states of (111)-oriented gold thin film has been theoretically shown to be a superior candidate for Majorana fermions (MF) due to its orders of magnitude stronger spin-orbit coupling compared to semiconductor nanowires.[1] We experimentally demonstrate an ideal platform using heterostructure based nanowires for achieving this, and exploit quantum tunneling to probe the MFs forming at the end of the nanowires. By controlling the material properties of the tunnel barrier, we explore the peculiar behaviors of superconducting gold surface states in both pair tunneling (Josephson like) and quasiparticle tunneling regimes that may hint the signatures of MFs. Additionally, in the mesoscopic 1D gold nanowire superconductor, we observe a new superconducting phase with an energy gap much larger than any of the superconductors in the tunneling device, hinting possible unknown pairing mechanism. Our approach directly demonstrates a crucial step in achieving realistic fault-tolerant quantum computation devices based on non-abelian particles. [1] A. C. Potter and P. A. Lee, Phys Rev B 85, 094516 (2012)

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