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Hybridized Electron-Hole States in Inverted InAs/GaSb Composite Quantum Wells[1] IVAN KNEZ, R.R. DU, J. KONO, Rice University, G. SULLIVAN, Teledyne Scientific Company, S. SASA, Osaka Institue of Technology, M. INOUE, Osaka Institute of Technology — Recently, it has been proposed that inverted InAs/GaSb composite quantum wells (CQWs) will exhibit the quantum spin Hall effect, characterized with a bulk gap and an odd number of gapless Kramers pair states at the edges. We have successfully fabricated a double-gated device on high-quality MBE-grown InAs/GaAs CQWs in the inverted regime, in which we were able to fine-tune the band structures via an electrical field. At $T = 20$ mK, and zero front and back gate bias, only electrons are present in the CQWs, with a typical density of $7\text{x}10^{11}\text{cm}^{-2}$ and mobility of 90,000 cm^2/Vs. We observed clear evidence for an energy gap in the inverted regime, with values of the gap consistent with those theoretically predicted. In addition, our preliminary data analysis suggests that bulk conductivity does not vanish even at $T = 20$ mK for the CQWs studied. We propose a semi-classical model of hybridized electron-hole states to explain our data. Ref. C. Liu et al. Phys. Rev. Lett. 100, 236601 (2008), Y. Naveh and B. Laikthman, Euro. Phys. Lett. 55, 545 (2001).

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