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**Gate-Tuned Mott Transition in Dilute InAs/GaSb Quantum Wells** LINGJIE DU, Department of Physics and Astronomy, Rice University, WENKAI LOU, KAI CHANG, Institute of Semiconductors, Chinese Academy of Sciences, GERARD SULLIVAN, Teledyne Scientific and Imaging, RUI-RUI DU, Department of Physics and Astronomy, Rice University — We investigate the origin of the bulk gap in inverted InAs/GaSb quantum wells (QWs) that host spatially-separated electrons and holes using charge-neutral point (CNP) density (n_o˜p_o) in gated devices as a tuning parameter. We find two distinct gap regimes: for I), n_o >>51010/cm2, a soft gap opens predominately by hybridization, which closes under B// >˜10T; for II), approaching the dilute limit n_o˜51010/cm2, a hard gap opens leading to a true bulk insulator with quantized helical edges, continuously for B// up to 35T. Our results confirm that hard gap is associated with the Quantum Spin Hall (QSH) effect but cannot be explained by single-particle band theory. Instead it originates from many-body correlations. The data are remarkably consistent with a Mott insulator bulk state in the dilute InAs/GaSb bilayers. Specifically, spontaneous exciton binding is a viable mechanism for driving the Mott transition. Our results point to the importance of charge interactions in properties of QSHE in InAs/GaSb, in addition to single-particle band theories. The work in Rice was supported by DOE (measurements) and NSF (materials).

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