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Electron delocalization in gate-tunable gapless silicene[1] WEI-FENG TSAI, Department of Physics, National Sun Yat-sen University, Taiwan, YAN-YANG ZHANG, KAI CHANG, X.-T. AN, Institute of Semiconductors, Chinese Academy of Sciences, China, G.-P. ZHANG, Department of Physics, Renmin University of China, China, X.-C. XIE, ICQM, Peking University, China, SHU-SHEN LI, Institute of Semiconductors, Chinese Academy of Sciences, China — The application of a perpendicular electric field can drive silicene into a gapless state, characterized by two nearly fully spin-polarized Dirac cones owing to both relatively large spin-orbital interactions and inversion symmetry breaking. Here we argue that since inter-valley scattering from nonmagnetic impurities is highly suppressed by time-reversal symmetry, the physics should be effectively single-Dirac-cone like. Through numerical calculations, we demonstrate that there is no significant backscattering from a single impurity that is nonmagnetic and unit-cell uniform, indicating a stable delocalized state. This conjecture is then further confirmed from a scaling of conductance for disordered systems using the same type of impurities.

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Wei-Feng Tsai
Department of Physics, National Sun Yat-sen University, Taiwan

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