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Probing the Topological Phase Transition via Density Oscillations in Silicene and Two-Dimensional Germanium[1] JIANHUI ZHOU, Carnegie Mellon University, Pittsburgh, PA 15213, USA, HAO-RAN CHANG, Sichuan Normal University, Sichuan, 610066, China, HUI ZHANG, Ohio University, Athens, Ohio 45701, USA, YUGUI YAO, Beijing Institute of Technology, Beijing 100081, China, DI XIAO, Carnegie Mellon University, Pittsburgh, PA 15213, USA — The quantum spin Hall effect (QSHE) has attracted much attention from both theoretical and experimental aspects. First principles calculations predict that low-buckled silicene and two dimensional (2D) germanium are the promising candidates for QSHE. We theoretically investigated two kinds of density oscillations: the Friedel oscillations and collective excitation in the silicene and 2D germanium within random phase approximation. We found that the tunable spin-valley constraint band structure could lead to some exotic properties in the two phenomena. Based on the exact analytical and numerical results, we demonstrated that the beating structure of screened potential as well as the undamped plasmon mode can be taken as a probe of topological phase transition from a band insulator to a topological insulator in silicene and 2D germanium. Our proposal could establish the connection between the topological phase transition and the density oscillations that can be accessed by a variety of experimental techniques.

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