Topological Aharonov-Bohm Interferometers Defined By Inhomogeneous Electric Field In Silicene

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We study topologically protected currents as a source of Aharonov-Bohm oscillations in clean systems in silicene [1]. Chiral channels [2,3] in the system are formed by flips of the electric potential perpendicular to the structure [4,5]. In our calculations we define four terminal system in quantum ring shape (Fig. 1(a)), where two different configurations of resistance measurement are proposed: with current probes plugged to two nearest leads (e.g. 4→1) and (ii) in straight line (e.g. 3→1) as presented in Fig. 1(b) and 1(c), respectively. The current direction is determined by the valley state at Fermi level defined for each input lead. The K and K' valley in channels propagate current in different directions (see Fig. 1(d)), hence the direct cross-transport of the electron (e.g. 1→3) is forbidden due to the lack of backscattering. We show that oscillations of resistance measurement in external magnetic field (Fig. 1(e)) are related to the current confinement at quarters of the ring. The period of these oscillations agree with Aharonov-Bohm interference at n/4 (n=1,2,3,4) of the area of the circle.

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FIGURES

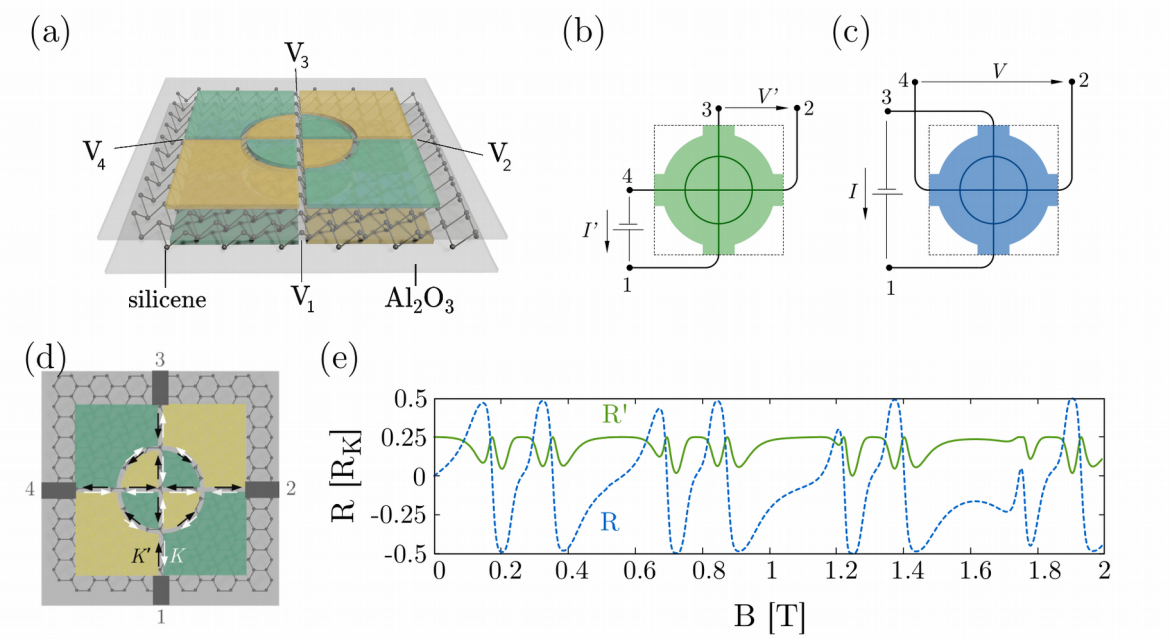

Figure 1: (a) Scheme of the four-terminal system with (d) current direction marked by black (white) arrow for (K') K valley. Conductance measurement configurations (b) R' and (c) R in external magnetic field (e) in units of von Klitzing constant R_K