Spin-Valley Filtering in Strained Graphene Structures with Artificially Induced Carrier Mass and Spin-Orbit Coupling

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References:

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Abstract:

The interplay of massive electrons with spin-orbit coupling in bulk graphene results in a spin-valley dependent gap. Thus, a barrier with such properties can act as a filter, transmitting only opposite spins from opposite valleys. In this Letter we show that a strain induced pseudomagnetic field in such a barrier will enforce opposite cyclotron trajectories for the filtered valleys, leading to their spatial separation. Since spin is coupled to the valley in the filtered states, this also leads to spin separation, demonstrating a spin-valley filtering effect. The filtering behavior is found to be controllable by electrical gating as well as by strain.

Keywords:

spin-orbit, graphene, valleytronics