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Rashba spin-orbit interactions in zigzag graphene nano-ribbons[1]
MAHDI ZAREA, Ohio Univesity, NANCY SANDLER, Ohio University — The crystalline structure of graphene can be described in terms of a pseudo-spin degree of freedom and spinor wavefunctions. This characteristic has important physical consequences not observed in normal semiconductors. For zigzag ribbons, for instance, this translates into the existence of localized chiral edge states, with momentum coupled to pseudo-spin. In the presence of Rashba spin-orbit interactions (RSOI), this special feature makes the material a good candidate to produce localized spin polarized currents. To address this issue we investigated the role of the RSOI on the band-structure and wavefunctions of an infinite graphene plane and a zigzag nano-ribbon. We present analytic and numerical results showing that the spin profile along the edge is state-dependent. We compare these results with the profiles obtained in the presence of the intrinsic spin-orbit interaction [1]. We show that the RSOI can create average localized spin polarized currents along the edges of zigzag ribbons with appropriate applied voltages. [1] Zarea, M., Busser, C. and Sandler, N. PRL 101, 196804 (2008).

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