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Persistent currents in a Kane-Mele graphene ring with armchair edges MING-CHE CHANG, National Taiwan Normal University, BOR-LUEN HUANG, Academia Sinica, CHUNG-YU MOU, National Tsing Hua Univeristy — A graphene nano-ribbon with armchair edges is known to have no edge state. However, if the nano-ribbon is in the quantum spin Hall (QSH) state, then there must be helical edge states. By folding a graphene ribbon to a ring and threading it by a magnetic flux, we study the persistent charge and spin currents in the tight-binding limit. It is found that, for a broad ribbon, the edge spin current approaches a finite value independent of the radius of the ring. For a narrow ribbon, inter-edge coupling between the edge states could open the Dirac gap and reduce the overall persistent currents. Furthermore, by enhancing the Rashba coupling, we find that the persistent spin current gradually reduces to zero at a critical value, beyond which the graphene is no longer a QSH insulator.

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