Abstract Submitted
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Solitons, charge fractionization, and the emergence of topological insulators in graphene rings[1] CONSTANTINE YANNOULEAS, IGOR ROMANOVSKY, UZI LANDMAN, School of Physics, Georgia Institute of Technology — The doubly-connected polygonal geometry of planar graphene rings is found to bring forth topological configurations for accessing nontrivial relativistic quantum field (RQF) theory models that carry beyond the constant-mass Dirac-fermion theory. These include generation of sign-alternating masses, solitonic excitations, and charge fractionization. The work integrates a RQF Lagrangian formulation with numerical tight-binding Aharonov-Bohm electronic spectra and the generalized position-dependent-mass Dirac equation. In contrast to armchair graphene rings (aGRGs) with pure metallic arms,[2] certain classes of aGRGs with semiconducting arms, as well as with mixed metallic-semiconducting ones, are shown to exhibit properties of one-dimensional nontrivial topological insulators. This further reveals an alternative direction for realizing a graphene-based nontrivial topological insulator through the manipulation of the honeycomb lattice geometry, without a spin-orbit contribution.

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[2]I. Romanovsky, C. Yannouleas, and U. Landman, Phys. Rev. B **87**, 165431 (2013)

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