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Imaging massless Dirac fermion flow in graphene nanoribbons LIVIU P. ZÂRBO, Texas A&M University, BRANISLAV K. NIKOLIĆ, University of Delaware — Since its recent experimental discovery, graphene has been the focus of intense theoretical and experimental research. Its unconventional electronic structure characterized by the linear momentum dispersion of electrons which behave as massless Dirac particles at half-filling makes graphene an ideal candidate not only for investigating fundamental physics questions, but also for constructing new nanoscale devices. Despite its importance for device applications, there are very few studies of local features of electronic transport in graphene nanoribbons (GNRs). Moreover, the application of recently advanced scanning probe techniques to imaging electronic flow in graphene is expected to lead to many interesting discoveries. Therefore, we investigate the local features of charge transport through GNRs, by employing our bond current formalism which expresses the local current fluxes flowing between neighboring sites of the hexagonal lattice in terms of nonequilibrium Green functions. We show that, while the charge density profiles for clean zigzag graphene nanoribbons (ZGNRs) close to Dirac point peak at the edges due to the zero-energy edge states, the current densities concentrate towards the nanoribbon center. The analysis of local charge current flow explains unusual transport properties of ZGNRs such as low sensitivity of current flow to edge vacancies or long-range impurities. Journal Ref: EPL **80**, 47001 (2007).

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