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Berry's Phase and Giant Non-Reciprocity in Dirac Quantum Dots JOAQUIN RODRIGUEZ-NIEVA, MILDRED DRESSELHAUS, LEONID LEVITOV, MIT — Recently, nanoscale pn-junction rings have been introduced as a vehicle for coherent control of electronic states in Dirac materials [1]. Confined states in such ring-shaped electron resonators arise due to constructive interference of electronic waves incident at the pn junction at oblique angles and inward-reflected from the ring. Contrary to confined electronic states in conventional quantum dots, Dirac electrons are characterized by a non-trivial Berry's phase. Here we show [2] that the Dirac quantum dot energy levels are sensitive to the Berry's phase. In particular, we predict that the Berry's phase can induce a giant spectral non-reciprocity arising in weak magnetic fields. The effect is maximal for massless Dirac electrons, e.g. graphene, and is manifested in anomalously large splittings of the resonances which are degenerate at B=0 due to time reversal symmetry. This non-reciprocity effect overwhelms the conventional orbital and spin-induced non-reciprocity. The predicted giant non-reciprocity is readily accessible by Faraday and Kerr optical rotation measurements as well as by scanning tunneling spectroscopy. [1] Zhao, et al., Science 348, 672 (2015). [2] JRN, et al., arXiv:1508.06609.

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