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Resonant Tunneling and Intrinsic Bistability in Twisted Graphene Structures JOAQUIN RODRIGUEZ-NIEVA, MILDRED DRESSELHAUS, LEONID LEVITOV, MIT — Bistable systems exhibit several distinct macroscopic states and can switch between them upon variation of some control parameter. Nonvolatile electronic systems that exhibit intrinsic bistability and fast switching times are desirable for low-power memory and logic. Experimental realizations of such systems, however, are scarce. We propose a novel mechanism for intrinsic bistability in van der Waals heterostructures formed by twisted graphene monolayers. Bistability in these systems originates from resonant tunneling and charge coupling between different graphene layers. These characteristics, governed by Dirac-like spectrum and Moiré periodicity of the tunneling Hamiltonian, allow multiple stable states in the sequential tunneling regime. In the bistability region, an intermediate electrically decoupled graphene layer can, for the same external bias, be either in a resonant or non-resonant state with respect to the top/bottom layer. Features of interest, such as resonant tunneling, negative differential resistance and bistability, are controlled by parameters easily accessible in experiments, namely the twist angle and interlayer conductances. We estimate the power required to retain this state, switching times, and assess volatility of such intrinsically bistable systems.

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