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Electronic properties of graphene antidot lattices VLADIMIR M. STOJANOVIC, University of Basel, Switzerland, MIHAJLO VANEVIC, TU Delft, The Netherlands, NENAD VUKMIROVIC, Lawrence Berkeley National Laboratory, MARKUS KINDERMANN, Georgia Institute of Technology — We study graphene antidot lattices – superlattices made by perforating voids in a graphene sheet. We show that, due to their bipartite structure, such lattices display zero-energy flat bands . We also find quasi-flat bands at low energies resulting from the presence of lattice-scale defects in the system and argue that the ensuing localized electron states compete with the states induced by the superlattice-scale defects that have been proposed as hosts for electron-spin qubits. For representative antidot lattices, we predict the real-space electron density profiles due to both flat and quasi-flat bands. We also investigate the effect of phonons in antidot lattices using a model that accounts for the phonon-modulation of the hopping integrals. Based on the adopted model, we quantify the nature of charge carriers by computing the conduction-band quasiparticle weight due to the electron-phonon coupling. We find a strong phonon-induced renormalization, which provides an indication of polaronic behavior and points to the necessity of taking into account the inelastic degrees of freedom in future studies of graphene antidot lattices.

Vladimir Stojanovic
University of Basel

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