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Interplay between electron-phonon and Coulomb interactions in the honeycomb lattice LAURA CLASSEN, MICHAEL M. SCHERER, Institute for Theoretical Physics, University Heidelberg, CARSTEN HONERKAMP, Institute for Soild State Physics, RWTH Aachen University and JARA - FIT Fundamentals of Future Information Technology — We study the impact of electron-phonon interactions on the many-body instabilities of electrons in the honeycomb lattice and their interplay with local and non-local short-ranged Coulomb interactions at charge neutrality. Therefore, we consider the in-plane optical phonon branches giving the most important contribution to the electron-phonon coupling and calculate the effective phonon-mediated electron-electron interaction by integrating out the phonon modes. The ordering tendencies are studied by means of a momentum-resolved functional renormalization group approach allowing for an unbiased investigation of the appearing instabilities. In the case of an exclusive and supercritical phonon-mediated interaction, we find a nematic ground state being favored over the s-wave superconducting state conjectured from a simple mean-field treatment. We further discuss the influence of phonon-mediated interactions on the instabilities induced by onsite, nearest neighbor and next-nearest neighbor density-density interactions. We find an extension of the parameter regime of the spin density wave order going along with an increase of the critical scales where ordering occurs.

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