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**Interplay of superconductivity and electrically controlled band structure in silicene 0-$\pi$ transitions, $\varphi_0$-junctions, Majorana bound states, and odd-frequency superconductivity** DUSHKO KUZMANOVSKI, ANNICA BLACK-SCHAFFER, Department of Physics and Astronomy, Uppsala University, JACOB LINDER, Department of Physics, NTNU, Norwegian University of Science and Technology — Silicene, the Si-atom analog of graphene, is a viable candidate for experimental realization of non-trivial topological phases due to the larger spin-orbit coupling. Also, owing to the buckled structure, it allows for tuning of its various band gaps by an applied electric field. An intriguing prospect is to consider effects due to the interplay between the non-trivial band structure and superconducting correlations in silicene, and to study the external control of such unusual phenomena via an electric field. We demonstrate theoretically that proximity-induced superconductivity in silicene offers the possibility to exert strong quantum ground state control. We show that electrically controlled 0-$\pi$ transitions occur in Josephson junctions in the presence of an exchange field. We also discover that zigzag-oriented interfaces, featuring intervalley scattering, cause a $\varphi_0$ state with an applied electric field. Additionally, we demonstrate that Majorana bound states along the silicene edge are tunable via the edge orientation, electric, and in-plane spin exchange fields. Finally, we investigate odd-frequency superconducting pair amplitudes in both bulk silicene, and nanoribbons with two kinds of edges.

Dushko Kuzmanovski
Department of Physics and Astronomy, Uppsala University

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