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Electrostatic effects in Majorana hybrid structures PIYAPONG SITTHISON, TUDOR STANESCU, West Virginia University — We study the electrostatic effects that emerge in proximity-coupled semiconductor- superconductor (SM-SC) structures due to the charge transfer induced by the work function difference between the two materials. The effects are described theoretically using a tight-binding model of the heterostructure solved within a self-consistent Poisson-Schrodinger scheme. We find that these effects are responsible for i) generating an effective Rashba-type spin-orbit coupling and ii) modifying the spatial dependence of the low-energy wave functions near the SM-SC interface. This change in the wave-function amplitude at the interface strongly affects the proximity-induced superconducting gap. Both effects have critical consequences on the stability of the Majorana-hosting topological superconducting phase that is predicted to emerge in this type of structures. For a thin-film geometry, we determine the dependence of the effective spin-orbit coupling and induced superconducting gap on the film thickness and on the strength of the SM-SC coupling.

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