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Finite two-dimensional electron gas in a patterned semiconductor system[1] ORION CIFTJA, VICTORIA LIVINGSTON, ELSA THOMAS, SETH SAGANTI, Prairie View AM University — On various occasions, fabrication of a two-dimensional semiconductor quantum dot leads to a small system of electrons confined in a domain that is not circular and may have a pronounced square (or rectangular) shape. In this work we consider a square-shaped semiconductor quantum dot configuration and treat the system of electrons as a finite two-dimensional electron gas. Within this framework, we adopt a Hartree-Fock approach and study the properties of a small two-dimensional system of electrons confined in a finite square region. We calculate the energy for various finite systems of fully spin-polarized (spinless) electrons interacting with a Coulomb potential. The results give a fairly accurate picture of how the energy of the finite system evolves towards the bulk value as the size of the system increases. The calculations for a square domain are challenging since expressions depend in each component of particle's position and not the radial distance from the center of the square-shaped semiconductor quantum dot. Therefore, we also consider a possible circularly symmetric approximation to the problem. We assess the quality of this approximation and discuss instances where its use is not only desirable, but also accurate.

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