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Temperature-Dependent Band Structure of $LaAlO_3/SrTiO_3$ Interfaces

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In recent years, the two dimensional electron gases (2DEG) that form at some oxide interfaces have attracted worldwide attention due to their fascinating properties such as
conductivity, superconductivity, and magnetic order.
Here, we build a theoretical model for exploring the electronic properties of the 2DEG at $LaAlO_3/SrTiO_3$ interfaces considering the strong dependence of the dielectric constant of $SrTiO_3$ on temperature, electric field, and wave vector.
We model the $SrTiO_3$ dielectric properties using Landau-Ginzburg theory for the polarization.
By solving a set of self-consistent Hartree equations
for the charge density and lattice displacement, we obtain the band structure and charge density profile for the $SrTiO_3$ film at different temperatures and different doping.
We find that the charge density is less confined to the interface at low temperatures and low doping.

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