Electronic Structure of Graphene

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Recently it shown that polarization of a two-dimensional graphene sheet by an external charge produces an attractive image potential that supports, in addition to the well-known π* bands, a double series of Ridberg-like image potential states converging onto the vacuum level. Being quantified in the perpendicular to the graphene sheet direction, in the parallel plane these states have nearly free electron character like similar states on metal surfaces. A large extension of wave function of image-potential states into the vacuum implies that they are very sensitive to any change of shape and environment of the graphene sheet. Thus the properties of these states can be modified by an external electric field and a shape/geometry variation. The lowest-energy members of such states have been experimentally observed in graphene sheets grown on some substrates.

Some examples of the such unoccupied electronic states in other cabon-based materials, like graphite, multilayer graphene, fullerenes, and nanotubes as having common origin with the graphene image-potential states will be presented.