## Quantum interference effects in light absorption

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## (https://www.aps.org/)

When light is absorbed by a semiconductor, electrons move from valence bands to conduction bands, and the charge distribution changes. In the sketch below the situation is shown for GaAs, with the charge distribution in the valence bands on the left (a) and its modification shown on the right (b) after photomomental sorrest and the second in Addiated the charge some content the left exactly in Addiated the charge some the left exactly in Addiated the charge some content to be the second structure of the second second structure of the second structure o

This project will focus on the calculation of these processes, in typical materials and in topologically nontrivial materials where to date they have been much less investigated. A comfortable familiarity with 3<sup>rd</sup> year quantum mechanics is required, as well as an openness to do a "quick study" of the kind of perturbation theory required to describe absorption processes, and to familiarize yourself with the Bloch functions (if you're not familiar with them already!) that are introduced in condensed matter physics. You should not be averse to writing and using computer codes.

We also hope to look at how these processes are affected if nonclassical light, such as squeezed states of light, are used in the absorption processes. So an interest in quantum optics is required, although an initial familiarity with it is not.

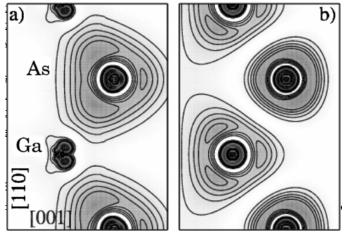


Figure 1

A plot of the electron density in the [110] plane of GaAs. Panel (a) shows the electron density of the highest  $\Gamma$  valence electron, and panel (b) the electron density of the lowest  $\Gamma$  point conduction band. Dark regions correspond to higher densities. The densities in panel (b) have been multip two since the lowest conduction band  $\Gamma$  point is twofold degenerate whereas the highest valence band  $\Gamma$  point is fourfold degenerate.

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