B. Bandstructure

The dipole moments which govern the EIT characteristics are determined using eight-band $\vec{k} \cdot \vec{p}$ theory including strain effects. We study the conical quantum dots shown in Fig. 2. The dot material is InAs and the barrier material is GaAs. Both InAs and GaAs are

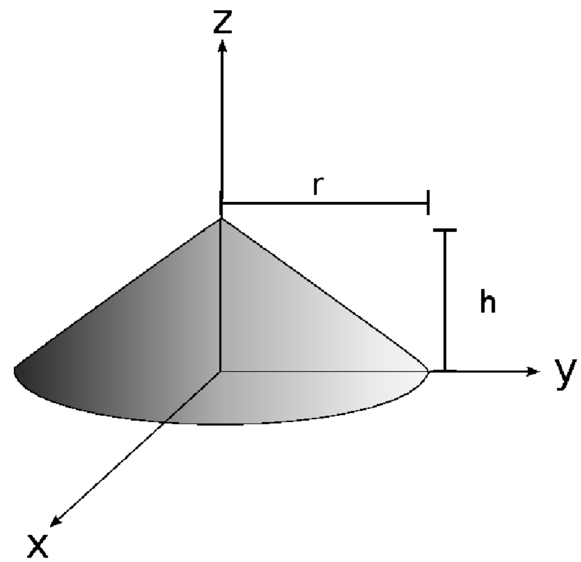

FIG. 2: The shape of the quantum dots under consideration.

zincblende materials so in order to reduce the problem to a two dimensional model we disregard anisotropy effects. This entails that we disregard phenomena such as piezoelectricity and atomistic anisotropic effects[32,33]. The atomistic anisotropic effects have been investigated by Bester and Zunger[34] showing that they lead amongst other things to a splitting of states which in our model are degenerate. This splitting is however less pronounced for cylindrical shaped quantum dots as studied here. Recently it has been shown that second order piezoelectric terms effectively cancel linear piezoelectric effects for cylindrical shaped quantum dots. [19,35,36] We have checked the isotropic assumption and found a maximum error for the strain fields of 8% along the z axis, going rapidly to zero at the edges of the dot.

We investigate both the effect of strain and band mixing. The effect of band mixing is determined by comparing the eight-band results with one-band model results for the conduction band and the heavy holes. Due to the lattice mismatch present in the systems under consideration in this paper (InAs/GaAs quantum dots) the materials will be strained.