Abstract Submitted
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Spin-orbit coupling and curvature effects on the static polarizability of single-wall carbon nanotubes[1] S. E. ULLOA, G. S. DINIZ, Department of Physics and Astronomy, Ohio University — Carbon nanotubes (CNTs) are known to exhibit metallic or insulating behavior for different chiral vectors. Application of external electric fields and the presence of spin-orbit interaction (SOI) result in modification of the energy level structure of CNTs and their electrical response functions. SOI is known to significantly couple spin and orbital degrees of freedom in these nanostructures [1], and we consider interesting related effects. In particular, we present here calculations of the static dielectric response of different single-wall CNTs in the long-wavelength limit regime when subjected to uniform external electric fields both along and across the longitudinal direction (parallel to the nanotube axis). Our calculation uses a four-orbital tight-binding following the Slater-Koster formalism and includes the effect of finite curvature on the CNT. We consider Rashba and intrinsic SOIs, and use a random phase approximation to evaluate $\epsilon(q \to 0, \omega = 0)$. We find that the metallic-to-semiconductor transition induced by the intrinsic SOI is suppressed as the Rashba field is taken into account. We further show that this behavior has a clear signature on measurable quantities, such as the static polarizability. We discuss the dependence of these effects on nanotube size, field strenghs, and curvature.
[1] F. Kuemmeth et al., Nature 452, 448-452 (2008).

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