Invited

Pseudo-spin-dependent scattering in carbon nanotubes

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The electronic scattering properties of defected armchair single-walled carbon nanotubes are investigated by analytical and numerical methods [1-3]. Evaluation of the local density of states and its Fourier transform shows that electron scattering depends on the interplay between tube and defect symmetries [3]. Particularly, the conservation of the pseudo-spin and particle-hole symmetry plays a crucial role. It is shown that the lack of the latter is responsible for the pseudo-spin selection rules observed in the experiments by Ouyang et al. [4]. The symmetry breaking arises from the lattice reconstruction appearing, e.g., in 585 di- vacancies and Stone-Wales defects. We report also comparison with other experiments [1,5]. Our results could pave the way for a possible pseudo-spin filter device.

References

[1] G. Buchs, D. Bercioux, et al., Phys. Rev. Lett. 102, 245505 (2009).
[2] D. Bercioux, et al., Phys. Rev. B 83, 165439 (2011).
[3] L. Mayrhofer & D. Bercioux, Phys. Rev. B 84, 115126 (2011).
[4] M. Ouyang, J.-L. Huang, and C. M. Lieber, Phys. Rev. Lett. 88, 066804 (2002).
[5] J. Lee, et al., Phys. Rev. Lett. 93, 166403 (2004).

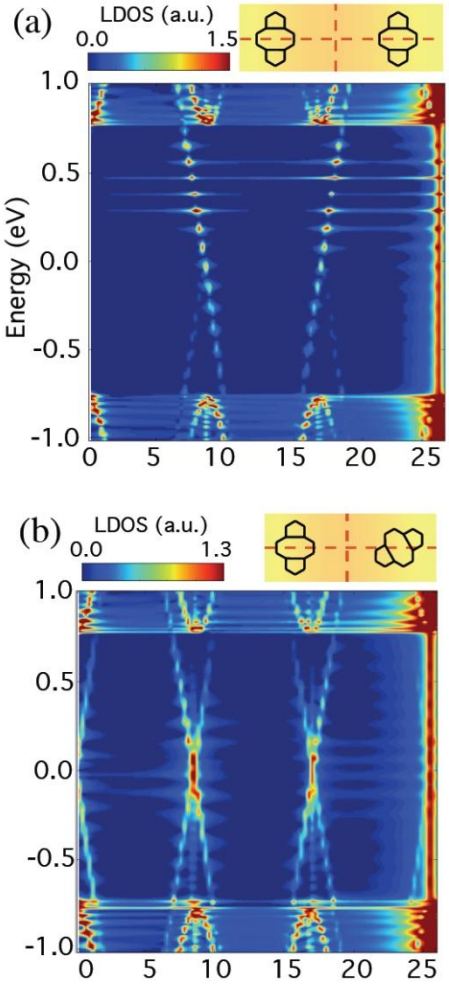

Figure 1. Density plot of the Fourier transformed local density of states as a function of the exchanged momentum and energy for the case of two 585 DV defects with t_D = 0.5t. In panel (a) we consider two Type I DV defects, in panel (b) two Type I and Type II DV defects. The signal at k ~ 25.5 nm^{-1} is associated with Rx, the smallest length scale of the armchair SWNT along the x axis [3].