Plasmon Modes of Peapod Nanotubes

Slava V. Rotkin

Beckman Institute for Advanced Science and Technology, UIUC, 405 N.Mathews Avenue, Urbana, IL 61801, USA
e-mail: rotkin@uiuc.edu

I implement continual semi-classical modeling of the calculation of plasmon frequencies in fullerene structures in [1]. It was shown that a plasmon excitation of a single cluster will develop into plasmon-Frenkel-type-exciton (PFE) in the lattice. Dispersion of new plasma modes were obtained for three-dimensional (3D), 2D and 1D systems.

Recent discovery of fullerene peapods (Figure 1) and study of their electronic structure by means of EELS and other electron spectroscopy revived the model of PFE.

A transverse branch of plasmon modes was calculated for a single nanotube on a base of micro-model [2].

Combination of these two models for plasmons in carbon structures with a similar density of electrons yields the plasmon mode dispersion for the peapods.

In conclusion, a new approach is proposed for a calculating a high frequency response function of a single peapod and ordered peapod material.

Acknowledgements. Author acknowledges support through a CRI grant of UIUC, DoE grant DE-FG02-01ER45932, NSF grant ECS-0210495, RFBR grant 00–15–96812 and Beckman Fellowship from the Arnold and Mabel Beckman Foundation.

References:

[1] V.V. Rotkin, R.A. Suris, "C60 electron collective excitation nature", in *Fullerenes. Recent Advances in the Chemistry and Physics of Fullerenes and Related Materials*. v.III. Eds: R.S.Ruoff and K.M.Kadish. ECS Inc., Pennington, NJ, 1996, 940–959.

[2] Y. Li, S.V. Rotkin and U. Ravaioli, "Electronic response of nanotubes in transverse electrical field", submitted, 2002.

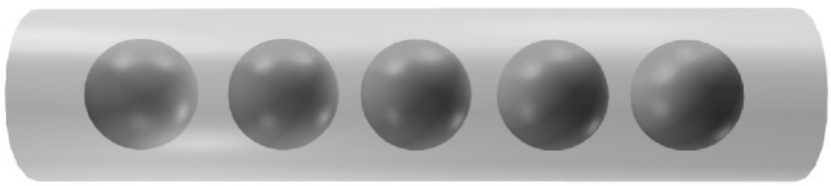

Figure 1 The peapod structure studied in the paper. The interaction between dipole plasmons of a single fullerene cluster and transverse plasmons of a nanotube results in developing new plasmon modes of the system.