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Electrodynamical forbiddance of the strong quadrupole light-molecule interaction and its manifestation in fullerene C₄₀

A t present it is well proved in our works that the reason of SERS, SEHRS and SEIRA is so-called strong quadrupole light-molecule interaction, which arises in surface electromagnetic fields strongly varying in space near a rough metal surface. This interaction is associated with terms of the light-molecule interaction Hamiltonian with the quadrupole moments Q_{xx} , Q_{yy} and Q_{zz} , or their linear combinations transforming after the unit irreducible representation of the molecule symmetry group, which results in appearance of strong forbidden lines in molecules with sufficiently high symmetry. The general requirement for observation of these lines is belonging of the molecule to the symmetry group, where the component of the dipole moment d_z , which is perpendicular to the surface transforms after the irreducible representation another, than the unit one. However, it appears that for the molecules, which belong to the cubic symmetry groups T, T_{a^2} , T_h , O, O_h and the icosahedral groups I and I_h the strong quadruple light-molecule interaction in these molecules is of a purely dipole type. This property must result in the absence of the lines with the unit irreducible representation in the SEIRA and SEHRS spectra of molecules, belonging to these groups. The absence of the indicated lines at 496 and 1470 cm⁻¹ was observed in fullerene C_{60} that strongly supports the Dipole-Quadrupole theory of the indicated processes.

Biography

Aleksey Mickhailovich Polubotko graduated from Physical faculty of Leningrad State University in 1973. He completed his PhD in A.F. loffe Physico-Technical Institute Russian Academy of Sciences and defended the PhD thesis in Azerbaijan Institute of Physics in Baku in 1983. Currently, he works as a physicist theorist and a senior scientific researcher of the sector of semi-conductors and Dielectrics of the Department of Dielectrics and Semiconductors of A F loffe Physico-Technical Institute in Saint Petersburg. He has more than 120 scientific papers, preprints and abstracts published in reputed journals and reported on many scientific conferences.

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