

Corrections to the Casimir-Polder Potential due to Electric Octupole Coupling

A. Salam

Department of Chemistry, Wake Forest University, Winston-Salem, NC 27109,

USA

It is shown that by decomposing the electric octupole moment into its irreducible components of weights 1 and 3, corrections to the electric dipole-dipole dispersion energy arise from the former contribution. These manifest in energy shifts between a dipole polarizable molecule and a second that is either mixed dipole-octupole polarizable or purely electric octupole polarizable, or between two mixed dipole-octupole polarizable species. Molecular QED theory [1-3] is used to evaluate these interaction energies. Interestingly, it is found that the isotropic forms of the first and third potentials mentioned above are independent of the octupole weight-3 term and contain no static contributions, therefore resulting in no true near-zone asymptotically limiting form, unlike the second interaction, which depends on both octupole weights [4].

- [1] D. P. Craig and T. Thirunamachandran, *Molecular Quantum Electrodynamics*, Dover, New York, 1998.
- [2] A. Salam, *Molecular Quantum Electrodynamics*, John Wiley & Sons, Inc., Hoboken, 2010.
- [3] A. Salam, *Non-Relativistic QED Theory of the van der Waals Dispersion Interaction*, Springer, Cham, 2016.
- [4] A. Salam and T. Thirunamachandran, *J. Chem. Phys.* **104**, 5094 (1996).