Iranian Journal of Physics Research, Vol. 21, No. 4, 2022

The evaluation of the interaction potential of two non-polar molecules in Green function approach

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(Received 27 March 2020 ; in final form 10 August 2021)

Abstract

In this research, by assuming that the vacuum electric field fluctuations can convert a molecule (or an atom) into an oscillating electric dipole, the interaction potential of the two atoms or two non-polar molecules is calculated in terms of the molecular polarizabilities and the distance between them. Considering the net electric field at the position of a molecule as a sum of the vacuum electric field and the electric field due to the induced electric dipole of the other molecule, and substituting in the quadratic stark shift formula, the interaction potential of the two molecules is related to the vacuum electric field correlation function. By writing the interaction potential in terms of the imaginary parts of vector potential Green function tensor components (via the fluctuation-dissipation theorem and Kubo's formula in statistical mechanics) and computing the required Green function components, the interaction potential between the two molecules is evaluated. The small and large distances limits of the general formula investigated and the consistencies with the previous works are shown.

keywords: vacuum electric field, quadratic Stark efect, molecular polarizability, electric field correlation function, fluctuation-dissipation theorem, vector potential Green function

For full article, refer to the Persian section