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Vibrationally dependent interactions of cold molecules SVETLANA KOTOCHIGOVA, Temple University — Controllable dipole-dipole interaction between polar molecules in an optical trap lies at the heart of many proposals to exploit entanglement as an essential resource for strongly correlated many-body states and quantum information processing. Even though polar molecules have a permanent electronic dipole moment and interact at large internuclear separations R via dipole-dipole interactions, at shorter distances Van der Waals forces prevail. Here we study the vibrationally dependent short-range interactions between cold molecules and cold molecules with their constituent atoms. The interaction coefficients are obtained by integrating the product of the dynamic polarizabilities $\alpha(i\omega)$ over imaginary frequencies. Both the parallel and perpendicular components of the dynamic polarizability are calculated. The calculation is done for the polar RbCs and KRb molecules and its constituent atoms. This data can be used to estimate limits on the collisional lifetime of molecules in optical traps and find microscopic mechanisms by which the losses occur. The ultimate goal is to find optimal experimental conditions to diminish these many-body losses. The author acknowledges support of this work by ARO.

Svetlana Kotochigova
Temple University

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