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Long-Range Tails in van der Waals Interactions[1] ULRICH JENTSCHURA, CHANDRA ADHIKARI, VINCENT DEBIERRE, Missouri Univ of Sci Tech — We investigate the oscillatory long-range tails of long-range interatomic interactions, based on a quantum electrodynamic formalism. The matching of the scattering amplitude to the effective Hamiltonian conclusively answers any questions regarding the placement of the so-called pole terms, which correspond to a very particular physical process, namely, virtual resonant emission into an energetically lower atomic state. The resonant process leads to conceptually interesting, but numerically small, oscillatory long-range tails. These tails drastically differ from the predictions of Casimir-Polder theory [Phys. Rev. Lett. 118, 123001 (2017)]. Phenomenologically, it is interesting to note that for the first time, we are now in the position to also calculate the short-range, non-retarded, van der Waals effects for systems involving excited (Rydberg) atoms. The van der Waals coefficients, in atomic units, are found to be in the range of a few 100,000. The calculations enable us to estimate the pressure shift of such transitions, which are crucial for the determination of fundamental constants from current, and planned, high-precision measurements involving simple atomic systems.

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