

Manifestation of zero-point quantum fluctuations in atomic force microscopy

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Based on rigorous quantum-field theory, long-range probe-sample dispersion forces in atomic force microscopy are analyzed. The interactions, being attractive or repulsive, can be divided into a purely geometrical part, depending on probe geometry and working distance, and a solely material-dependent part given in terms of the dielectric permittivities involved. The calculations are consistent with published experimental data and promise new analytical possibilities opened by "dispersion microscopy."