

Formulas for force on a insulative sphere near a conductive wall

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Abstract— A charged particle is attracted to a conductive wall by a force that depends on the size, shape, and position of the particle, the magnitude and distribution of the charge, and the dielectric constants of the particle and the surrounding medium. This force is calculated analytically for a uniformly charged sphere by solving for the electric field distribution in bipolar coordinates, and then integrating the Maxwell stress tensor over a surface enclosing the particle. The result is an infinite series of transcendental functions that converges very slowly when the particle is close to the wall, and is thus impractical for everyday use in design or understanding. Simpler approximate closed-form expressions are derived, and illustrated with a trajectory calculation.