Modeling of surface tension of spherical charged aerosol clouds at the altitude of standard atmosphere

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Spheres of charged microparticles (Coulomb spheres) are observed in plasmas of low-pressure gas discharges at various gas temperatures. Coulomb spheres, similar to those obtained in the laboratory, can hypothetically exist in aerosol clouds of the Earth's atmosphere and mesosphere under influence of electrical phenomena. At atmospheric pressure, similar long-lived spherical plasma formations are observed near the Earth's surface and in the lower atmosphere in the form of a ball lightning. It can be assumed that some natural ball lightnings, like Coulomb spheres, consist of charged particles. To calculate the surface tension of a Coulomb sphere in plasma, the potential model was used with the hydrodynamic model of a positive column with charged microparticles [1, 2]. The surface tension coefficients of Coulomb spheres and potential energy of microparticles on the spheres surfaces in neon glow discharge for particles with a diameter of 4 and 2 μm at a temperature of 77 and 295 K, respectively, were calculated. The experimental values of pressure were reduced to the values corresponding to the altitude of standard atmosphere (35–60 km). The obtained values of the surface tension coefficient are compared with the data obtained by other authors for ball lightnings. The small value of the surface tension of the Coulomb spheres excludes their autonomous existence outside the gas-discharge plasma.

[1] Polyakov D N, Shumova V V and Vasilyak L M 2021 *Phys. Lett. A.* **389** 127082

[2] Polyakov D N, Shumova V V and Vasilyak L M 2023 *Russ. J. Phys. Chem. B* **17** 1241–1245