



To terrestrial planets upper atmosphere superrotation

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We considered the kinetics of a rarefied exosphere replenished by particles injected from a spherical surface inside which collisions are significant. As we have shown, peculiarities of the motion of a rarefied gas in the gravitational field of a slowly rotating planet, Venus, Earth and Mars, can give rise to superrotation.

We have shown that one of the superrotation mechanisms for rarefied planetary atmospheres is the separation of particles: some of them fly away from the planet, while others become its satellites. Based on the proposed mechanism, we estimated the superrotation for the exospheres of Venus, Earth, and Mars.

Our main results are as follows.

- 1) We found an exact solution of the boundary value problem for the two-dimensional collision less Boltzmann equation that includes particles with elliptical and hyperbolic orbits.
- 2) We obtained and analyzed the solution of the kinetic equation with weak elastic collisions.

We determined the spatial distributions of the atmospheric-gas density and mean angular velocity and established the possibility of exospheric superrotation. In conclusion, it should be emphasized that the separation of particles with weak collisions is a universal, although, probably, not the only superrotation mechanism for an upper rarefied slowly rotating atmosphere.