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Direct comparison of hydrodynamic and kinetic models for thermal escape problems ALEXEY VOLKOV, Univ of Alabama - Tuscaloosa — Thermal escape is the process of mass loss of a planetary atmosphere by gas molecules who leave the atmosphere with translational energies exceeding the gravitational binding energy. Application of hydrodynamic models to thermal escape problem is not straightforward, because they require boundary conditions in the exosphere, where flow is non-equilibrium. The goal of the present work is to study the properties of the hydrodynamic model of atmospheric escape and to establish the domain of its validity by means of systematic comparison of results of hydrodynamic and kinetic simulations. The consideration is limited by Parker's model, which implies the search of solutions of one-dimensional hydrodynamic equations with a critical point and vanishing temperature far from the source. Thermal escape described by Parker's model is found to occur in the low-density regime, when escape is dominated by heat conduction, and the high-density (HD) regime, when escape is dominated by adiabatic expansion. The comparison of results of hydrodynamic and kinetic simulations shows that Parker's model is capable of describing escape only in the HD regime. Based on this finding, a criterion of validity of Parker's model is developed in terms of the source Knudsen number and Jeans escape parameter.

Alexey Volkov
Univ of Alabama - Tuscaloosa

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