

**Internal Free Boundary Problem for Cold Plasma Equations**

**Научный руководитель – Розанова Ольга Сергеевна**

***Коновалова Анна Витальевна***

*Аспирант*

Московский государственный университет имени М.В.Ломоносова,

Механико-математический факультет, Москва, Россия

*E-mail: a.kosheeva2014@yandex.ru*

1. We study a 1D cold plasma model with two media having different constant background ion densities, separated by an unknown internal interface. The problem is posed as a Riemann problem, where the interface position is part of the solution.
2. The interface is treated as a strongly singular free boundary carrying a delta-type mass concentration. Its motion is governed by generalized Rankine–Hugoniot conditions together with an entropy (stability) condition formulated in terms of Lagrangian characteristics.
3. When characteristics intersect, smooth solutions break down and the evolution proceeds via alternating singular shock waves and rarefaction regions. In contrast to the constant-background case, each rarefaction region here must still contain a singular shock at the interface.
4. Depending on the ratio of background densities, the interface inside a rarefaction region can be attached to two rarefaction waves or to one rarefaction wave and a spatially homogeneous state, and these configurations may switch multiple times. For commensurate oscillation periods, the pattern in the characteristic plane is periodic but structurally very rich.
5. The resulting free-boundary problems are nonlinear, degenerate, and may force loss of smoothness of the interface at switching points. This raises difficult open questions on existence, uniqueness, and robust numerical computation of such singular solutions.