Ponderomotive model of plasma confinement and border formation in astrophysical jets

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Jets (highly collimated plasma outbursts) is a widely-spread phenomenon in astrophysics. The research is devoted to the problem of the jet self-collimation and the jet border formation. We develop a self-consistent model of plasma trapping inside the jets under the assumption that on the jet boundaries there is a ponderomotive potential force, preventing particles from crossing the jet boundary. The ponderomotive force is created by the long-living low-frequency surface electromagnetic waves propagating along the jet boundaries, due to the non-equilibrium state of plasma. The electric field in the surface waves is amplified in the inhomogeneous plasma, due to the plasma resonance effect. We simulate non-linear self-consistent structures (interdependent profiles of plasma density and of the ponderomotive potential), which can occur at the boundary of an astrophysical jet. The necessary calculations have been performed to justify the model and to compare it with the already known theoretical and experimental results. In the report we present our results of the modeling.

References

[1] A.A. Dubinova, Vl.V. Kocharovsky, Proceedings of the International Astronomical Union (2010), 6, pp. 239-242.