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# MHD Simulation of Solar Wind Interaction with comets with the CASIM code

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The Cometary Atmosphere Simulator (CASIM) is designed to simulate in three dimensions the complex interaction between the cometary atmosphere and the hypersonic solar wind using a multi-fluid approach. Our simulator is based on the solution of multi-fluid equations using an efficient adaptive Cartesian mesh. It is designed to use the capabilities of highly parallel super-cluster computers [1].
The CASIM code is based on a real-time computational combination of two elements:
1. A magnetohydrodynamic element that solves in three dimensions the ideal MHD equations for ion, neutral and electron groups using an adaptive MUSCLLax-Friedrich algorithm.
2. A chemical element that evaluates the contribution of reactions of various species in the coma.
This combined approach leads to a more accurate representation of the cometary atmosphere since additional details of the interaction between the neutral gas and the plasma and their resulting structures are revealed. In particular, the multi-fluid representation of the ion and neutral populations gives an improved view of the coupling between heavy and light molecules and the resulting coma boundaries at different spatial scales.
In this paper we present the latest version of the CASIM code, describe its capabilities, and show the latest cometary simulations. In those simulations we investigate more precisely the evolution of the interaction between the cometary atmosphere and the solar wind starting from the early stages of the cometary outgassing to the peak of its activity. One of the interesting results of these examples is that it reproduces the expected electron and ion temperature profiles and shows the expected electron cooling effect by water molecules in the inner coma.

## References

[1] M. Benna, et al., *Astrophys. J.* **617**, 1, 656 (2004)