

# Cloud collisions inducing molecule formation in the atomic interstellar gas

P. Lesaffre<sup>1</sup> P. Hennebelle<sup>2</sup>  
and M. Gerin<sup>2</sup>

<sup>1</sup>Institute of Astronomy, Madingley Road, Cambridge CB3 0HA, UK  
email: lesaffre@cam.ac.uk

<sup>2</sup>LERMA, Observatoire de Paris and ENS, CNRS UMR8112, 24 Rue Lhomond, 75231 Paris  
cedes 05, Fr  
email: patrick.hennebelle@lra.ens.fr, gerin@lra.ens.fr

## Abstract.

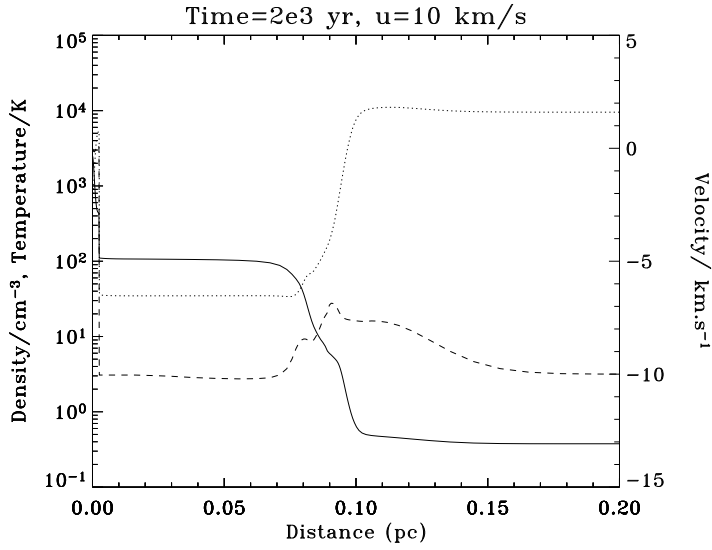
The chemistry that takes place in the diffuse interstellar gas appears to be rich and complex, the abundance (or even the presence) of some species is not fully understood yet (e.g.  $\text{H}_3^+$  or  $\text{CH}^+$ ). Most of the studies attempting to reproduce the abundance of chemical species assume either chemical equilibrium or stationarity. However it is now well established that the interstellar diffuse gas is out of equilibrium. Here we study the impact of a collision between 2 CNM clouds on the chemistry. Since the problem involves a large range of spatial and temporal scales, special numerical techniques are required. We use the implicit, 1D moving mesh code presented in Lesaffre et al. (2004). During the collision the cloud becomes highly inhomogeneous. A shocked layer forms, in which both high and low temperatures develop, as well as high densities. The building of a high density core increases drastically the formation rate of several species, while other species trace the shock layer. As soon as molecular hydrogen is formed,  $\text{H}_3^+$  appears in the medium density CNM phase.

**Keywords.** ISM : clouds, ISM : molecules , ISM : evolution, ISM : structure, hydrodynamics, astrochemistry

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## References

Lesaffre, P., Chize, J.-P., Cabrit, S. & Pineau des Forêts, G. 2004, *A&A* 427,147



**Figure 1.** Structure of the simulated cloud at  $t = 2000$  yrs for a shock velocity of  $10 \text{ km.s}^{-1}$ . The gas density ( $\text{cm}^{-3}$ , full line), the gas temperature (K, dotted line) and the velocity ( $\text{km.s}^{-1}$ , dashed line) are plotted as a function of the distance from the cloud midplane. Note the interface between the warm neutral medium (WNM, with  $T \sim 10^4 \text{ K}$ ) and the cold neutral medium (CNM,  $T \sim 40 \text{ K}$ ) at a distance of 0.1pc.