FRAGMENTED MOLECULAR COMPLEXES: THE ROLE OF THE MAGNETIC FIELD IN FEEDING INTERNAL SUPERSONIC MOTIONS

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A hierarchical structure for molecular complexes (mean density $\sim 10 cm^{-3}$, mass larger than a few $10^5 M_\odot$) in their "cold" phase i.e. preceeding the formation of massive stars, has been derived from extensive large scale $^{13}CO(J=1-0)$ observations: the mass is found to be distributed into virialized clouds which fill only a very low fraction ($\sim 10^{-2}$) of the volume of the complex and are supported against gravity by internal supersonic motions.

We have found an efficient mechanism to transfer kinetic energy from the orbital motions of the clouds to their internal random motions. The large perturbations of the magnetic field induced at the cloud boundaries by their interactions with their neighbours generate systems of hydromagnetic waves trapped inside the clouds. The magnetic field lines being closely coupled to the gas at the densities which prevail in the bulk of the clouds volume (a few 100 cm^{-3}), internal velocity dispersion is thus generated.

Although our approach relies on an analytical solution obtained when shear only is considered, the interesting conclusions are:

i) the computed internal velocity dispersion of the clouds is comparable to the values deduced from the observed linewidths,

ii) the energy pumping rate allows the internal velocity dispersion to be fed over several 10^7 years, an order of magnitude longer than the dissipation timescale of the supersonic motions.

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