[IM07] Properties of the Clumps Generated by the Parker-Jeans Instability

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In a magnetized gas disk under the simultaneous influence of self- and external gravities, the Parker and Jeans instabilities are expected to generate structures with scales of the HI super-cloud and GMC as well. Particularly perturbations of undular mode lead the ISM disk to bear out condensations of two distinctly different scales. The Jeans gravitational instability is responsible for the larger one of the two, while the Parker is for the smaller one. The relative importance of the self- and external gravities would determine the competition in the growth rate between the structures of the two different origins. We have made MHD simulations for three choices of the self- and external gravity combination. They correspond to the cases where the growth rate of the Jeans instability is higher, more or less the same as, and lower than the Parker. From the simulation results we have identified clumps and followed up their physical and geometrical properties as functions of time. Among the properties included are the mass, density, velocity, velocity dispersion, and volume occupation fraction. We have modelled the clumps as ellipsoids and located their principal axes with respect to the Galactic coordinate axis. The set of three MHD simulations will be compared in terms of the clump properties. This will suggest us how the giant molecular clouds and HI super-clouds may have formed in the Galaxy. We will also discuss limitations of our current simulations.

[IM08] Kinematics and Energetics Involved with the Parker-Jeans instability

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To understand the formation mechanism of such large scale structures as the HI super-cloud and the giant molecular cloud in the Galactic ISM disk, we have made three-dimensional MHD simulations of the Jeans and Parker instabilities in a magnetized, isothermal, gaseous disk under the influence of external gravity. From the simulation results we have synthesized line profiles of HI emission along with the channel maps. The profiles and maps are compared with the corresponding data from the Leiden/Argentine/Bonn Galactic HI survey. We have followed up time variations of various physical quantities along the vertical direction. Included among the quantities are density, velocity structure, and FWHM of the resulting line profiles. Vertical variations of the density and velocity demonstrate vertical oscillations in the disk. Features of the oscillation last from the beginning to the end of our simulations. The dispersion of velocities in the horizontal plane is shown to be about 5 km/s, which is comparable to the sound speed we have chosen. However, the FWHM of the synthesized line profiles amounts to 1 km/s. This much difference between the dispersion and the FWHM represents some of the limitations our MHD simulations have to overcome. We will discuss problems stemming from the isothermal equation of state and the neglect of turbulence. In view point of interstellar turbulence, we will focus on the energetics involved in our model of the ISM disk.