

On the Formation of HI Super-clouds and GMCs

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The HI super-clouds and giant molecular cloud complexes(GMCs) are considered to be the two largest structures in the Galactic ISM disk. The former is of 1~2 kpc scale, while the latter of a half kpc. The HI super-clouds are about an order of magnitude more massive than the GMCs. In this study we model the Galactic ISM disk as an isothermal, magnetized, gaseous layer under the influence of both self and external gravities. Two major instabilities one can expect from such disks are the Jeans and Parker instabilities. We will examine how the two instabilities interplay to generate the two largest structures in the Galactic ISM distribution.

If the self-gravity dominates the external one, the whole disk is overwhelmed by the Jeans gravitational instability. When the relative importance of the self-gravity is less than a certain value, the two instabilities manifest themselves in the disk simultaneously. Therefore, depending on the relative importance between the two sources of gravity, the Jeans gravitational instability tends to form the HI super-clouds and the undular mode of the Parker instability seems to be responsible for forming the giant molecular cloud complexes. In this way we may understand how the two largest structures in the Galactic ISM disk have come about. Observational criteria that would test the idea presented in this study will be discussed briefly.