Parker Instability under External and Self Gravities

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When an externally given gravity of stellar origin is considered as the driving agent of the Parker instability, the resulting structures of the Galactic ISM disk would have clumps of material alternatively on the north and south sides of the mid-plane. This is because the very nature of the magnetic Rayleigh-Taylor instability makes the velocity field of mid-plane crossing symmetric mode grow faster than the one of anti-symmetric mode. When the self-gravity of the ISM itself is taken as a sole source of the driving agent, the resulting large-scale structures would have clumps with their centers right in the mid-plane of the Galactic disk. This is because the self-gravity triggers the Jeans gravitational instability which prefers the anti-symmetric mode of velocity field to the symmetric one. We have done a linear stability analysis of the Parker instability under the influence of both the self and external gravities simultaneously. On the basis of the resulting dispersion relation, we will discuss how the Jeans, Parker and convective instabilities would interact with each other in an isothermal magnetized gas disk. A particular emphasis will be given to an implication for the large-scale distribution of the giant molecular cloud (GMC) complexes in the Galaxy and for that of GMC associations seen from external galaxies.