Effects of Alfven waves on the origin of turbulence in star formation regions

Midori Matsumoto[1]; Masahide Iizima[2]; Takayuki Ono[3]

[1] Geophys. Sci., Tohoku Univ.; [2] Geophysical Inst., Tohoku Univ.; [3] Department of Astronomy and Geophysics, Tohoku Univ.

The origin of turbulence in molecular clouds is an important issue on the star formation. In order to study effects of MHD waves on the formation of turbulence in star formation regions, one-dimensional propagations of infinitesimal-amplitude Alfven waves in an inhomogeneous magnetic field are investigated using MHD numerical simulations. The simulations are performed on the case of a plasma beta of 0.1 and a ratio of the velocity perturbation and phase velocity of 0.01. Close to the center of the simulation box, the magnetic field has a gradient of -22.5 micro gauss per pc for a distance of 1 pc. In order to focus on effects of inhomogeneity of the magnetic field, we assume a homogeneous and isothermal gas.

The numerical experiments showed that propagations of Alfven waves into an inhomogeneous magnetic field lead to an excitation of sound waves. The compressibility reached 0.1%, and two percents of the initial energy of Alfven waves were converted to the energy of sound waves. Although these values are less than thresholds for the formation of turbulence in molecular clouds, we confirmed mode coupling processes in star formation regions. We will extend the numerical experiments to two-dimensional propagations of finite-amplitude waves, and investigate effects of mode coupling and cascading on formation processes of compressible MHD turbulence.