§11. Simulation of MHD Self-Organization Model

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We constructed an MHD self-organization model (Fig. 1) in which we are able to control the following physical parameters,

1. Injection speed of input energy to the system,
2. Dynamic response time of the system (growth rate of structural instability),
3. Dissipation rate of the energy.

The simulation runs which we executed first are aimed to examine how the injection speed of energy from outside into the system affects the generation of the structure. For this purpose we changed the plasma viscosity in the viscous region.

The intensity of the vortices excited in the system can be calculated from the equations of the balance between incoming energy and outgoing energy, and the results fit the simulation results (Fig. 2).

The injection speed of input energy changes the growth rate of the structural instability and the propagation characteristics of the structure. Essentially, the generation and degeneration of the structure strongly depends upon the injection speed of the input energy (Fig. 3, 4).

Examining the simulation results, we found that the existence of the wave packets, rather than each waves, plays an essential role in the generation and degeneration of the structure.

We are now making various simulations to analyze the characteristic of the wave packets and to reveal the physical mechanism of the generation and its maintenance of the structure.

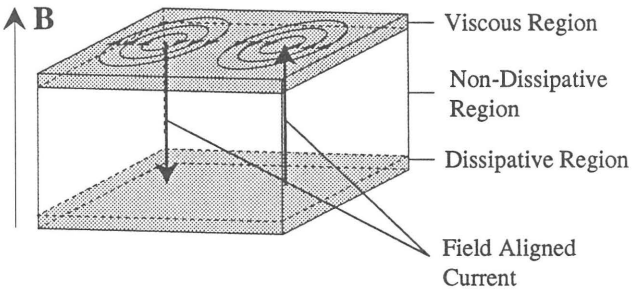

Fig. 1. MHD self-organization model

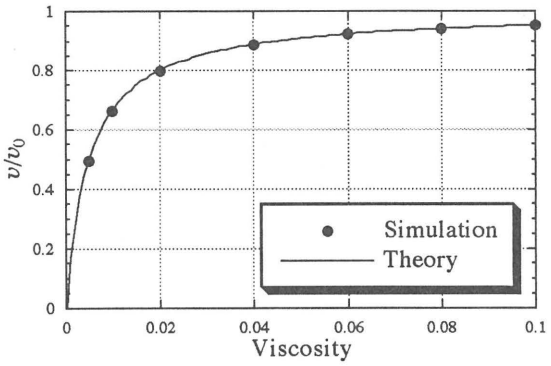

Fig. 2. Theory and simulation result

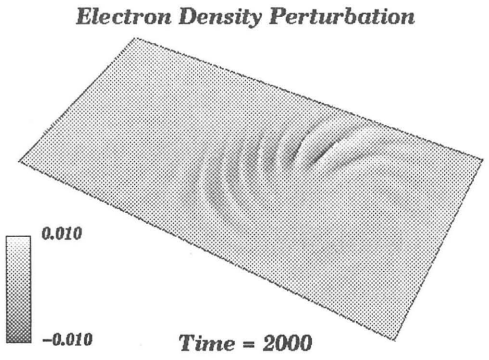

Fig. 3. Generated structure

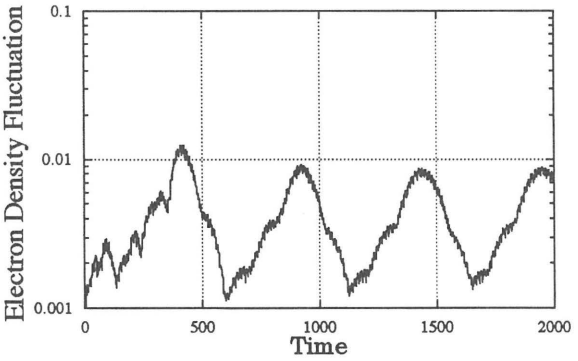

Fig. 4. Time development of structure