§28. Simulation of Blob Transport

Ishiguro, S.

It is recognized that a plasma is transported across magnetic field lines as long-lived macroscopic coherent structures "blobs" in scrape-off layer (SOL) of magnetic confinement fusion devices[1-5]. In order to reveal physics related to blob dynamics, three dimensional particle-in-cell (PIC) code with particle absorbing boundaries has been developed[6].

Configuration of our three dimensional PIC simulation is followings. External magnetic field is pointing into the z-direction. Particle absorbing boundaries corresponding to diverter plates are placed in the both ends of z-axis. A particle absorbing plate corresponding to the first wall is also placed at the one end of the x-axis. Particle reflecting plane is placed in the other end of the x-axis. A particle impinging to the absorbing boundaries is removed from the system. In the y-direction, periodic boundary condition is applied.

This simulation code is applied for investigation of blob dynamics and related self-consistent electric field formation. Figure 1 shows the feature of high density blob (rod) which is initially located as a column in the system. The blob is modified to cigar like structure in time because plasma particles are absorbed by the particle absorbing plane. At the same time the body is moved across the magnetic field lines. This motion is explained as follows. Ions and electrons drift in the positive y-direction and negative y-direction due to grad-B drift, respectively. Thus, top side and bottom side of the high-density region are positively and negatively charged, respectively. As a result, an electric field in the negative y-direction in the high-density region is created. The high density region moves in the negative x-direction due to EXB drift[5].

Numerical analyses based on two dimensional macroscopic model equation have discussed stability and modification of blobs.[7,8] These macroscopic features and detail kinetic behavior related to velocity space instabilities will be studied by our simulation model.

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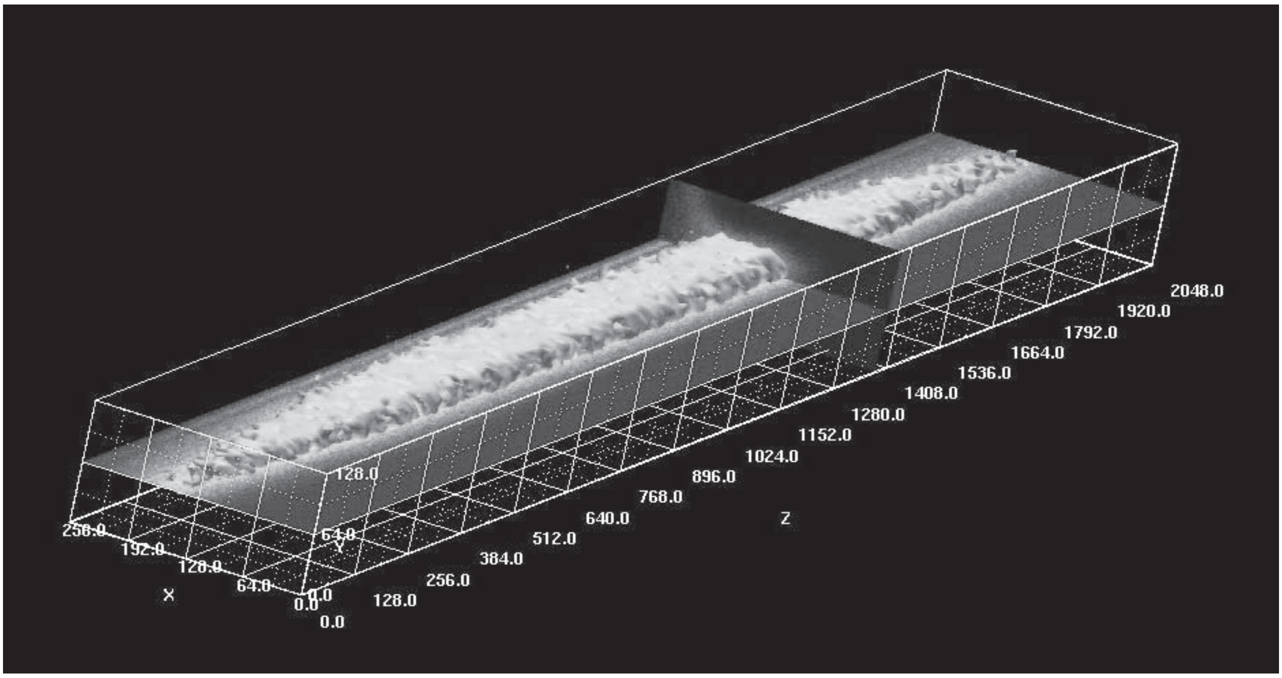

Fig. 1 Isosurface and contour plot of ion density.