## §7. Computer Simulation on Potential Formation in Divertor Plasma

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In edge region of fusion plasma, that is, divertor plasma region, the presence of dust grains sputtered from the divertor plate is possible to change the plasma structure [1,2]. Cloud of micron-size dust grains mixed in plasma is negatively charged due to the mobility difference between electrons and positive ions flowing to the dust grains. Thus, Coulomb force acts between the particles. In this work, two dimensional particle simulations on dynamic characteristic of Coulomb dust grain cloud are investigated as a fundamental study of plasma containing the particles.

In order to simulate the two dimensional dynamic behaviors of dust cloud, the negative charge quantity and the mass of dust grain were approximated to be typical experimental value in dust plasma produced by radio frequency discharge. The fundamental characteristics on rotational motion of dust clouds, which are driven by external force, were analyzed with Coulomb strongly coupled structure formed in confinement potential. At first, dust cloud with disk-like Coulomb strongly coupled structure was formed by the assumption that the confinement potential was radially proportional to the square of distance. Behavior of dust cloud at internal obit was observed when the external force with $\omega_0 < \omega_D$ make the edge obit of dust cloud rotate at azimuthal direction. Figure 1 shows rotating angular frequency $\omega_D$ of particles at internal obit as a function of rotating angular frequency $\omega_0$ of particles at edge obit. Here, $\nu$ denotes friction coefficient between particle and neutral gas. It is seen that dust cloud behaves rigidly. This is because both particles at the edge obit and at the internal obit are rotating with almost same angular frequency until a critical value $\omega_c$. It is also found that the angular frequency of particle at the internal obit is reduced drastically to slip between particles at the edge obit and the internal obit when $\omega_0 > \omega_c$. The critical frequency $\omega_c$ increases with decreasing the friction coefficient $\nu$.

Figure 2 shows temporal evolution of phase shift between particles at the edge obit and at the internal obit for $\omega_0$ =0.5. Here, (a) , (b) and (c) denote phase shifts of particles at the edge obit, inside the obit and more inside the obit, respectively. It is found that particles at the internal obit rotate shearly for the particles at the edge obit.

Reference

[1] K. Narihara et al, Nuclear Fusion, vol. 37, pp. 1177-1182, 1997.

[2] J. Winter,Plasma Phys. Control. Fusion, vol. 40, pp. 1201-1210,1998

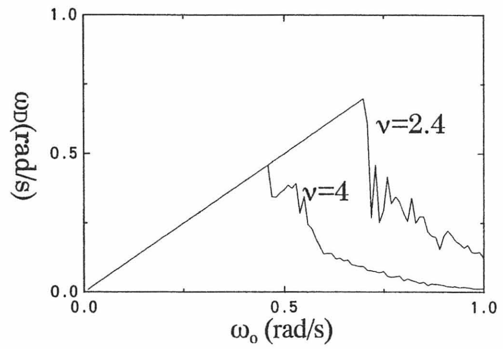


Fig.1 Rotating angular frequency $\omega_D$ of particles at the internal obit as a function of rotating angular frequency $\omega_0$ of particles at edge

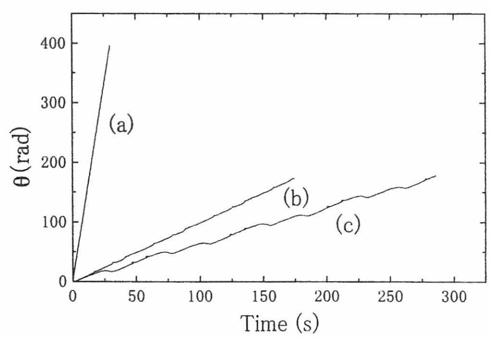


Fig.2 Temporal evolution of phase shift between particles at the edge obit and at the internal obit for $\omega_0$ =0.5.