Seminar

Institute for Plasma Research

Title : Ion-flow driven instabilities in sheath-presheath of low temperature plasma

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Venue : Committee Room 3, (New Building), IPR

Abstract :

Ion-flow driven instabilities excited in the sheath-presheath region can enhance the friction between the particles, which is much stronger than normal coulomb collision friction. When these instabilities exist, the particle dynamics in the sheath-presheath regime will be modified even in low pressure, un-magnetized plasma. Several interesting phenomena in sheath-presheath are explained on this basis. For example, enhanced electron scattering by ion-acoustic instability excited near the sheath edge is expected to be responsible for Langmuir's Paradox. Ion-ion two stream instability causes ion velocity-locking, when different ion streams are present. This phenomenon explains the approach of different ions to the sheath edge with one common velocity in two-ion-species plasma in spite of having different masses. However, the experimental details of these instabilities in sheath-presheath regime are very rare. In this thesis work, ion-flow driven instabilities; ion-ion counter streaming instability, ion-acoustic instability and ion-ion two-stream instability in two-ion-species plasma has been explored. A simple and versatile set-up is designed to study these instabilities in collisionless sheath-presheath. A stainless steel mesh grid and Langmuir probe are used to produce and study sheath-presheath regime in a steady hot-cathode filament discharge plasma. After determining the sheath dimensions thoroughly using conventional and Laser-heated emissive probes, ion-ion counter streaming instability through mesh grid immersed in uniform plasma is studied in various conditions. The effect of mass on the instability is investigated in different gas discharges and in two-ion-species plasma. Ion-acoustic instability excited near the sheath edge is observed and the suitable parameters to sustain the instability are explored. In two-ion species plasma, the phase velocity of ion-ion two-stream instability is measured for the first time. The phase velocity is identified to be close to the Bohm velocity of the lighter ion species.