Formation of multiple double layers in the present of grounded ring in RF expanding plasma

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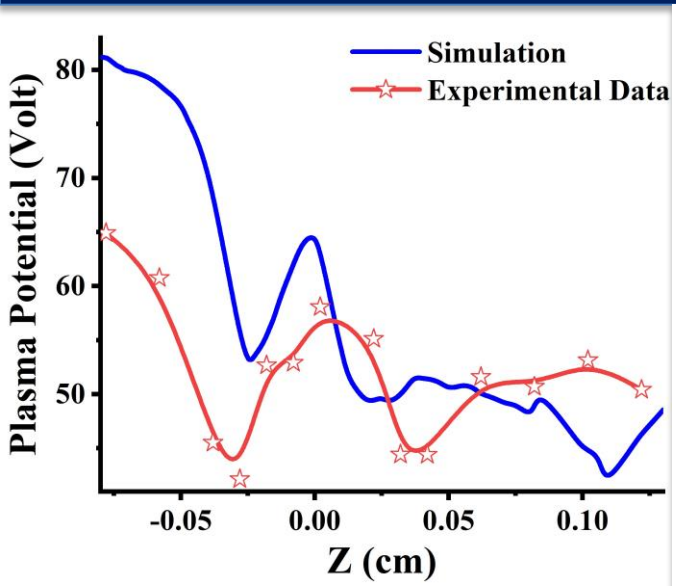

Fig: Comparison of axial potential profile between experimental data and computer simulation; red line represents the experimental values whereas blue line represents the computer simulation.

A double layer (DL) consists of two oppositely charged layers with a small gap and strong electric between these layers where quasineutrality condition is spatially violated. Auroras observed in the northern and southern hemispheres are a result of strong DL formed there. For deep space propulsion, DL can be used to generate thrust as it has the ability to accelerate ions and electrons. Plasma is generated in a helicon source of diameter 10 cm and expanded to the expansion chamber of diameter 30 cm in the presence of a diverging magnetic field at 7×10^{-4} mBar. A grounded ring is present between the source and the expansion chamber (Z = 0 cm). Two sharp potential drops of 18.6 V and 11 V are observed on both sides of this ring. XOOPIC simulation is performed for the same experimental condition and when compared shows that potential drops occur almost at the same positions. In PIC simulation, multiple structure is seen when both grounded ring and diverging magnetic field are present and single DL is observed when grounded ring is absent but diverging magnetic field is present. The experimental results indicate that a grounded ring along with a diverging magnetic field can convert a single potential structure to a multiple structure.

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