U054-017 **Room: Ocean B** **Time: May 15 9:00-9:30**

Nonlinearlity, Stochasticity, and Multi-scale Couplings in Collisionless Plasmas

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Nonlinearity and stochasticity of collisionless plasmas cause wide variety of phenomena in space and laboratory physics. A remarkable property of a collisionless plasmas compared to ordinary fluids is their multi-scale nature. Collisionless plasmas have several characteristic spatial/temporal scales, such as gyro-radius, skin depth, or Debye length of each particle species. These characteristic scale violates power-law type self-similarity, and consequently, rich scale-dependent structures occur. Further, structures in each scale interact one another, resulting a variety of complexity.

These cross-scale couplings between elementary processes cause a number of interesting and challenging phenomena in plasma physics. Advances in plasma theory along with recent high resolution observations and latest experimental technologies will bring us deep insight to the basic nature of the cross scale complexity. For example, the theory of plasma turbulence sheds a new light to old astronomical problem of accretion disks. The problem of anomalous heat transfer in galaxy plasmas is another good example.

In these phenomena, nonlinearity is essential; one powerful approach is to examine the formal structure of the non-linear equations. One classical example is the Taylor relaxed state, which gives the minimum energy state under given constraints. This state is supposed to be realized in plasma stationary states, and can explain the structure of the solar corona. The problem of turbulent flow is much more complicated, however, some kind of minimum/maximum state may explain steady states, such as the one found in Jupiter atmosphere. This kind of approach is also fruitful in laboratory plasmas for controlled fusion. Plasma confinement would be easier if the confined state of the plasma is close to a state that the plasma “wants to be.”

A brief overview with emphasis on theoretical aspect will be given in the presentation.