



## Nonlinear dynamics of space plasmas

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Solar-terrestrial environment provides a unique laboratory for investigating the fundamental processes in plasmas such as kinematic vortex, vortex-vortex interaction, current sheet, magnetic flux rope, magnetic reconnection, jet, and intermittent turbulence. In this talk, we will present an overview of some recent theoretical, numerical and observational studies of nonlinear processes in space plasmas. First, we discuss ground optical imaging of complex structuring and self-organization of ionospheric plasma bubbles involving bifurcation, connection, disconnection and reconnection which are the signatures of nonlinear evolution of interchange instability and secondary instabilities responsible for the generation of coherent structures and turbulence. Second, we present the simultaneous ground and space observations of an erupting solar coronal loop which show that the type-II solar radio bursts can be emitted from both upstream and downstream of the shock front. Third, we present the observational evidence of magnetically reconnected current sheets in the vicinity of a turbulent front magnetic cloud boundary layer, and discuss the relation between current sheets, turbulence, magnetic reconnections and jets at the leading edge of an interplanetary coronal mass ejection. Fourth, we report the observation of magnetic reconnection at the interface region of two interplanetary magnetic flux ropes. The front and rear boundary layers

of three interplanetary magnetic flux ropes are identified by *in situ* spacecraft measurements. A quantitative analysis of the reconnection condition and the degree of intermittency reveals that rope-rope magnetic reconnection is the most likely site for genesis of interplanetary intermittent turbulence in this event. The dynamic pressure pulse resulting from this reconnection triggers the onset of a geomagnetic storm. Finally, we discuss numerical MHD simulation and space observation of Lagrangian coherent structures in the photospheric supergranular turbulence and solar cyclogenesis.

### References

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