U054-001 **Room: Ocean B** **Time: May 14 9:00-9:30**

Tutorial: Relativistic Plasmas and Particle Acceleration in Space and Laboratory – Recent Topics –

Hideaki Takabe[1]; Shinpei Shibata[2]; # Shuichi Matsukiyo[3]

[1] ILE, Osaka University; [2] Sci., Yamagata Univ; [3] ESST. Kyushu Univ.

Relativistic effects on plasmas are much more prominent for compact objects such as black-hole and neutron-star (pulsar) magnetosphere. In the pulsar magnetosphere, magnetic energy density can be a million times larger than that of rest mass density of the gas, where gas pressure can not balance against magnetic pressure. Jets with velocities near the speed of light are observed at black holes For the theoretical point of view, there are two main relativistic effects which bring about new phenomena; (1)electric force which is neglected in non-relativistic approximation becomes important and plays a role of pressure or inertia, (2)strong gravity and rotation deform the structure of the electromagnetic field. These effects are not well understood and to be discussed in the meeting. Especially, magnetic neutral sheet in relativistic situation must be important to understand relativistic particle acceleration.

In a region sufficiently far from those compact objects, on the other hand, statistical acceleration of charged particles via wave-particle interactions becomes essential. Acceleration of charged particles in the vicinity of a collisionless shock has been extensively studied. Nevertheless, a number of unresolved problems have remained. For instance, the standard theory of the DSA (diffusive shock acceleration) model does not explain well position of the ’knee’ in energy spectrum of cosmic rays. Mechanisms of preacceleration of nonthermal particles required by the DSA model are also unresolved (the injection problem). Recently, some modified versions of the standard model and alternative accelration mechanisms have been proposed. In this tutorial some examples of in-situ satellite observations near the earth and numerical simulations of those acceleration processes as well as other controversial topics are introduced.

Some recent topics in laboratory plasmas, e.g., control of relativistic runaway electrons in a tokamak, and nonlinear interactions between plasmas and high energy electrons (tens of MeV) produced by ultra-intense lasers, are also introduced.