ICEHAP Seminar

2015年4月8日（水）午後2：00～

会場：理学部2号館 308物理会議室

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"Supercomputing for exploring electron accelerations in strong shock waves"

要旨／abstract

Collisionless shock waves provide us great opportunities to explore nonlinear dynamics in strongly inhomogeneous plasmas. Dynamics therein result in excitation of various types of electrostatic and electromagnetic waves and associated plasma heating and acceleration.

Extreme circumstances encountered in such situations can be realized in astrophysical phenomena, such as supernova remnant (SNR) shocks where the plasma kinetic energy overwhelms other magnetic and plasma internal energies. SNR shocks have been thought to be a generator of cosmic rays, and exploring nonlinear dynamics in extreme circumstances therefore clarifies how charged particles are accelerated to relativistic energies out of the thermal counterpart. We present results from ab initio particle-in-cell (PIC) simulations of strong shock waves by the help of state-of-the-art supercomputer systems. We found different types of electron acceleration mechanisms: A shock surfing acceleration via interactions with coherent electrostatic waves in the upstream region, and a stochastic acceleration by turbulent magnetic reconnecction. These were found to be very effective in multi-dimensional shock structures.