S001-P10
ポスター 3 ：11/6　AM1/AM2 （9:00-12:30）

エクサ計算時代に向けた PIC コード開発と天体衝撃波シミュレーションへの応用

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Development PIC simulation code for the exascale computing and its application to astrophysical shock simulations

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Using massively parallel supercomputer systems with a parallelized particle-in-cell (PIC) code is a powerful way to elucidate nonlinear phenomena, including particle accelerations. Indeed, we have elucidated important acceleration mechanisms in collision-less shocks using the Japanese flagship supercomputer system with hundreds of thousands of processor cores (e.g., Matsumoto et al., 2017).

Here we report the current development status of our PIC simulation code and its application to astrophysical shocks. Due to time evolution, the load imbalance among MPI processes in PIC simulations arises if particles were in-homogeneously distributed in the simulation domain. This imbalance becomes problematic when using huge numbers of MPI processes (say more than millions of cores), and we met this situation when we used the supercomputer Fugaku. We have adopted the recursive multi-section algorithm which has been successfully implemented in the cosmological N-body simulations (Makino, 2004; Ishiyama et al., 2009). We successfully implemented this method to the PIC code for the first time with benchmark tests of the Weibel instability and collision-less shock simulations. Then we applied this new PIC code to collision-less shock simulations. With the new code, we can take a long upstream domain to track accelerated particle evolution for a long time. In this presentation, we report initial results from long-term simulations of high-Mach number oblique shocks and discuss primary to subsequent electron acceleration mechanisms.