

Numerical simulation of asymmetric reconnection with GPU

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Magnetic reconnection is generally accepted as an important elementary process in the geo-magnetosphere. Especially, the asymmetric reconnection is more general than the symmetric one. So it takes an important role on clarifying Anemone type flares and flux transfer events at the dayside magnetopause, and so on. However, it is also a phenomenon that have many unsolved problems. We aim to understand the asymmetric magnetic reconnection by numerical simulation based on MHD equations.

In this calculation, GPU-accelerated computing(GPGPU) was performed. Although we use only one GPU now, we are going to use multiple GPUs. In that case, the slow transmission speed between CPU and GPU becomes a large problem. On the parallel computing with multiple GPUs, calculation domain is divided into arbitrary pieces and each GPU must have the information required to calculate in a each device memory. However, the transferring of the data between GPU-GPU is not permitted. Instead of it, we use the communication between CPU-GPU. This process becomes the bottle neck and this GPU-accelerated computing is not effective. In order to avoid this problem, we hide the data communication between CPU-GPU behind the GPU calculation.

Furthermore, using this GPGPU code we confirmed the previous study by Cassak & Shay in 2007 that in the asymmetric reconnection, X-point moves toward the weak magnetic field side.

Keywords: asymmetric reconnection, GPGPU, parallel calculation