

Multi-GPU Simulations of the Infinite Universe

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The StePS (Stereographically Projected Cosmological Simulations) is a new zoom-in cosmological direct N-body simulation method, that can simulate an infinite universe with unprecedented dynamic range for a given amount of memory, and in contrast of the traditional periodic simulations, its fundamental geometry and topology match observations. We present the Multi-GPU realisation of this algorithm with MPI-OpenMP-CUDA hybrid parallelisation, and show what parallelisation efficiency can be reached with our implementation. With our code it is possible to run simulations with few a Gpc diameter and with $10^9 M_{\odot}$ mass resolution in the center under days on the MARCC (Maryland Advanced Research Computing Center) GPU cluster, or run extremely fast simulations with reasonable resolution for fitting the cosmological parameters. These simulations can be used for the prediction needs of large surveys such as DES (Dark Energy Survey), Euclid or WFIRST (Wide Field Infrared Survey Telescope).