

UTILIZING GRAPHIC PROCESSING UNITS FOR LARGE SCALE SIMULATIONS: EXAMPLE OF DUST DYNAMICS IN AGB BINARY WINDS

D. Vinković

*Physics Department, University of Split and Science and
Society Synergy Institute, Croatia*

E-mail: dejan@iszd.hr

Graphic Processing Units (GPUs) are easily accessible massively parallel processors with a large low-cost computing capability. GPUs are now the most powerful processor in a desktop computer. Development of new GPUs continues to outpace progress in CPUs due not only to its highly data-parallel nature but also to its ability to achieve higher arithmetic intensity. These characteristics gradually transform GPUs into the mainstream numerical accelerators in the heterogeneous supercomputing environments. However, unlike traditional CPUs that have been studied by researchers for long time, the fast evolving GPU technology is still considered as a mysterious innovation by general users/developers. In this presentation I will demonstrate a simple example of GPU usage for computation of dust dynamics in a stellar wind driven by radiation pressure force from a binary - an AGB star and its main sequence companion. The equation of motion is modified according to some specifics of AGB winds dynamics. We use a simple leap-frog integration scheme. Overall, at least several million integration steps are performed in a typical simulation producing a 2D image of the dusty cloud integrated over 2000 years. I will show basic building blocks of the GPU code written in C with CUDA library, demonstrate problems caused by colliding memory requests on GPUs, and show some illustrative examples of speed ups by a factor of several hundreds (reducing computational time from a couple of days to minutes).