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Plasma Turbulence Simulation and Visualization on Graphics Processors: Efficient Parallel Computing on the Desktop GEORGE STANTCHEV, DEREK JUBA, WILLIAM DORLAND, AMITABH VARSHNEY, University of Maryland — Direct numerical simulation (DNS) of turbulence is computationally very intensive and typically relies on some form of parallel processing. Spectral kernels used for spatial discretization are a common computational bottleneck on distributed memory architectures. One way to increase the efficiency of DNS algorithms is to parallelize spectral kernels using tightly-coupled SPMD multiprocessor hardware architecture with minimal inter-processor communication latency. In this poster we present techniques to take advantage of the recent programmable interfaces for modern Graphics Processing Units (GPUs) to carefully map DNS computations to GPU architectures that are characterized by a very high memory bandwidth and hundreds of SPMD processors. We compare and contrast the performance of our parallel algorithm on a modern GPU versus a CPU implementation of several turbulence simulation codes. We also demonstrate a prototype of a scalable computational steering framework based on turbulence simulation and visualization coupling on the GPU.

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