GPU Technology Conference 2010 Sessions on Astronomy & Astrophysics (subject to change)

IMPORTANT: Visit www.nvidia.com/gtc for the most up-to-date schedule and to enroll into sessions to ensure your spot in the most popular courses.

2108 - Binary Black Holes Simulations using CUDA

Get the latest information on how to evolve binary black holes simulations on GPUs.

Speaker: Abdul Mroue, CITA, Univ. Of Toronto

Topics: Astronomy & Astrophysics, Algorithms & Numerical Techniques, Physics Simulation

Time: Wednesday, September, 22nd, 16:00 - 16:50

2082 - CU-LSP: GPU-based Spectral Analysis of Unevenly Sampled Data

Standard FFT algorithms cannot be applied to spectral analysis of unevenly sampled data. Alternative approaches scale as $O(N^2)$, making them an ideal target for harnessing the raw computing power of GPUs. To this end, I have developed CU-LSP, a CUDA spectral analysis code based on the Lomb-Scargle periodogram. Preliminary benchmarking indicates impressive speed-ups, on the order of 400 relative to a single core of a modern CPU. An initial application of CU-LSP will be the analysis of time-series data from planet-search and asteroseismology satellites.

Speaker: Richard Townsend, University of Wisconsin-Madison

Topics: Astronomy & Astrophysics, Algorithms & Numerical Techniques, Signal processing

Time: Wednesday, September, 22nd, 10:00 - 10:50

2099 - Cosmology Powered by GPUs Redux

Cosmological simulations aim at reproducing the physical processes which occur on the largest scales of the Universe since the Big-Bang by means of numerical calculations on supercomputers. Using CUDA, I have implemented standard cosmological techniques on GPU architecture (PM N-Body solver, Hydrodynamics & moment-based radiative transfer) and

designed them to run on supercomputing facilities by means of MPI+CUDA mixed programming. These applications are able to run on 100 or more graphics devices with typical scalar x50 accelerations and with a communication overhead limited to 15%. It allow to explore physical regimes which were out of reach of current simulations.

Speaker: Dominique Aubert, Strasbourg University

Topic: Astronomy & Astrophysics

Time: Wednesday, September, 22nd, 11:00 - 11:50

2090 - Developing Highly Scalable Particle-Mesh Codes for GPUs: A Generic Approach

Dive deep into a multi-parallel Particle in Cell code that utilizes MPI, pthreads, and CUDA. Around this specific application a general C++ framework for transparent data transfers between GPUs has been developed and will be presented. Further techniques employed include interleaving of communication and computation, particle tiling and a study of how well CUDA performance can be transferred to OpenCL.

Speakers: Guido Juckeland, TU Dresden - ZIH, Michael Bussmann, Forschungszentrum Dresden-Rossendorf

Topics: Physics Simulation, Astronomy & Astrophysics, High Performance Computing

Time: Tuesday, September, 21st, 15:00 - 15:50

2044 - GRASSY: Leveraging GPU Texture Units for Asteroseismic Data Analysis

Learn how to use the hidden computation capability of GPU texture units for general purpose computation. We describe GRASSY, a system for stellar spectral synthesis where the core problem is interpolation between pre-computed intensity value. We map these pre-computed tables to the GPU's texture memory. Interpolation then becomes a texture lookup where the hardware automatically performs the interpolation, albeit at very low precision. Our mathematical framework reasons about the impact of this precision and our performance results show 500X speedups. This work generalizes the GPU texture units as computation engines and opens up new problems for GPU acceleration.

Speaker: Matt Sinclair, UW-Madison

Topics: Astronomy & Astrophysics, High Performance Computing

2000 - Gravitational N-body Simulations: How Massive Black Holes Interact with Stellar Systems

Astrophysics is a field where super computing is a must to obtain new scientific results. in particular, the study of the interaction among massive black holes and surrounding stars is a hot topic, which requires heavy computations to have good representation of what happens in the inner regions of galaxies. We present the results obtained with our high precisioned N-body code, NBSymple, which exploits the joint power of a multi core CPU system together with the high performance NVIDIA Tesla C1060 GPUs.
The code is available at the website: astrowww.phys.uniroma1.it/dolcetta/nbsymple.html

Speakers: Roberto Capuzzo-Dolcetta, Sapienza Univ. of Roma, Alessandra Mastrobuono Battisti, Sapienza- University of Rome

Topics: Astronomy & Astrophysics, Algorithms & Numerical Techniques

Time: Wednesday, September, 22nd, 14:00 - 14:50

2092 - Integrating CUDA into a Large-Scale Commercial Database Management System

In a large-scale database installation where data tables are distributed across multiple servers, computational throughput can be optimized by using GPUs on each server and integrating database management with GPU resources. In the Department of Physics and Astronomy at The Johns Hopkins University, we are experimenting with a set of software tools that closely couple SQL statements with GPU functionality. While still under development, the new framework is now routinely used in our research projects, e.g., to study the spatial clustering of galaxies as well as genomics.

Speakers: Richard Wilton, The Johns Hopkins University, Tamas Budavari, Johns Hopkins University, Alex Szalay, The Johns Hopkins University

Topics: Databases & Data Mining, Astronomy & Astrophysics, High Performance Computing, Tools & Libraries

Time: Wednesday, September, 22nd, 11:00 - 11:50

2178 - Using GPUs to Track Changes in the Sun

Learn how GPU computing is enabling astrophysicists to study our closest star. NASA's recently launched Solar Dynamics Observatory is continuously streaming full-disk images of the Sun at visible, UV and EUV wavelengths. This presentation will discuss ways that GPU computing is helping scientists cope with the analysis of the immense data volumes as well as in numerical modeling of the Sun.

Speaker: Mark Cheung, Lockheed Martin Solar & Astrophysics Laboratory

Topics: Astronomy & Astrophysics, Computer Vision, Computational Fluid Dynamics, Physics Simulation

Time: Wednesday, September, 22nd, 17:00 - 17:50