

Perspectives of GPU Computing in Physics and Astrophysics

Dep. of Physics, Sapienza Università di Roma, September 15-17 2014

Organized by Dep. of Physics Sapienza, IAC, INFN, INGV, Roma, Italy

Sponsored also by: E4, Harpa-HP, Physics at the Terascale, nVIDIA

SCIENTIFIC PROGRAM

MONDAY, SEPT. 15, 2014

09:15– 09:30 Welcoming Address

Science with GPUs

First Morning Session

chair: R. Capuzzo Dolcetta

09:30 – 10:00 **D. J. Bard** (SLAC Natl. Acc. Lab., Stanford, USA) (I)

[*Cosmological Calculations on the GPU*](#)

10:00 – 10:20 **C. Gheller** (ETH, CSCS, Switzerland) (C)

[*Ramses for GPU Accelerated Numerical Cosmology*](#)

10:20 – 10:40 **M. Spera** (INAF, Astr. Obs. of Padova, Italy) (C)

[*Using GPUs to Solve the Classical N-Body Problem in Physics and Astrophysics*](#)

10:40 – 11:00 **Y. Meiron** (KIAA-PKU, China) (C)

[*Expansion Techniques for Stellar Dynamics on GPUs*](#)

11:00 – 11:30 Coffee Break

Second Morning Session

chair: R. Spurzem

11:30 – 12:00 **T. Schultess** (ETH, Zurich, Switzerland) (I) *Performance Portable*

[*Application Software Strategies and Energy Efficiency Considerations*](#)

12:00 – 12:20 **L. Wang** (Dep. Of Astronomy, Univ. of Beijing, China) (C)

[*Acceleration of the Direct N-Body code NBODY6++ with GPU*](#)

- 12:20 – 12:40 **M. Mapelli** (INAF, Astr. Obs. of Padova, Italy) (C)
[Simulating the Nursery of Stars with GPUs](#)
- 12:40 – 13:00 **S. Grimm** (Univ. Zurich, Switzerland) (C)
[GENGA: a GPU code for Planet Formation and Evolution](#)
- 13:00 – 15:00 Lunch Time

First Afternoon Session

chair: M. Arca Sedda

- 15:00 – 15:30 **J. Bedorf** (Univ. of Leiden, The Netherlands) (I)
[Galaxy Simulations Powered by GPUs](#)
- 15:30 – 15:50 **D. Perret** (LESIA, Obs. de Meudon, France) (C)
[Design of a GPU Based RTC for E-ELTs Adaptive Optics](#)
- 15:50 – 16:10 **G. Debreczeni** (VIRGO and Res. Inst. for P and N. Physics, Budapest, Hungary) (C)
[Gravitational Wave Physics is in the Doorstep of a New, Very Exciting Era](#)
- 16:10 – 16:30 **K. Adamek** (Silesian Univ. in Opava, Czech Republic) (C)
[The Implementation and Comparison of a Polyphase Filter on Many-Core Systems](#)
- 16:30 – 17:00 Coffee Break

Second Afternoon Session

chair: D. Melini

- 17:00 – 17:20 **M. J. Castro** (Univ. of Malaga, Spain) (C)
[HySEA-Tsunami Model: a GPU Implementation for the Italian TEWS](#)
- 17:20 – 17:50 **D. Komatitsch** (CNRS, Marseille, France) (I)
[Exascale Challenges for Acoustic Waves and Inversion](#)
- 17:50 – 18:20 **P. Messmer** (ETH-nVIDIA, Zurich, Switzerland) (I)
[GPU Optimization for Seismic Applications](#)

TUESDAY, SEPT. 16, 2014

The international context

First Morning Session

chair: G. Parisi

- 09:30 – 10:00 **S. Girona** (PRACE, Barcelona, Spain) (I)
[*PRACE: access to Tier-0 systems, and enabling the access to ExaScale systems*](#)
- 10:00 – 10:20 **R. Spurzem** (Natl. Astron. Observatories, Chinese Academy, China) (C)
[*Astrophysical GPU Supercomputing in China and Europe*](#)
- 10:20 – 10:50 **M. Fatica** (nVIDIA, S.ta Clara, USA) (I)
[*GPU Computing for Scientific Applications: Past, Present and Future*](#)
- 10:50 – 11:20 **C. Cavazzoni** (CINECA, Italy) (I)
[*Exascale: challenges and opportunities in a power constrained world*](#)
- 11:20 – 11:50 Coffee Break

Science with GPUs

Second Morning Session

chair: M. Bernaschi

- 11:50 – 12:20 **D. Pleiter** (Univ. of Regensburg and Exasc. Inn. Cent., Julich, Germany) (I)
[*GPUs in Physics: Analysis of Architectural Features*](#)
- 12:20 – 12:40 **D. Berenyi** (Wigner RCP, Budapest, Hungary) (C)
[*Code Generation for Differential equation Solvers*](#)
- 12:40 – 13:00 **M.F. Nagy-Egri** (HAS Wigner RCP, Budapest, Hungary) (C)
[*Static GPU Code Generation in Scientific Computing*](#)
- 13:00 – 15:00 Lunch Time

First Afternoon Session

chair: F. Sciortino

- 15:00 – 15:30 **J. Anderson** (Univ. of Michigan, USA) (I)
[*GPU Accelerated Soft Matter Particle Simulations*](#)
- 15:30 – 16:00 **A. Kohlmeyer** (Temple Univ., USA) (I) *withdrawn*

[After the Gold-Rush: How Have GPUs Changed Condensed Matter Simulations?](#)

16:00 – 16:20 **L. Rovigatti** (Univ. of Vienna, Austria) (C)

[Investigating the Phase Behaviour of Valence-Limited DNA Constructs on GPUs](#)

16:20 – 16:40 **V. Kukulin** (Moscow State Univ., Russia) (C) *withdrawn*

[New Solutions for Quantum Scattering Problems via GPU](#)

16:40- 17:10 Coffee Break

Second Afternoon Session

chair: M. Bernaschi

17:10 – 17:40 **S. Melchionna** (IPCF, CNR, Roma, Italy) (I)

[Simulations of Proteins Suspensions in Crowding Conditions on Massive GPU Clusters](#)

17:40 – 18:00 **M. Baity Jesi** (Univ. Complutense, Madrid, Spain) (C)

[Phase Transition in Heisenberg Spin Glasses](#)

18:00 – 18:20 **M. Berganza** (Sapienza Univ. of Roma, Italy) (C)

[Parallel Monte Carlo Simulations of Spin Models in Non-Regular Topologies](#)

18:20 – 18:40 **M. Lulli** (Sapienza Univ. of Roma, Italy) (C)

[3D Ising Spin Models: a Test Ground for Wide Spectrum Optimizations](#)

19:30 **Bus pick up for the social dinner at Caffè delle Arti**

WEDNESDAY, SEPT. 17, 2014

Science with GPUs

First Morning Session

chair: A. Messina

09:30 – 10:00 **A. Lonardo** (INFN, Roma, Italy) (I)

[A FPGA-Based Network Interface Card with GPUDirect Enabling Real-Time GPU Computing in HEP Experiments](#)

10:00 – 10:20 **S. Tupputi** (INFN-CNAF, Bologna, Italy) (C)

[GPGPU for Track Finding and Triggering](#)

10:20 – 10:40 **F. Rossi** (Univ. of Bologna and INFN, Bologna, Italy) (C)

[Robust Algorithms for Current Deposition and Dynamic Load-balancing in a GPU Particle-in-Cell Code](#)

10:40 – 11:00 [Poster Presentations](#)

11:00 – 11:30 Coffee Break

Some Hardware Perspectives

Second Morning Session

chair: P. Vicini

11:30 – 12:00 **A. Galli** (Hewlett Packard, Italy) (I)

[Accelerators Technology Update](#)

12:00 – 12:30 **C. Dahnken** (INTEL, SSG DRD EMEA, USA) (I)

[Intel Xeon Phi: How to get the most out of the Intel Co-Processor](#)

12:30 – 13:00 **P. Altoè** (E4 Computer Engineering, Italy) (I)

[HPC Benchmarks on ARM64+GPUs](#)

13:00 – 15:00 Lunch Time

Science with GPUs

First Afternoon Session

chair: P. Vicini

15:00 – 15:30 **D. Rossetti** (INFN, Roma, Italy) (I)

[Efficient Data Movement on GPU-Accelerated Clusters](#)

15:30 – 15:50 **B. Messer** (Oak Ridge Natl. Laboratory, USA) (C)

[Moving Applications to Titan](#)

15:50 – 16:10 **M. Garofalo** (Univ. of Napoli Federico II, Italy) (C)

[Acceleration of Machine Learning Models Based on GPU](#)

16:10 – 16:30 **F. Simula** (INFN, Roma, Italy) (C)

[Distributed Simulations of Polychronous and Plastic Spiking Neural Networks: Experiment with GPUs](#)

16:30 – 17:00 Coffee Break

Second Afternoon Session

chair: R. Capuzzo Dolcetta

17:00 – 17:20

Y. Okabe (Dep. of Physics, Tokyo Metr. Univ., Tokyo, Jap) (C)

[GPU-based computation of the Monte Carlo simulation of classical spin systems](#)

17:20 – 17:40

E. Calore (INFN, Ferrara, Italy) (C)

[Design and Optimization of a Portable Lattice Boltzmann Code for Heterogeneous Architectures](#)

17:40 – 18:00

S. Thomson (Univ. of Edinburgh, UK) (C)

[Taranis: Ray Tracing Radiative Transfer in SPH](#)

18:00 – 18:30

[Meeting Final Discussion and Conclusion](#)