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Saeid Aliei

Experience

Sep 2024 - Present **Data Processing Software Engineer**, *Square Kilomotre Array Observatory (SKAO)*, Macclesfield, United Kingdom.

Supervisor: Peter Wortmann, Line Manager: Marco Bartolini

Description: SKA is one of the biggest and most ambitious scientific endeavors in history. At full operational scale, it will produce 50 times more data than that of CERN's Large Hadron Collider (LHC). Processing at such immense rates requires innovative algorithms, new computational techniques, and cutting-edge infrastructure. This isn't a mere technological challenge, but an opportunity to reshape how we process, analyze, and interpret scientific data in the modern era. My role involves developing high-performance software and pipelines that can process datasets, at petabytes per second scale. The opportunity to contribute to such groundbreaking scientific research is intriguing. It's not just about solving complex and challenging engineering problems daily, but also enabling humanity to explore the cosmos in ways and scales we've never been able before.

Oct 2023 - Aug 2024 **AI/HPC System Engineer**, *Area Science Park, Institute of Research and Technological Innovation (RIT)*, Trieste, Italy.

Supervisor: Stefano Cozzini

Description: The research scholarship aimed to develop a cutting-edge High-Performance Computing (HPC) infrastructure tailored specifically for advanced HPC and Artificial Intelligence (AI) research. The initiative seeks to work on the boundaries of computational capabilities by integrating innovative hardware and software solutions, optimizing performance, and enhancing scalability. Through this scholarship, I used advanced architectures and Infrastructure as Code (IaC) solutions to help design and build a robust HPC cluster capable of supporting diverse scientific and AI-driven applications, thus fostering research in fields ranging from computational physics and astronomy to computational biophysics and deep learning. I also helped develop the digital twin of the cluster using QEMU/KVM/libvirt virtualization stack, among others, as an internal staging tool before the production stage.

Jun 2023 - July 2024 **Research Assistant Professor**, *College of Science and Technology, Temple University*, Philadelphia, United States.

Supervisor: Axel Kohlmeyer

Description: I met Prof. Kohlmeyer while doing my master's in HPC in Trieste. He is one of the leading figures of computational chemistry and the HPC community, and the core developer of LAMMPS, a widely used large-scale molecular dynamics simulation software. After an opening in his group, he invited me to be a non-tenure track research assistant professor faculty staff at the College of Science and Technology of Temple University. However, because of my Iranian nationality and the complications that arose while obtaining the US VISA, I never got the chance to work with him in person at Temple University.

Mar 2023 - Sep 2023 **Consultant with the MHPC Program of ICTP/SISSA**, *The Abdus Salam International Center for Theoretical Physics*, Trieste, Italy.

Supervisor: Ivan Girotto

Description: Master in High-Performance Computing (MHPC), is a distinctive program offered jointly by the International School for Advanced Studies (SISSA) and the International Center for Theoretical Physics (ICTP) in Trieste/Italy. I joined the MHPC program as an individual consultant after I finished my thesis and research stay. My main responsibilities involve expanding on my previous research project on the LBE3D software and helping students and lecturers with advanced programming and parallel programming courses.

2021 - 2022 **HPC Application Expert**, *The Abdus Salam International Center for Theoretical Physics (ICTP)*, Trieste, Italy.

Supervisor: Ivan Girotto

Description: LBE3D is a highly optimized, massively parallel software for doing computational fluid dynamics research, designed for large HPC centers such as CINECA, which is in active development by the HPC groups of ICTP and the Eindhoven University of Technology with a custom build system built on top of CMake with continuous integration in our self-hosted git service and utilizing large-scale MPI parallelism. Our work involved the continuation of our previous project in the MHPC program, benchmarking, finding bottlenecks, porting the performance-critical parts of the software to the multi-GPU paradigm, optimization, and analyzing the resulting large datasets of HDF5/VTK outputs.

Education

2019 - 2021 **Masters in High Performance Computing**, *The Abdus Salam International Center for Theoretical Physics (ICTP)*, *International School for Advanced Studies (SISSA)*, Trieste.
Italy

Thesis Title: *Porting of LBE3D Lattice-Boltzmann Kernels to GPU using OpenACC*

Supervisors: Federico Toschi, Ivan Girotto

Description: Lattice-Boltzmann Method is widely used in computational fluid dynamics to study the behavior of fluid flows. Computational fluid-dynamics studies require huge computational resources when simulating 3-dimensional systems at high resolution. LBE3D is a CFD solver that is highly optimized for HPC environments utilizing massive hybrid MPI and OpenMP parallelism. In this work, we port the performance-critical kernels of the application to GPU using OpenACC and CUDA toolkit. OpenACC is a directive-based approach to GPU computing and is optimal for large scientific applications like LBE3D to offload the parallel kernels to GPUs with minimal changes to the source code.

2016 - 2018 **Masters in Physics, Astronomy**, *Sharif University of Technology*, Tehran, Iran.

Thesis Title: *Cosmological Observables in Past Lightcone*

Supervisors: Shant Baghram, Sohrab Rahvar

Description: One of the important concepts in cosmology is that all of the observations are done on the past lightcone. In general, cosmological linear perturbation theory is done in a particular gauge and often on spacelike hyperplanes. In order to link quantities calculated in perturbation theory with observables, we have to take into account the effects coming from projecting these quantities onto the past lightcone. We studied in this project these effects and calculated the corrections over observable quantities such as the two-point correlation function and power spectrum of matter perturbations in the cosmos. We developed a new code to compute the correlation function and power spectrum of matter with these relativistic and past lightcone effects taken into account, utilizing the COFFE and the CAMB software as a foundation.

2012 - 2016 **Bachelor of Science, Physics**, *Isfahan University of Technology*, Isfahan, Iran.

Thesis Title: *Exploring blackhole solutions in higher dimensions*

Supervisors: Behrouz Mirza

Description: This project reviewed the blackhole solutions in 4 dimensions, we explored which of their properties can be generalized to higher dimensions and which of them violated in d>4. We studied the Schwarzschild solution and its stability and symmetries in d>4 and reviewed the Myers-Perry blackholes.

2008 - 2012 **Allameh Jafari High School for Brilliant Talents**, Tehran, Iran.

Programming Skills

Languages: Python, C/C++, Fortran, Bash

HPC Programming: Parallel Computing(MPI/OpenMP, CUDA/OpenACC), Parallel Data Management(MPI-IO, HDF5), Optimizations (including x86 Assembly), Benchmarking (Valgrind, Intel VTune, NVIDIA Nsight), GPU/Hybrid Computing, AI/ML Frameworks (PyTorch), Distributed Computing, Scientific Computing

HPC Sysadmin: Infrastructure as Code (Ansible, Terraform), Virtualization (QEMU, libvirt), Containerization (Singularity, Docker, Podman, Enroot), Kubernetes Cluster (K8s, K3s), Storage Systems (Lustre, Ceph), Monitoring (Prometheus, Grafana), Workload Management (Slurm)

Conferences and Scientific Workshops

April 2023 **ICTP - Quantinuum Quantum Hackathon**, The Abdus Salam International Center for Theoretical Physics, held jointly with Quantinuum, Trieste.

March 2021 **EuroHPC Summit Week - PRACEdays21**, Partnership for Advanced Computing in Europe (PRACE) *and* European Technology Platform for High-Performance Computing (ETP4HPC), held virtually.

Nov 2019 **1st EUSMI/NFFA-Europe Joint School on Data management**, The Abdus Salam International Center for Theoretical Physics, held jointly with Nanoscience foundries and fine analysis, Trieste.

April 2018 **6th Workshop on Collaborative Scientific Software Development and Management of Open Source Scientific Packages**, The Abdus Salam International Center for Theoretical Physics, held at Sharif University of Technology, Tehran.

May 2018 **Coding in Cosmology with CAMB and CosmoMC**, Shahid Beheshti University, Tehran.

Oct 2017 **Tehran Meeting on Blackholes**, Sharif University of Technology, Tehran.

Teaching Experience

Sep 2023 **Lab Instructor**, Introduction to Linux, The Abdus Salam International Center for Theoretical Physics.

Oct 2021 **Mentor at 8th Workshop on Collaborative Scientific Software Development and Management of Open Source Scientific Packages**, The Abdus Salam International Center for Theoretical Physics, held virtually.

Spring 2018 **Teaching Assistant**, General Physics II, Sharif University of Technology.

Fall 2018 **Teaching Assistant**, Advanced Cosmology I, Sharif University of Technology.

Spring 2017 **Teaching Assistant**, Special Relativity, Sharif University of Technology.

Honors

Fall 2020 **ICTP Scholarship**, Masters in High Performance Computing.

Fall 2016 **Top 0.1%**, Nationwide Physics graduate studies qualification.

Fall 2012 **Top 0.01%**, Nationwide University entrance qualification.

Publications

2023 **S. Aliei, I. Girotto, S. F. Schifano, F. Toschi**, An OpenACC Based Multicomponent Lattice-Boltzmann Solver on GPUs, Manuscript submitted for publication.

2023 **M. Celoria, G. Di Staso, A. Gabbana, S. Aliei, I. Girotto, S. Fabio Schifano, F. Toschi, and A. Cristhoper Trujillo Ochoa**, Performance optimization of DSMC method on NVIDIA Volta V100, In Preparation.

2021 **I. Girotto, K. Datadien, S. Aliei, G. Di Staso, S. F. Schifano, R. Benzi, F. Toschi** , The Chaotic Life of Mayonnaise, EuroHPC Summit Week 2021, Scientific and Industrial Conference (PRACEdays21).

Languages

Native **Persian, Azerbaijani**

Fluent **English**

Basic **Italian**

References

Peter Wortmann, *Square Kilomotre Array Observatory (SKAO)*, Macclesfield, United Kingdom.
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