Master Project

GPU implementation of Gadget3 with OpenACC

Duration: 4 months
Mentors: Prof. Olaf Schenk (USI), Claudio Gheller (CSCS)
Working place: Lugano, Switzerland

Prerequisites
The prerequisites for this MSc project are good knowledge of C, some familiarity with GPU programming, and basic knowledge of parallel programming concepts.

Within this MSc project, the applicant will learn the OpenACC programming model, apply it to a real cosmological application, and will get insight into the complexity of highly parallel, cosmological simulation tools.

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The cosmological TreePM-MHD-SPH Gadget is a highly optimized and fully MPI/OpenMP parallelized code. It is used within various, large scale projects (e.g. Magneticum, www.magneticum.org), typically running on hundreds of thousands of cores. It makes use of the FFTW library to perform the PM part of the gravity solver, where for the local short range part a tree code is used. These routines - as well as the core routines of the hydro solver (based on smoothed particle hydrodynamic method, SPH) – have been started to port to modern systems, which in addition to multicore CPUs, provide GPU accelerators on the individual nodes (like PizDaint at CSCS) of modern architectures. In addition, many of the additional physics modules (like cooling, starformation, chemical networks), which are essential for modern, cosmological applications, would also need to be ported to GPU accelerators. Being purely local processes, they offer the ideal target to the OpenACC programming model.

Contact information and application

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