

Bachelor thesis: Numerical implementation of the two body problem in general relativity on CUDA

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Prerequisites: some experience in C++, interest to learn CUDA

Language: English or German

Topic: The two body problem in Newtonian gravity can be solved analytically and has been studied in significant detail. However, applying the theory of general relativity results in a set of nonlinear field equations for which a solution, in the fully nonlinear regime, can only be obtained by numerical approximations.

GPGPU (general purpose computing on graphic processing units) has the potential to significantly increase the performance of such simulations. However, to obtain optimal performance on such systems is usually more difficult compared to traditional CPUs.

The goal of this bachelor thesis is

- Understand the physical motivation and the mathematical formulation of the general relativistic two body problem.
- Familiarization with the CUDA programming paradigm for NVIDIA GPUs.
- Implementation of the problem under consideration on GPUs and conducting a performance comparison with a CPU only system.