N-body Simulations Using the GPU

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My project is built around the idea to use the graphics card as a method of accelerating the simulation of physical systems in the form of N-body systems. This vastly reduces the high amount of time required for simulating these systems, allowing me to create complex simulations of physical systems at home that are otherwise difficult to observe in real-world experiments. In many cases, the graphics card can replace huge and cost intensive computer clusters. With a specialized software I wrote in C++ and accelerated with CUDA, I was able to simulate the collision of galaxies and their formation, the process of crystallization and the behavior of Lab-on-a-Chip devices in the field of nanofluidics, addressing the issue of controlling the liquid flow through nano pipes, at home. To show that my simulations represent the behavior of the real world, I also simulated known problems and compared my results with real-world experiments. I am able to use the graphics card as a powerful tool for accelerating computer simulations and to drastically lower the cost and time needed to run N-body simulations, thus increasing efficiency. I was also able to apply the concept of N-body systems onto many different physical systems, essentially broadening the range of application for N-body systems. Additionally, I created a program that allows other people to create and simulate their own N-body systems, making the process of creating N-body simulations faster and available to everyone, without the need to write specialized code to control the graphics card first.

Awards Won:

Fourth Award of $500