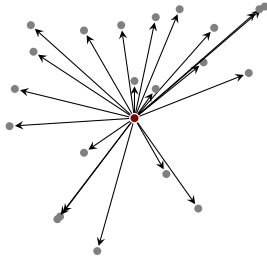


The Problem



- N Particles of mass m , initially in unit box $[0, 1]^3$.
- Direct $\mathcal{O}(N^2)$ evaluation of gravitation

$$\mathbf{F}_i = \sum_{i \neq j} Gm^2 \frac{\mathbf{r}_i - \mathbf{r}_j}{|\mathbf{r}_i - \mathbf{r}_j|^3}$$

- Equation of motion

$$m\ddot{\mathbf{r}}_i = \mathbf{F}_i$$

- Simple timestepping

Project Outline and Goals

- 1** Analysing the code
- 2** Porting to NVIDIA GPUs using CUDA
- 3** Understanding and optimising accelerator performance
 - Shared memory, coalescing and memory organisation
 - Profilers and hardware performance counters
- 4** Developing an optimised implementation on the CPU
 - Caches, multithreading and vectorisation
 - Hardware performance counters on the CPU
- 5** Comparing two platforms: CPU vs GPU