

Background Material

0.1 GPU Computing

The question why use GPUs naturally arises from the title of this project. CPUs in large computing clusters like the University of Southampton's Iridis Compute Cluster could be used. This would simplify the project as extra code called a kernel has to be written for the simulation to run on a GPU. The problem arises in the way CPUs share data in computing clusters. To write code for CPU parallel computing MPI has to be used. A block diagram of this is shown in Figure 1.

This process of sharing data between compute nodes is what really limits CPU parallel computing. The overhead this adds would cause simulations not to scale linearly compared with using a GPU for a highly parallel task. As by comparison the GPU threads are able to access the same shared memory as shown in Figure 2. With regards to writing GPU kernels there are two languages to choose from; OpenCL and CUDA. CUDA is a language developed by Nvidia that only runs on Nvidia GPUs, whereas OpenCL is open source and can run any GPU and indeed a wider range of compute devices. The existing code uses OpenCL kernels, to enable greater hardware compatibility, so OpenCL is the language that will be used for this project.

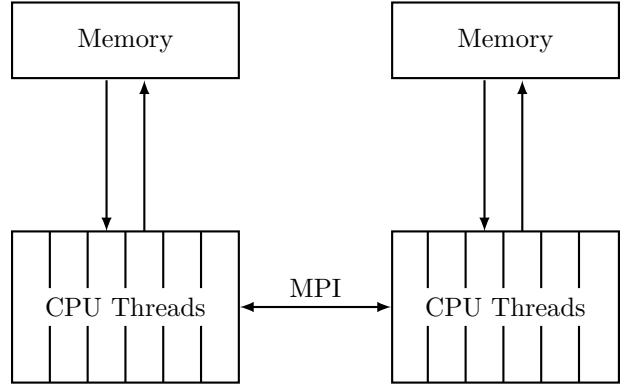


Figure 1: MPI block diagram.

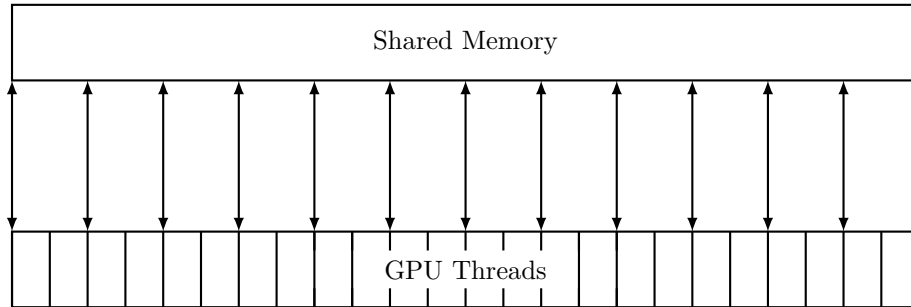


Figure 2: GPU memory block diagram.

0.2 Physics of Particle Evaporation