

GPU-based Optimization for SPIIR Gravitational Pipeline

The computational effort required by real-time detection of gravitational waves is very large because tens of thousands of templates need to be processed in real time. Graphics processing unit(GPU) plays an important role in gravitational wave detection, depending on its highly parallel design and convenient general propose programming. The SPIIR detection pipeline is fully optimized and accelerated and the optimization details are described in detail in this report. The filtering part is accelerated using time coalesced memory access to get a $2\times$ speedup. The post-processing part is optimized iteratively using multiple strategies such as optimizing memory access and removing divergence and gets a more than $20\times$ speedup. In addition, GPU idle time is reduced by optimizing data transfer between CPU and GPU and converting time-consuming CPU code to GPU code. The throughput of the whole pipeline is successfully increased by 4-fold. Race condition problems in the filtering part are also fixed to solve the problem that the pipeline program outputs wrong results in some latest high-speed GPUs, which ensures the stability and reliability of gravitational wave detection.

Authors: GUO, Xiaoyang (Tsinghua University); Ms CHU, Qi (The University of Western Australia); Prof. CAO, Junwei (Tsinghua University); Prof. DU, Zhihui (Tsinghua University); Prof. WEN, Linqing (The University of Western Australia)

Presenter: Prof. CAO, Junwei (Tsinghua University)

Session Classification: Poster session