GPU-Accelerated 1D Hydrodynamic Loop Model
PHSX 591 Solar Flares & CMEs
Final Project Proposal

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We propose to simulate post-flare loops using a one-dimensional hydrodynamic model and use it to match observations of loop cooling. Our model will solve the 1D gas-dynamic equations given by Longcope 2014. This will be achieved using the explicit finite difference method implemented on a graphics processing unit (GPU) to leverage the GPU's immense parallelism. The high performance offered by a GPU should allow for the simulation of larger loop systems than provided by previous studies.

To verify our model we will reproduce the results contained in Longcope 2014. Since this model is an explicit model, we would also like to do tests to characterize the numerical stability of the model by testing it over a variety of temporal and spatial scales.

Once the model has been verified, we will attempt to match SDO/AIA observations of loop cooling by adjusting the amount of energy input, the temporal profile of the energy input, and the thermal conductivity of the plasma. Using these free parameters, we will use regression to reproduce the time-delay between brightenings observed in the various AIA EUV channels.

References

Longcope, D. W. (2014). "A Simple Model of Chromospheric Evaporation and Condensation Driven Conductively in a Solar Flare". In: *ApJ* 795, 10, p. 10. DOI: 10.1088/0004-637X/795/1/10. arXiv: 1409.1886 [astro-ph.SR]. URL: http://adsabs.harvard.edu/abs/2014ApJ...795...10L.