Lecture 0: Welcome & Course Overview

CMSE 822: Parallel Computing

Prof. Sean M. Couch

Who Am I?

Dr. Sean M. Couch (he/him)

- Assistant Professor in Physics & Astronomy, CMSE
- PhD in Astrophysics from U. of Texas at Austin
- Postdoc at UChicago, Caltech
- Started at MSU in 2015 (same time as CMSE!)
- Designed original version of CMSE 822
- Computational Astrophysics - Blowing up stars!

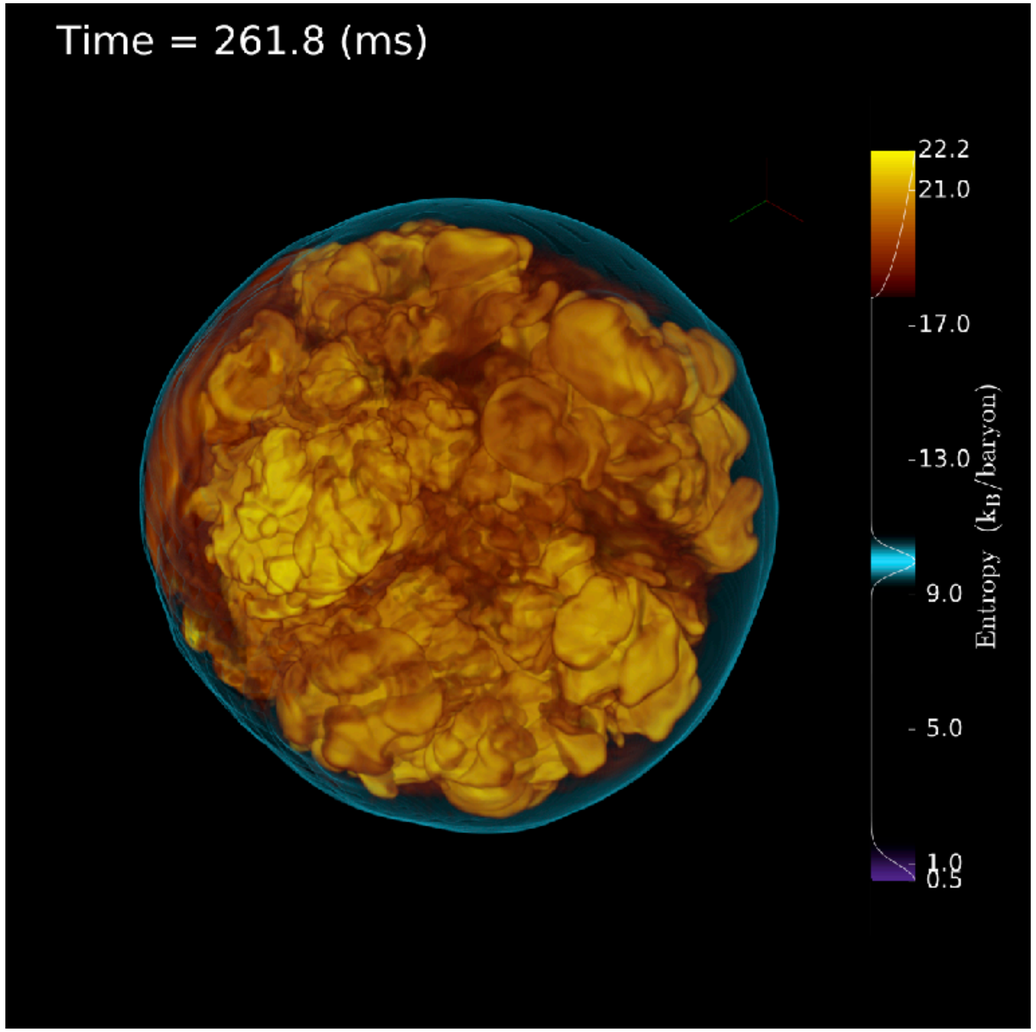
Who Am I?

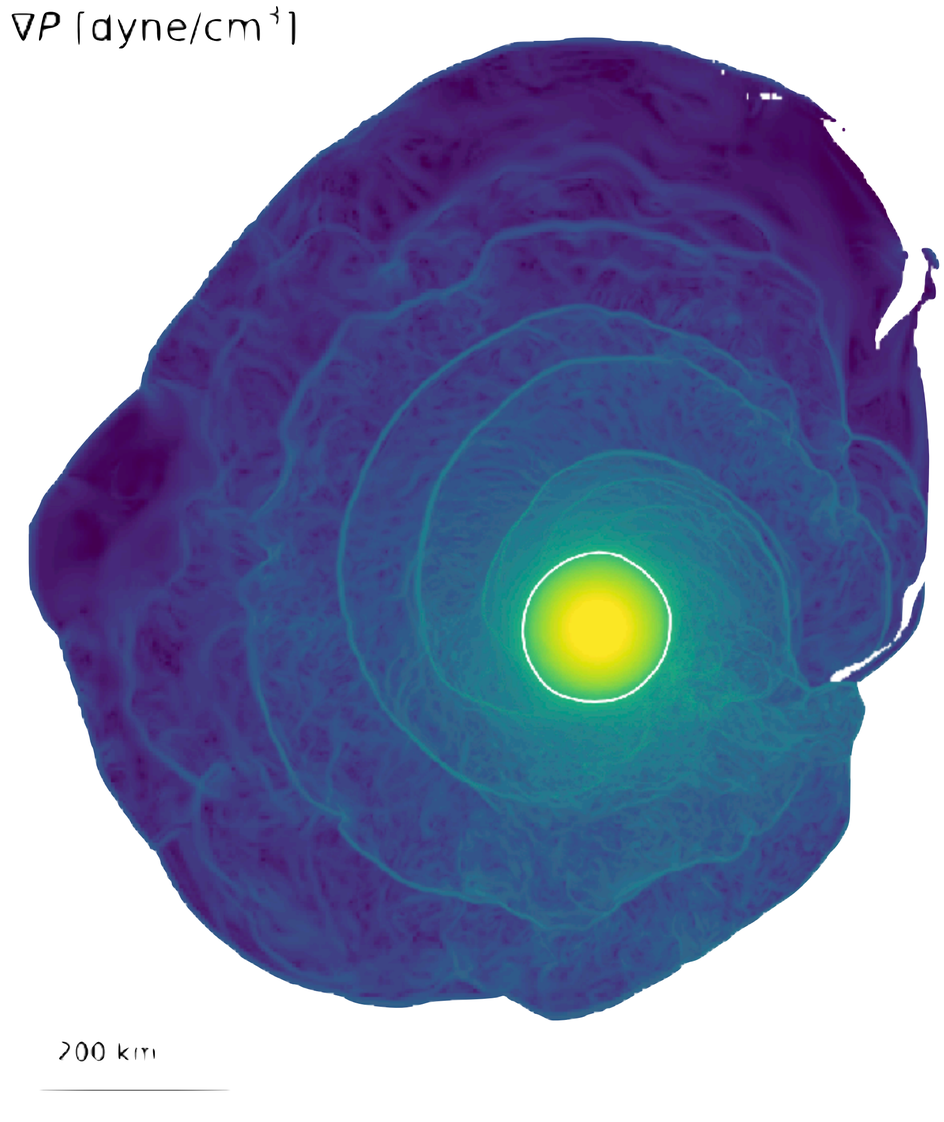
Dr. Sean M. Couch (he/him)

- scouch@msu.edu
- Office hours: by appointment
- Zoom: msu.zoom.us/my/scouch
- www.pa.msu.edu/~couch

Who Am I?

Dr. Sean M. Couch (he/him)





Teaching Assistant

Mr. Jared Carlson (he/him)

- CMSE PhD student
- Office hours: MW, 4-5 pm
- Zoom: https://msu.zoom.us/j/91001529758
- cmse822ta@gmail.com

Course Objectives

Learning goals:

- Benchmark and profile the performance of serial and parallel applications
- Develop and optimize applications using:
  - shared-memory threading parallelism
  - distributed-memory message passing
  - hybrid parallelism
  - and GPU hardware
- Make effective use of high-performance parallel computing architectures

Course Objectives

Recommended background:

- One semester of introductory calculus.
- Ability to program proficiently in C/C++,
- basic understanding of data structures and algorithms (both at the level of CSE 232).
- Basic linear algebra and differential equations.

Course Format

Class Meetings

- Lecture (recorded and posted for review)
- Questions from Slack
- Extra Credit Quizzes
- Group work/discussion/exercises
- Group work on homework

Course Format

Zoom Etiquette

While in the main session:

- click on raise hand if you have questions or type into the chat window
- Click on participants to see the list of participants. “Raise Hand” is in the bottom left of the sidebar
- keep yourself muted and video off unless you have been called on

Course Format

Zoom Etiquette

While in the breakout rooms:

- turn on video or microphone to communicate with teammates
- **if you are not ok with video/audio, you need to find other ways to participate
  - alternatives include typing in the chat or a google doc
  - need to remember that you build interactions through communication; sharing video/audio can be an easy way to do this
- one person should share their screen to help instructional team members that are circulating around
- if you have questions, click on ‘ask for help’
  - the instructors can’t see if you raise your hand in the breakout rooms
  - alternatively, you can also rejoin the main session to ask for help
- look for broadcast messages and announcements to close breakout rooms

Course Format

Zoom Etiquette

If you have technical difficulties:

- try to leave and rejoin Zoom
- try to reinstall Zoom on your device
- try to connect to Zoom on a different device
- contact MSU IT for help
- **You can always start your own meeting to test your video and audio capabilities**

Course Format

Schedule

- Single processor computing, performance analysis, optimization
- Parallel computing theory/topologies/prototypical problems
- Distributed memory parallelism and basic MPI
- Shared memory parallelism and basic OpenMP
- Advanced MPI programming
- Advanced OpenMP programming
- GPUs

Assignments
Using GitHub repos

- Will use git repos (via GitHub Classroom) to distribute and collect work
- GitHub web interface is great, *but*…learn to use the CLI!
- Commit like voting in Chicago: do it early, do it often (shows your work!)
- Submit work in plain text, Markdown, or PDF (no Word docs!)
- If you submit handwritten work as PDF, it must be neatly organized and legible

Final Project

More details later

- Multiple project topics to pick from covering all the typical parallel computing problem types
- Must use multiple forms of parallelism
- Write-up, code, and performance study will be evaluated
- Peer-review: you will evaluate ~3 of your classmates' projects following a detailed rubric

Programming

or “can I make it if I don’t know C/C++?”

- codeacademy.com
- learncpp.com
- Slack channel: #learncpp
- eBooks from MSU library

“You may program in any language you like so long as it is C, C++, or Fortran.” - S. Couch

Learning during a Pandemic

Flexibility!

- Communication!
- Effort!
- Do what you can, when you can
- Distractions…..