Lecture 0: Welcome & Course Overview

CMSE 822: Parallel Computing

Prof. Sean M. Couch

Who Am I?

Dr. Sean M. Couch (he/him)

- Associate 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: TBD, by appointment
- Zoom: msu.zoom.us/my/scouch
- www.pa.msu.edu/~couch

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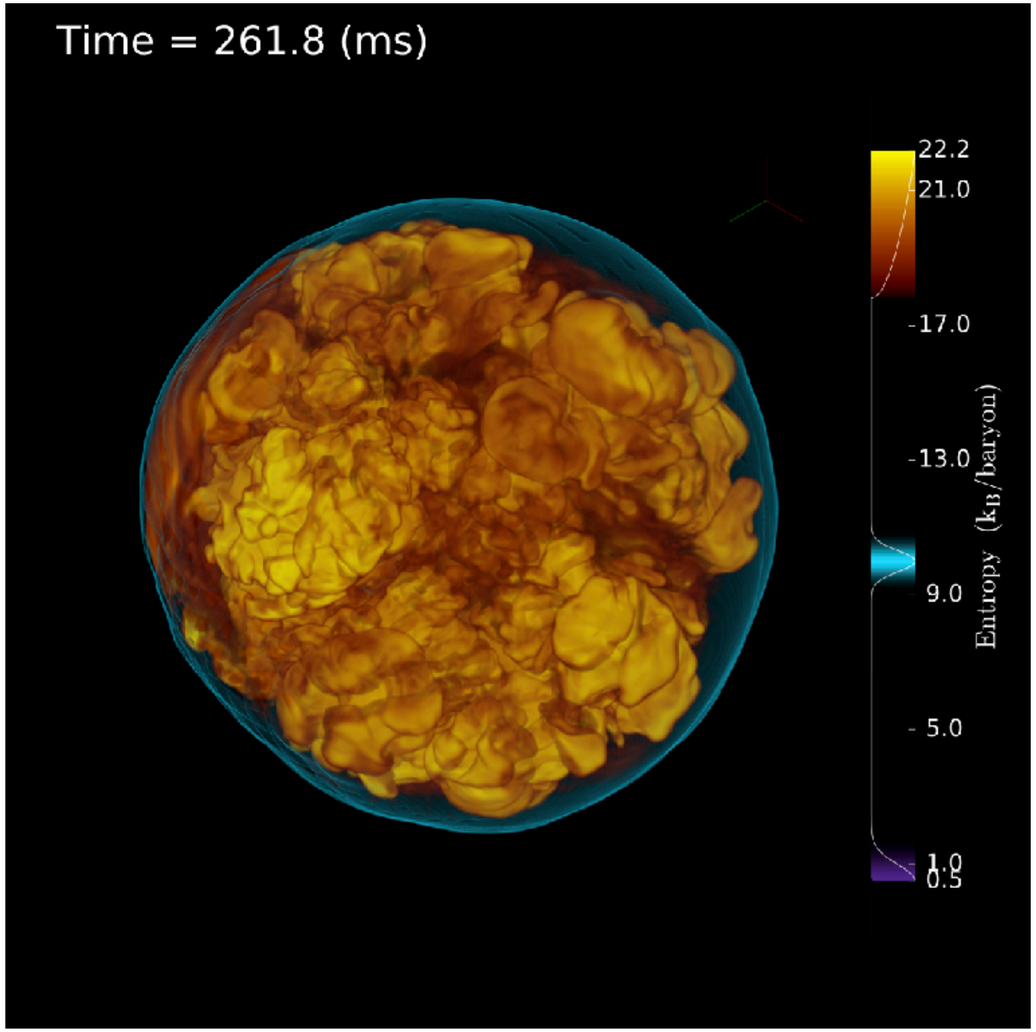

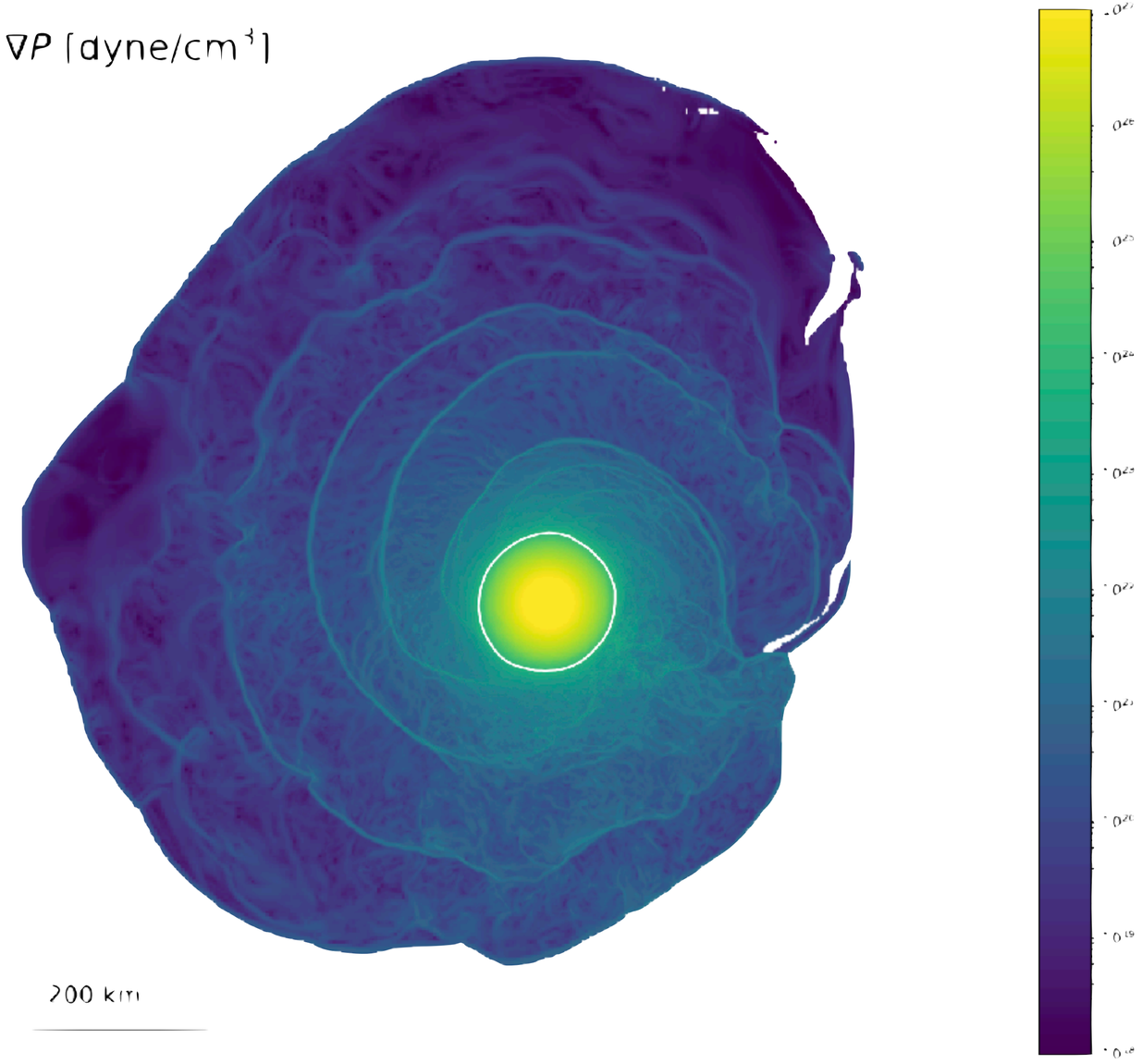

Teaching Assistant

Mr. Vicente Amado

- CMSE PhD student
- Help session: Tu, 1-3 pm, 2504 EGR
- amadovic@msu.edu

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
- Understand the current state of high-performance parallel computing

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

- Lecture/discussion/in-class work
- Pre-class Assignments (reading, exercises)
- 6 Group Programming Projects
  - Peer reviews
  - Group member assessments
- Individual Final Project

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

Group Projects

- Collaboration and participations REQUIRED!
- Peer-assessment of teammate contributions
  - Will be confidential
- Peer-review of other groups' projects
  - One per each of the six projects using provided rubrics
- Organized via GitHub Classroom

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

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 post-Pandemic

Flexibility!

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