

Lecture & Homework Schedule

Reading & Resources:

Class content is drawn from a broad range of reference materials, including review articles and textbooks. Many of these sources are free and available online. Any that aren't online can be found on reserve in the PMA library. The abbreviation used in the course schedule below follows each reference.

Online:

- "Introduction to Astrophysical Computational Hydrodynamics" by M. Zingale **(Z)**
- "Grid-Based Hydrodynamics in Astrophysical Fluid Flows" ARA&A by R. Teyssier **(T)**
- Feynman Lectures, Vol II Chpt 40, 41 **(FL)**
- "Monte Carlo Radiative Transfer" living review by Noebauer & Sim **(NS)**
- "Computer Simulation with Particles" by Hockey & Eastwood **(HE)**
- "SPH Methods in the Modeling of Compact Objects" by S. Rosswog **(R)**
- "Radiative Processes in Astrophysics" by Rybicki and Lightman **(RL)**

On Reserve:

- "Gravitational N-body Simulations" by Aarseth **(A)**
- "Numerical Recipes" 3rd edition, by Press et al., **(NR)**
- "Computer Architecture: A Quantitative Approach" 6th addition by Hennessy & Patterson **(HP)**
- "Computational Physics" by Thijssen **(CP)**

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* Homework (HW) is due to be uploaded to Canvas (or posted to Github as applicable) by **Friday at 5pm of the week it is due.***

Date			Lecture Topic	Reading	HW
Jan	18	T	1. Introduction & Basics	Z Chapter 1, 2; HE 1.1-1.3; NR 1.1,4.1-4.3.	
Part 1. Grid-Based Methods					
	20	Th	2. Hydrodynamics	T §2.1; FL 40.1-3, 41.1-3 (worth reading all of Chapt. 40, 41 to refresh on fluid dynamics)	
	25	T	3. Finite Difference Methods	Z Chapter 3, 4; T §2.3; NR 20.0-20.2	
	27	Th	4. Finite Volume Methods		1
Feb	1	T	5. Artificial Viscosity & Tests	Z Chapter 6.1-6.3	
	3	Th	6. Guest Lecture		
Part 2. Particle-Based Methods					
	8	T	7. Gravity, N-body	HE 11.1,11.2; A Chapter 1, 2	
	10	Th	8. N-body II / Tree Codes	A Chapter 6; NR 21.1,21.2,21.8	2
	15	T	9. SPH Basics	R §1.2, §2.1, §3.1-3.2, §3.5-3.8	
	17	Th	10. SPH II		
Part 3. Approaches to Radiation					

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Date			Lecture Topic	Reading	HW
	22	T	11. Monte Carlo & Probability	NR 7-7.1.1,7.7,7.8; NS §1, §3, §4	
	24	Th	12. Radiation as particles & MCRT	NS §2,§5,§6.1-6.5	3
Mar	1	T	13. Radiative Transfer & Rays	RL 1.1-1.4	
	3	Th	14. Radiation Hydrodynamics	T §4; RL 1.8	
	8	T	15. Guest Lecture		
Part 5. High-Performance Computing					
	10	Th	16. Parallel Computing	HP Chapter 1	4
	15	T	Spring break (no class)		
	17	Th	Spring break (no class)		
	22	T	17. Computer Architectures	HP Chapter 2.1,2.2,3.1,5.1,5.2	
	24	Th	18. Scaling / TACC		
Part 4. Lagrangian & Hybrid Methods					
	29	T	19. Guest Lecture		
	31	Th	20. Magnetohydrodynamics (MHD)		5
Apr	5	T	21. Ideal MHD	T §3.1	
Part 6. Miscellaneous					
	7	Th	22. Source Terms	T §6 (mostly 6.1-6.2)	
	12	T	23. Non-ideal MHD	T §2.4, §3.2	
	14	Th	24. Adaptive Mesh, Moving Mesh	T §7.1-7.2	6
	19	T	25. Data Visualization		
	21	Th	26. Paper Discussions		
	26	T	27. Paper Discussions		
	28	Th	28. Paper Discussions		
May	3	T	29. Project Updates/Presentations		
	5	Th	30. Project Updates/Presentations		
	13	F	Final Project Report Due		