PHY 688: Astrophysical Fluids and Plasmas

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Web: http://bender.astro.sunysb.edu/classes/fluids/

COVID-19 Remote Learning Requirements

This class is scheduled as hybrid (remote/in-person) for Spring 2021 semester. Depending on enrollment and preferences, we may do fully online. Students will need the following for online participation:

- A computer with a microphone that can run Zoom
- The ability to do short programming / plotting exercises. This can either be on your local machine or via the virtual-SINC sites.
- The ability to upload each of their homeworks and exams as a single legible PDF file.
- Assessment will be done via homeworks and student presentations.

Learning Outcomes:

- To understand the origin of the equations of hydrodynamics and magnetohydrodynamics.
- To learn how to apply the fluid equations to astrophysical environments.
- To learn how to solve the equations of hydrodynamics numerically.

Organization:

Course material will be presented through a mix of slides, discussions/derivations on the blackboard, and interactive programming examples. Homeworks will be analytic derivations and programming tasks.

Office Hours:

I will be available via zoom for one-on-one meetings throughout the semester. Official office hours will be listed once the semester begins.

Texts:

We will use *The Physics of Fluids and Plasmas: An Introduction for Astrophysicists* by A. R. Choudhuri. For the computational portion of the class, we will use my online notes:
https://github.com/Open-Astrophysics-Bookshelf/numerical_exercises

Preliminary Lecture Schedule:

class meeting	topic	text chapter
1	introduction	1
2–3	Boltzmann equation	2
4–5	moments / hydrodynamics	3
6–7	ideal fluids	4
8–9	viscous flow	5
10–12	gas dynamics	6
13–14	computation interlude	–
15–16	instabilities	7
17–18	turbulence	8
19–20	rotation	9
21–23	computational hydrodynamics	–
24–25	MHD	14
26–27	reconnection	15
28	summary	–

The lectures will likely slide around by a week or two depending on how in-depth we decide to go on some topics and also the interests of the class.

Computing

It is assumed that students have some programming knowledge.

Grading:

There will be 7–9 homework assignments (a problem or two for each major topic, as well as a final presentation of your choosing). The homework will count for 80% of your final grade, with the presentation the remaining 20%.

Student Accessibility Support Center Statement

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Student Accessibility Support Center, ECC (Educational Communications Center) Building, Room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Student Accessibility Support Center. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities.

Academic Integrity

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Electronic Communication

Email to your University email account is an important way of communicating with you for this course. For most students the email address is 'firstname.lastname@stonybrook.edu'. *It is your responsibility to read your email received at this account.* For instructions about how to verify your University email address see this:

http://it.stonybrook.edu/help/kb/checking-or-changing-your-mail-forwarding-address-in-the-epo

If you choose to forward your University email to another account, we are not responsible for undeliverable messages.

Religious Observances

See the policy statement regarding religious holidays at

http://www.stonybrook.edu/commcms/provost/faculty/handbook/employment/religious_holidays_policy.php

Students are expected to notify the course professors by email of their intention to take time out for religious observance. This should be done as soon as possible but definitely before the end of the 'add/drop' period. At that time they can discuss with the instructor(s) how they will be able to make up the work covered.