Space 574: Introduction to the Space Environment

Syllabus for F23

# Instructor

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# Grader

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PhD Candidate

Climate and Space Sciences and Engineering

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# Course Format

In person lectures only. In exceptional situations the instructor might give some classes by Zoom. The appropriate zoom link will be announced in time.

# Course Overview

Physics of the Space Environment's goal is to introduce the graduate-level space physics needed to understand the Earth's space environment. For PhD students in Space Physics this is course serves as the first foray into the field. For MS/MEng students, the course will provide an overview of the space environment to better understand the constraints on space system design and the science of missions to understand the space environments of the Sun, Earth and planets.

# Expected Knowledge

Pre-requisites: calculus & vector calculus ( credits),  vector and tensor algebra, classical mechanics, electricity & magnetism (senior level), statistical physics or thermodynamics.

Recommended: UG space physics, ordinary & partial differential equations, fluid dynamics, programming/scripting.

# Recommended Reading

##### Main text:

Gombosi: Physics of the Space Environment, Cambridge, 1998. doi: 10.1017/CBO9780511529474

##### Secondary text:

Gurnett & Bhattacharjee: Introduction to Plasma Physics, Cambridge, 2005. doi: 10.1017/9781139226059

##### Recommended:

Nicholson: Introduction to Plasma Theory, Wiley, 1983. ISBN-13: 978-0-471-09045-8

Bittencourt: Fundamentals of Plasma Physics, Pergamon, 1986. doi: 10.1016/C2009-0-06815-9

Krall & Trivelpiece: Principles of Plasma Physics, San Francisco Press, 1986. ISBN-13: 978-0-911-30258-5

Gombosi: Gaskinetic Theory, Cambridge, 1994. doi: 10.1017/CBO9780511524943

##### Plasma Formulary:

Richardson: 2019 NRL Plasma Formulary ([https://library.psfc.mit.edu/catalog/online\_pubs/NRL\_FORMULARY\_19.pdfLinks to an external site.](https://library.psfc.mit.edu/catalog/online_pubs/NRL_FORMULARY_19.pdf))

# Office Hours

In general, the grader will be available to answer questions. The instructor is available by appointment.

# Homework

Please do not use the book problems for the homework, they contain several typos that were corrected in the version available on Canvas. Late HW turned in before the next HW set is due will be graded, but will have 50% deducted.

# Course grade

* Problem sets 30%
* Midterm 30%
* Final 30%
* Class participation, including attendance 10%

# Honor Code

All students in the class are bound by the College of Engineering Honor Code. You may not seek to gain an unfair advantage over your fellow students; you may not consult, look at, or possess the unpublished work of another without their permission; and you must appropriately acknowledge your use of another’s work.

# Specific policies for this course:

##### Homework (limited collaboration):

You may discuss homework assignments with your fellow students at the conceptual level, but must complete all calculations and write-up, from scrap to final form, on your own. Verbatim copying of another student’s work is forbidden. You may not consult homework solutions from a previous term unless they are made available in a publicly accessible form (no unfair advantage can be sought).

##### Midterm and final:

You can use a printed version of the NRL Plasma formulary ([https://library.psfc.mit.edu/catalog/online\_pubs/NRL\_FORMULARY\_19.pdfLinks to an external site.](https://library.psfc.mit.edu/catalog/online_pubs/NRL_FORMULARY_19.pdf)). In addition, a one sheet (A4) cheat sheet is allowed for the midterm and two sheets of cheat sheets are allowed for the final. You can also use a calculator (but no phones, iPads or e-readers are allowed).

# Accommodations for Students with Disabilities

If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way the course is usually taught may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Office of Services for Students with Disabilities (34-763-3000; http://ssd.umich.edu)) to help us determine appropriate academic accommodations.