

Syllabus for CLIMATE/SPACE 370 Solar-Terrestrial Relations

Fall 2021

Course description:

This is an upper-level undergraduate course that focuses on basic physical processes on the Sun, in the solar wind, in the magnetosphere and ionosphere and their implications to space weather that we experience both in the near-Earth space and on ground.

The course homework consists of solving problems focused on the basic physical concepts and analyzing data from ground-based and satellite instruments. The course ends with independent project work, whose results are presented in class and as a written report.

There are no pre-requisites to this course. Theoretical concepts and mathematical formulations are introduced as they are needed. Knowledge of basic electrodynamics and vector calculus is an advantage.

Instructor:

Professor Tuija Pulkkinen
Room 1521b, Climate and Space Research Building
Email: tuija@umich.edu
Office phone (mobile): 734-780 4079

Class hours:

Regular: 1:00 – 3:00 pm, Monday & Wednesday, 2424 CSRB

Instructor office hours:

Monday 11-12 or by appointment

Primary textbook:

“Understanding Space Weather and the Physics Behind It,” by Delores J. Knipp
The book is out of print, but you can either get a used copy from Amazon or an electronic copy from <https://spacetechnologyseries.com/~spacet9/books/Space-Weather.html>

Homework:

There are four homework assignments during the class. The homework assignments are due at midnight on the due date (see summary schedule). Assignments submitted late are reduced by 10%. Assignments are not accepted after homework has been discussed in class.

Final project:

The final project consists of analysis of a solar or solar wind active event and its impact on the magnetosphere - ionosphere system. The project is conducted by each student individually. The project outcome consists of a 20-min presentation in class and an 8-page written report (see summary schedule for due dates).

Extra credit:

There will be an opportunity for extra credit, please ask for an assignment. Furthermore, if 75% of the students complete the course evaluation survey, you will receive 1% extra toward your overall course grade.

Grading:

The grade breakdown is as follows:

In-class participation	10%
Homework sets 4x15%	60%
Final project presentation	10%
Final project written report	20%
Extra assignment	10%

Grade assignment:

A+	97%	B	83%	C-	70%
A	93%	B-	80%	D+	67%
A-	90%	C+	77%	D	63%
B+	87%	C	73%	D-	60%

Course code of conduct and academic honor code

The College of Engineering has an honor code. This is taken seriously.

<http://elc.engin.umich.edu/wp-content/uploads/sites/19/2019/03/Honor-Code-Pamphlet-2018.pdf>

Violation of this policy is grounds for the initiation of a report filed with the Dean's office and the case would come before the Honor Council of the College of Engineering. You are encouraged to contact me for any questions about this policy.

Policy on homework and project work

You are encouraged to form study groups to work on homework problems and to study together in other ways. You are allowed to consult with other students during the conceptualization of a problem. However, all written work, whether in scrap or final form, is to be generated by you individually. You are not allowed to possess, look at, use, or in any way derive advantage from the existence of solutions prepared in prior years, whether these solutions were former students' work product or copies of solutions that had been made available by others.

Policy on religious absence

If you expect to miss classes as a consequence of religious observance, you will be provided with a reasonable alternative opportunity to make-up missed academic work. It is your obligation to provide me with the dates of absence within the first three weeks of the semester. When the absence coincides with assignment due dates, the options to make up may be limited.

Disability policy:

If you may need an accommodation for a disability, please inform me at the beginning of the term. You should contact the Services for Students with Disabilities (SSD) office. Once the eligibility for an accommodation has been determined, you will be issued a Verified Individual Services Accommodation (VISA) form after which an accommodation can be arranged. Any information provided is private and confidential and will be treated as such. Please present the VISA form to me at your earliest convenience, but no later than two weeks prior to the need for the accommodation so that there is enough time to make the appropriate arrangements.

Student harassment and discrimination policy:

The University of Michigan is committed to maintain a work environment free of harassment and discrimination based on e.g. race, color, national origin, age, marital status, disability, religion, height, weight, sex, sexual orientation, gender identity, or gender expression. Discrimination and harassment diminish individual dignity and undermine students' academic success, and is not tolerated in any form.

- If you have experienced harassment or discrimination, please seek to talk to someone to get the support that you need. Confidential support and academic advocacy can be found e.g. with the Sexual Assault Prevention and Awareness Center (SAPAC) on their 24-hour crisis line, (734) 936-3333 and at sapac.umich.edu.
- Alleged violations can be non-confidentially reported to the Office for Institutional Equity (OIE) at institutional.equity@umich.edu.

If you witness harassment, discrimination or any kind of misconduct, please act so that we can develop a healthy and safe environment for everybody.

- In the situation, focus discussion or attention to non-sensitive topics
- After the situation, report to class instructor / student services / OIE
- Do what you can to help the victim seek the help that they might need.

I am always available for discussion of these topics. Note that professors are obliged to report Title IX violations. However, in handling the reports, I and others do our best to maintain privacy and confidentiality.

Student mental health and wellbeing:

If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available.

- Counseling and Psychological Services (CAPS) at (734) 764-8312 and caps.umich.edu during and after hours, on weekends and holidays, or through its counselors physically located in schools on both North and Central Campus. Y
- University Health Service (UHS) at (734) 764-8320 and <https://www.uhs.umich.edu/mentalhealthsvcs>
- For alcohol or drug concerns, see www.uhs.umich.edu/aodresources.
- For a listing of other mental health resources available on and off campus, visit: <http://umich.edu/~mhealth/>.

Course overview and due dates:

Date	Day	#	Lecture topic	Due dates	Reading
8/30	Mon	1	Introduction		1.1-1.4
9/1	Wed	2	Sun: Structure		2.1, 3.1
9/6	Mon		Labor Day		No class
9/8	Wed	3	Sun: Atmosphere		2.2, 2.3, 3.2
9/13	Mon	4	Sun: Magnetic field		3.3, 4.3, 6.1, 6.4, 6.5
9/15	Wed	5	Sun: Activity		9.1, 9.2, (9.3)
9/20	Mon	6	Solar wind: Structure	HW1 due	5.1, (5.2)
9/22	Wed	7	Guest lecture: Data analysis		
9/27	Mon	8	Solar wind: Disturbances		10.1, 10.2, 10.3
9/29	Wed	9	Magnetosphere: Internal field		7.1
10/4	Mon	10	Magnetosphere: Structure		7.2
10/6	Wed	11	Magnetosphere: Plasma motion	HW2 due	6.2, 7.3
10/11	Mon	12	Magnetosphere: Dynamics		7.4, 11.2
10/13	Wed	13	Guest lecture: Parker Solar Probe		
10/18	Mon	14	Homework 1 & 2 discussion		
10/20	Wed		Study break		No class
10/25	Mon	15	Data analysis & project introduction	HW3 due	
10/27	Wed	16	Magnetosphere: Substorms		11.2
11/1	Mon	17	Magnetosphere: Storms		11.1
11/3	Wed	18	Ionosphere-thermosphere: Structure	HW4 due	8.1, 8.2
11/8	Mon	19	Guest lecture		
11/10	Wed	20	Ionosphere: Activity		8.4
11/15	Mon	21	Homework 3 & 4 discussion		
11/17	Wed	22	Sun-Earth System: Coupling		
11/22	Mon	23	Sun-Earth System: Modeling		
11/24	Wed	24	Space Weather: Space Effects		13.1, 13.2
11/29	Mon		Thanksgiving holiday		No class
12/1	Wed	25	Space Weather: Ground Effects		13.3
12/6	Mon		Project presentations	Presentation due	
12/8	Wed		Project presentations		
12/13	Mon		Project presentations		
12/15	Wed		Exam week		No class
12/20	Mon		Exam week	Report due	No class
			End of semester		No class