Space Weather and the Space Environment

EAS 4939

Class Periods: Monday, Wednesday, Friday, Period 5, 11:45am – 12:35pm

Location: MAE–B 0211

Academic Term: Spring 2023

Instructor:
Alicia K. Petersen, PhD
Assistant Professor, Mechanical and Aerospace Engineering, UF
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Office Hours:
Mondays, 2pm-3pm, MAE-A 306 or MAE-A 304.
Wednesdays, 3pm–4:30pm, MAE-A 306 or MAE-A 304.
Course CANVAS Website:
https://ufl.instructure.com/courses/470529

Course Description

This 3 credit course will focus on: 1) Space Weather, what it is and what drives it, 2) the Sun-Earth System and the Space Environment, what comprises the near-Earth space environment, including radiation belts and the magnetosphere, ionosphere and thermosphere, and 3) Space Weather Impacts on technologies and Earth's space environment, such as during geomagnetic storms. The course will have a mix of lectures, in-class active learning activities, reading quizzes, written reflections, homework assignments, exams and projects. Throughout the course students will get the chance to learn how Space Weather and the Space Environment are studied and forecasted, and their effects on communications, spacecraft, infrastructure, astronauts and flight personnel. Students will also have the chance to test out space weather modeling via a modeling project using research-grade models on the NASA Community-Coordinated Modeling Center (https://ccmc.gsfc.nasa.gov/). This course aims to give students the insight to understand how the space environment affects the very systems and technologies studied in other MAE research and courses and to gain skills for studying wholistically a vast complex physical system, data analysis of diverse datasets, and using modeling for research, factoring in their inherent limitations and error.

Instructor assumes most students will have no prior exposure to the subject of space weather but are excited to study how and why these parts of a whole come together to impact a variety of mechanical and aerospace systems.

Course Pre-Requisites / Co-Requisites

Engineering major of junior standing or higher. Others may be approved with instructor permission.

Course Objectives

1. **Students will learn what space weather is and is not.**
    a. Primarily covered during Module 1.
2. **Students will gain a sense of the scope of the interconnected system of space weather drivers and impacts.**
    a. Primarily covered during Module 1 and Module 2.
3. **Students will be able to identify the connected systems that drive and are impacted by space weather.**
    a. Primarily covered during Module 2.
4. **Students will be able to recognize a potential impact of space weather, what space weather drivers are relevant and know where to find more information.**
    a. Primarily covered during Module 2 and Module 3.
5. **Students will be able to analyze current modeling, research and affected technologies in the context of current open questions and potential impacts of space weather.**
    a. Primarily covered during Module 2 and Module 3.
6. **Students will be able to evaluate some of the current and possible capabilities of space weather data analysis, modeling and forecasting.**

a. Primarily covered during Module 2 and Module 3.

7. **Students will be able to effectively communicate what they've learned for each of the above objectives whether spoken, visual or written catered to the audience and context.**
    a. Covered and assessed throughout course.

Materials and Supply Fees

No additional course fees beyond acquiring the required textbook.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Medium
3. An ability to communicate effectively with a range of audiences	High
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Medium
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	High

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbook

- An Introduction to Space Weather
- Mark Moldwin
- 2008, 1st Edition
- ISBN 978-0-521-86149-6 (hardcover) or ISBN 978-0-521-71112-8 (paperback)

Additional readings, notes and journal papers will be provided via CANVAS.

Recommended Additional Textbook

- Space Physics, An Introduction
- C. T. Russell, J.G. Luhmann, and R.J. Strangeway
- 2016, 1st Edition
- ISBN 978-1-107-09882-4

Course Schedule

Module 1: Space Weather: What is it? What drives it?, Weeks 1-5
Module 2: Sun-Earth System and Earth's Space Environment, Weeks 6-10
Module 3: Space Weather Impacts, Weeks 11-15

Attendance Policy, Class Expectations, and Make-Up Policy

In-class attendance is expected. In-class activities may be required and graded for credit, which may or may not be announced ahead of time and may or may not be made up, at instructor discretion.

If students have a planned absence of academic relevance or otherwise, reach out to instructor directly, via email through CANVAS (face-to-face check-in as well, if missing an in-class activity) more than one week ahead for any requested accommodations or extensions. For emergency and medical absences, please notify instructor via email through CANVAS prior to the missed class times for notification and requested accommodations or extensions. Any requested accommodations or extensions will be assessed on a case-by-case basis with a concerted effort towards equity. Types of requests which for example will be given consideration on a case-by-case basis may include: illness due to communicable viruses, research conference travel, university sports competitions, or funeral travel, to name a few.

Students are expected to have access to a personal computer and regularly monitor both email and CANVAS for class communications.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:
https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Evaluation of Grades*

Assignment	Percentage of Final Grade
Homework Sets (6)	25%
Projects & In-class Activities (TBD)	20%
Reading Quizzes (6)	5%
Written Reflections (3)	10%
Journal Assignments (3)	5%
Module Exams (2)	20%
Final Exam or Final Research Paper	15%
	100%

**Course Grade Percentage Breakdown is Subject to Change.*

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx,
https://handbook.aa.ufl.edu/teaching/policies/

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator
• Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
• Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

This syllabus is written with the best intentions to be accurate and complete.
However, everything stated herein is subject to change at instructor discretion.

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*: https://distance.ufl.edu/state-authorization-status/#student-complaint*.