PHYS F472G Advanced Topics in Physics II: Solar Physics

Fall 2025

Course Information

Title: Advanced Topics in Physics: Solar Physics

Number: F472G

Credit: 1

Prerequisites:

- PHYS F220 or an equivalent of 'Introduction to Computational Physics'
- PHYS F301 or an equivalent to 'Introduction to Mathematical Physics'

Location: TBD

Meeting Time: MWF, TBD

Course Type: In person

Instructor

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Office location: TBD (Reichardt Offcice) and 706A Elvey Building (GI Office)

Office hours: TBD at Reichardt Office and by appointment at GI Office

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Textbooks

- *The Sun - An Introduction*, Michael Stix, 2nd ed. Springer, 2002.
- *The Sun as a Guide to Stellar Physics*, Edited by Oddbjørn Engvold, Jean-Claude Vial and Andrew Skumanich, Elsevier, 2019, ISBN 9780128143346.}. doi:10.1016/C2017-0-01365-4

The lecture notes, workbooks, and reading materials will be made available online. The students do not need to purchase the textbooks.

Course Description and Goals

This course is a 1-credit course aimed at upper level undergraduate and graduate students. The course aims to introduce students to Solar Physics which is the theoretical and observational studies of the Sun's characteristics, through solar magnetism, oscillations, wind and eruptions.

Course Schedule

Tт Class	Tт Dates	Tт Topic	⏰ Deadlines
1		Overview of the Sun	
2		Characteristics of the Sun	
3		The Sun's Internal Structure	
4		The Sun's Atmosphere	HW 1 Due
5		Solar Oscillations	
6		Solar Convection and Rotation	
7		Solar Magnetism and Dynamo	HW 2 Due
8		The Solar Chromosphere and Corona	
9		The Solar Wind	
10		The Solar Wind (continued)	HW 3 Due
11		Solar Eruptions: Prominences, Flares, and Coronal Mass Ejections	
12		Space Weather	
13		Final Project Presentations	
14		Final Project Presentations	
			Final Report Due

Student Learning Outcomes

The students will learn about the Sun, its history and its characteristics. At the end of the class students will be able to:

- Understand the generation and transfer mechanisms of solar energy.
- Understand the dominant physical mechanisms that govern different regions of the Sun.
- Understand solar magnetism, generation and evolution of solar magnetic fields, and their impact on solar activity.

- Identify and differentiate between different types of solar eruptions and their impact across the solar system.
- Use data, models, and forecasting tools to analyze different solar phenomena.
- Understand open problems in Heliophysics.

Instructional Method

The class will consist of 14 lectures, designed as three 1-hour long in person lectures per week. Students are expected to attend lectures in person at the designated time. Lecture materials will primarily consist of slideshow presentations. All materials will be made available via Canvas.

Course Policies

- Quizzes will be given each week at a random date and used as a way of checking and enforcing attendance.
- Due to time limitations, there won't be enough time to go in-depth for all materials of interest. Students are highly recommended to read and study the designated supplementary materials by themselves before each class and ask questions during a class, office hours, or by setting up an appointment.
- Homework will be posted and collected through Canvas. Please submit your homework on the due date stated in the homework. Late homework will not be accepted without evidence of illness or genuine emergency.
- Deadline extensions will be granted collectively if the whole class agrees upon it. Students are encouraged to use Canvas to achieve consensus on deadline extension requests.
- Students are encouraged to work together on the homework problems. However, the submitted material must reflect student's own work.
- Plagiarism and cheating are not accepted with no exception and will result in a grade of zero for the assignment.
- Use of generative AI (such as Gemini, ChatGPT, Bard, DeepSeek, Copilot, etc.) is prohibited unless instructed.

Grading Policy

Type	% Percentage
Quizzes	15 (5% each)
Homework	45 (15% each)
Final Project Presentation	10
Final Project Report	30
Total	100

There will be three quizzes, three written assignments, a final project presentation and report. The quizzes will be given each week at a random class time to ensure attendance. The final reports will be graded using a specification grading policy. The final project will be made available from the beginning of the class. The instructor will provide various journal articles for the students to pick from. The students can also work with a paper of their preference after it's approved by the instructor. The project will include a final presentation and a project report on the paper student selected. The project report will detail the paper's motivation, its importance, a discussion of gained physical understanding in a commentary format. Final grades will be returned as letter grades with plus/minus modifiers. These will be derived from the overall percentage grade. The approximate conversions for each letter grade will be as follows: A+ (>97.5), A(>87.5), A-(>85), B+(>82.5), B(>72.5), B-(>70), C+(>67.5), C(>57.5), C-(>55), D+(>52.5), D(>42.5), D-(>40), F (<40)

Student Protections Statement

UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site: https://catalog.uaf.edu/academicsregulations/students-rights-responsibilities/.

UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: https://alaska.edu/nondiscrimination/.

Academic Honesty

UAF expects and requires academic honesty from all members of the University community, and takes any act of plagiarism and cheating seriously. It is expected that all assignments, including homework and reports, that are turned in for this course must the original work of the individual student. Failure to comply with this policy will result in penalty as stipulated under UAF regulations.

Incomplete Grade Policy

The instructor follows the University of Alaska Fairbanks Incomplete Grade Policy: "The letter "I" (Incomplete) is a temporary grade used to indicate that the student has satisfactorily completed (C or better) the majority of work in a course but for personal reasons beyond the student's control, such as sickness, has not been able to complete the course during the regular semester. Negligence or indifference are not acceptable reasons for an "I" grade."

Disabilities Services

The UAF Office of Disability Services implements the Americans with Disabilities Act (ADA), and ensures that UAF students have equal access to the campus and course materials. Any student who may need assistance with disabilities, should feel free to contact the Office of Disabilities Services (208 WHIT) by calling 907- 474-5655, or through email: uaf-disability-service@alaska.edu.

I will work with the Office of Disability Services to provide any reasonable accommodation to students with disabilities.

Effective Communication

Students who have difficulties with oral presentations and/or writing are strongly encouraged to seek assistance from the UAF Department of Communication's Speaking Center (907-474-5470, speak@uaf.edu) and the UAF English's Department's Writing Center (907-474-5314, Gruening 8th floor), and/or CTC's Learning Center (604 Barnette Street, 907-455- 2860).

Use of Generative AI

Generative artificial intelligence (AI) tools and large language models (LLMs), such as ChatGPT, are designed to assist in creating and analyzing text, code, video, audio, and other multimedia. Use of these resources in your coursework comes with benefits and risks. In this course, the rules for usage are as follows:

- Do not use AI unless the assignment explicitly allows for it in the instructions and/or rubric. If you are unsure if your use of AI on an assignment is acceptable, ask the instructor and ensure you have documentation of permissions as appropriate.
- Identify Contributions: Any work you submit that has incorporated AI-generated content should indicate which parts of the work are yours and which parts were generated or informed by AI. AI contribution should be no more than 10% of assignment content.
- Provide Attribution: All use of AI tools (such as ChatGPT and others) must be explicitly cited with an explanation of how the AI tool was used and which prompts were given. This may be lengthy. Consider including as an appendix. Correct formats for attribution can be found at: Citing ChatGPT - UAF Elmer E. Rasmuson Library.
- Include Reflection: Any use of AI tools must include a brief reflection on what you learned by using the tool. For example, did you identify incorrect elements within generated work? How will you refine future prompts to address similar problems?

Any use of AI within the course that does not meet these rules may be considered a breach of the UAF Code of Conduct and carry substantial penalty. While exercising responsible and ethical engagement with AI is a skill you may hone over time, your unique human insights, critical thinking, and creative contributions remain pivotal to your learning experiences and success.