

PHYS 472G Advanced Topics in Physics II: Solar Physics (2017)

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Class meets:	MWF 1:00 PM - 2:00 PM (October 2nd to November 1st, 2017)
Classrooms	Reichardt 204
Office hours:	MWF 8:25 AM - 10:25 AM or by appointment
Credits:	1 credit: 3 hours/week of lecture.
Textbook:	No textbook purchase is required. References are listed below.
Prerequisites:	PHYS F220; PHYS F301; or permission of instructor
Course Home Page:	http://www.gi.alaska.edu/~chungsangng/phys472G/phys472G.html

I. Course Description

The UAF Catalog listing for PHYS 472G: "Application topics provide expanded exposure to subjects in physics. Three topics are offered within the fall and spring semesters of each academic year as compressed 14-lecture, one-credit courses. Prerequisites: PHYS F220; PHYS F301; or permission of instructor. (1+0)"

This course will introduce some basic physics of the sun. At the end of this syllabus is a tentative schedule which lists topics we plan to cover in more details. This is subject to change. So you should check frequently the online version of this page: <http://www.gi.alaska.edu/~chungsangng/phys472G/phys472G.html>

II. Course Goals

The main goal of this course is to introduce you to the fundamental concepts, phenomena, and theories of solar physics, at the upper undergraduate level.

III. Student Learning Outcomes

- Know how to apply basic physical laws to model solar phenomena and solve basic problems related to topics covered in the course.
- Have basic understanding of various aspects of solar physics.
- Obtain good understandings on useful concepts, as well as theoretical and mathematical tools related to solar physics that can help students to conduct other research.

IV. Textbook, Reading Assignments, and References

Since this is a one-credit course lasting one month, you are not required to buy a textbook. However, topics will be mainly based on some selected sections from the following references that you can download:

1. (B) Benestad, 2006, Solar Activity and Earth's Climate (<http://link.springer.com/book/10.1007/3-540-30621-8>).
2. (K) Koskinen, 2011, Physics of Space Storms-From the Solar Surface to the Earth (<http://link.springer.com/book/10.1007/978-3-642-00319-6>).
3. (A) Aschwanden, 2005, Physics of the Solar Corona (<http://link.springer.com/book/10.1007/3-540-30766-4>).

There will also be materials from other references (and Internet sites), including

4. (KR) Kivelson and Russell, 1995, Introduction to Space Physics, Cambridge University Press (ISBN 0521451049).
5. (M) Mullan, 2010, Physics of the Sun: A First Course, CRC Press (ISBN 9781420083071).
6. (MA) Miralles and Almeida (ed.), 2011, The Sun, the Solar Wind, and the Heliosphere (<http://link.springer.com/book/10.1007/978-90-481-9787-3>).
7. (KC) Kamide and Chian (Eds.), 2007, Handbook of the Solar-Terrestrial Environment, Springer (ISBN 978-3-540-46314-6).
8. (E) Eddy, 2009, The Sun, The Earth, and the Near-Earth Space, NASA (ISBN 978-0-16-08308-8) (http://www.nasa.gov/publications/SES_Book_Interactive%20508.pdf).
9. (L1) Lang, 2001, The Cambridge Encyclopedia of the Sun, Cambridge University Press (ISBN 0-521-78093-4).
10. (L2) Lang, 2009, The Sun from Space, Springer (ISBN: 978-3-540-76952-1).
11. (S) Stix, 2004, The Sun - An Introduction, Springer (ISBN 978-3-642-56042-2).
12. (V1) Vita-Finzi, 2008, The Sun - A User's Manual, Springer (ISBN 978-1-4020-6680-5).
13. (V2) Vita-Finzi, 2013, Solar History - An Introduction (ISBN 978-94-007-4294-9).
14. (Br) Brekke, 2012, Our Explosive Sun, Springer (ISBN 978-1-4614-0570-2).
15. (RN) Rozelot and Neiner, 2013, The Environments of the Sun and the Stars, Springer (ISBN 978-3-642-30647-1).
16. (VV) Vaquero and Vazquez, 2009, The Sun Recorded Through History, Springer (ISBN

978-0-387-92789-3).

17. (F) Foukal, 2004, Solar Astrophysics, Wiley (ISBN 3-527-40374-4).

18. (R) Russell, Luhmann, and Strangeway, 2016, Space Physics (ISBN 978-1-107-09882-4).

There is a large volume of observation data and general information on solar physics in the Internet. Some links are listed in here:

<http://www.gi.alaska.edu/~chungsangng/phys472G/solar-nasa-video.html>

V. Instructional method

The class is one credit over a month, and so there are 3 hours per week for lectures. Based on the reading schedule listed below, you should have read the materials in references before coming to each day's lecture. You are also expected to contribute to discussion in class about physical concepts and mathematical derivations. I will not have time to read through all the materials, but will only highlight those points that are important or difficult. You must cover the rest by reading and ask for help if you encounter difficulties.

Note: some lecture notes will be available for download via the BlackBoard site.

VI. Homework

There will be approximately one homework set assigned per week. You should work on your homework as early as possible before a deadline so that you can have time to ask for help if you encounter difficulties in solving these problems. Late homework will not be accepted.

To emphasize the importance of doing homework, homework grade will count towards 50% of the total grade of the course.

Your submission of any homework problem cannot simply be a one-line statement of the answer. You need to show steps of how you used the method leading to that answer. I will grade the homework based on the method used, as well as the answer. Therefore, you should submit your partially finished work. This will help you getting partial credit, and let me identify your difficulties. Also, your work should be clean and clear enough for me to understand.

While it is good for you to have discussion with classmates or search the Internet for additional information, your submitted homework should be of your own, but not a direct copy from another source. Keep in mind that you will be required to do similar questions on your own during exams. In addition, it is against the UAF Honor Code to misrepresent work which is not your own. Plagiarism on homework or on an exam will result in a failing grade.

Solutions to the homework problems will be posted on BlackBoard after the due date. Therefore, late homework will not be accepted. The homework assignments will be posted on BlackBoard.

VII. Examinations

There will be one one-hour in-class final exam on the last day of class, Wednesday November 1st. It

will be a closed book exam. Calculators, computers, and communication devices are also not allowed. However, special or unusual formula or integrals essential to a particular question will be written down for that question. The final exam counts towards 50% of the total grade. ***You must not miss the Final Exam (except for documented illness or family emergency).***

Some questions in the exam will be similar to those you have seen in homework. This is to make sure that you don't just copy homework answers without truly understanding how to answer on your own. Thus, it is important to review homework sets and solutions before the exams. Exam questions will be graded based on the method used, as well as the answer. Therefore, you should write down explicitly and clearly step by step how you come up with your answers. This will help you getting partial credit.

VIII. Grading

The final grade will be composed of:

Final exam:	50 %
Homework	50 %
Total:	100 %

The course will be graded approximately on the following scale:

> 90 %	A
87 % -- 90 %	A-
83 % -- 87 %	B+
80 % -- 83 %	B
77 % -- 80 %	B-
73 % -- 77 %	C+
70 % -- 73 %	C
67 % -- 70 %	C-
63 % -- 67 %	D+
60 % -- 63 %	D
57 % -- 60 %	D-
< 57 %	F

IX. Getting Help

My office hours are 18:25 AM - 10:25 AM on Monday, Wednesday, Friday. I will be at Reichardt 108 during these office hours. Canceled office hours will be announced in class or by email. If you need to see me outside these office hours, please set up a time by appointment to come to my office at Elvey 706E. These are hours set aside especially to help you - do not feel like you are imposing or cheating by coming in. If you have problems that need immediate attention, please send me an e-mail or give

me a call at my office phone number.

X. Disabilities Services

The Physics Department will work with the Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accommodation to students with disabilities.

XI. Tentative Schedule

Below is a tentative schedule (subject to change). You should read the sections of the reference textbooks (indicated by initial letters) listed in IV for a given day before coming to the class for that day.

Date	Day	Ref. Reading	Topics	Homework due
10/2	M		Syllabus, resources	
10/4	W	B-Ch.2; A-1.1; K-1.1.4	Solar Observations	
10/6	F	B-3.2.1-3.2.3; K-1.1.1	Basic facts of the Sun	
10/9	M	B-3.2.4	Solar interior	
10/11	W	K-1.1.2; B-2.2	Solar radiation	
10/13	F	B-3.2.5-3.2.6; K-1.13	Photosphere/Chromosphere	HW1
10/16	M	B-3.2.7; A-1.2, 1.5 to 1.11	Solar Corona	
10/18	W	B-3.2.8; K-1.2	Solar Wind	
10/20	F	B-3.3; A-1.4	Solar magnetic field	HW2
10/23	M	B-4.1-4.8; K-1.1.5; A-1.3	Solar cycle/sunspots	
10/25	W	B-4.9; K-1.1.6, 12.1-12.3	Solar flares	
10/27	F	K-12.4-12.5	Coronal Mass Ejections	HW3
10/30	M	K-1.5.2, 12.4.2, 14.2.3	Space weather	
11/1	W		Final Exam	