Course Name: **Stars and Stellar Evolution**
Course Number: **PH 206**
Term Offered: **Summer 2019**
Credits: **4**
Instructor name: **Dr. Kathryn Hadley**
Instructor email: Kathryn.Hadley@oregonstate.edu
Instructor phone: **541-737-4312**
Link to instructor bio or website: **khadley.com**

Course Description
This course covers the properties of stars; star formation, evolution, and death; supernovae, pulsars, and black holes. We will study electromagnetic radiation and spectroscopy as they pertain to observations. An accompanying laboratory is used for demonstrations, experiments, and projects, as well as for outdoor observations. The courses in the astronomy sequence (PH 205, PH 206, PH 207) can be taken in any order. Lec/lab. (Bacc Core Course)

Prerequisites/Corequisites There are no separate pre- or co-requisites. However, students should have a working knowledge of basic algebra, logarithms, and scientific notation.

Communication
Please post all course-related questions in the General Discussion Forum so that the whole class may benefit from our conversation. Please email your instructor for matters of a personal nature. I will reply to course-related questions and email within 48 hours. I will strive to return your assignments and grades for course activities to you within seven days of the due date.

Course Credits
This course combines ~120 hours of instruction, online activities, and assignments for 4 credits.

Technical Assistance
If you experience computer difficulties, need help downloading a browser or plug-in, assistance logging into the course, or if you experience any errors or problems while in your online course, contact the OSU Help Desk for assistance. You can call (541) 737-3474, email osuhelpdesk@oregonstate.edu or visit the OSU Computer Helpdesk online.

Learning Resources
Textbook: Astronomy Today 9th Ed by Eric Chaisson and Steve McMillan, Pearson ISBN 9780134450278
Earlier version of the text would be almost as good, student is responsible for any updated material.

> **Note to prospective students**: Please check with the OSU Bookstore for up-to-date information for the term you enroll (http://osubeaverstore.com/Academics or 800-595-0357). If you purchase course materials from other sources, be very careful to obtain the correct ISBN.

Canvas
This course will be delivered via Canvas where you will interact with your classmates and with your instructor. Within the course Canvas site, you will access the learning materials, such as the syllabus, class discussions, assignments, projects, and quizzes. To preview how an online course works, visit the Ecampus Course Demo. For technical assistance, please visit Ecampus Technical Help.

Baccalaureate Core Learning Outcomes
This course fulfills the Baccalaureate Core requirement for the Physical Sciences category. It does this by exploring concepts and theories of the formation and evolution of stars, and applying scientific methodology to the investigation of these topics. The three Baccalaureate learning outcomes are:

1. Recognize and apply concepts and theories of basic physical sciences.
2. Apply scientific methodology and demonstrate the ability to draw conclusions based on observation, analysis, and synthesis.
3. Demonstrate connections with other subject areas.

Course Specific Learning Outcomes
PH 206 aligns with or meets the Baccalaureate learning outcomes in the following ways:

1. Recognize and apply concepts and theories of basic physical sciences.

In PH 206, you will explore and recognize fundamental concepts of physics as applied to the study of stellar evolution. Students develop hypotheses based on their present knowledge, incorporated within the framework of physical laws and apply fundamental principles involved with star formation and evolution, incorporating new knowledge based on observations of our Sun and stars in general. Students describe the constituent processes in a star, through the gathering of physical evidence, from land-based telescopes and space-based observatories such as SOHO. Students communicate with peers using the language of science.

Associated activities: Weekly homework assignments are based on the required textbook readings, tutorials and course web pages. Topical discussions requiring online posts allow you to choose a topic of interest within a small discussion group, flesh out a short report over the course of two weeks, and interact with others of your group. You will interact with classmates in other groups the following week. Discussions include topics such as the biological effects of sunlight, ancient astronomy and black holes.

Assessment: Student achievement of this outcome is measured through evaluation of homework submissions, lab reports, discussion posts and exam responses.

2. Apply scientific methodology and demonstrate the ability to draw conclusions based on observation, analysis, and synthesis.

You will make firsthand observations of physical phenomena, observe images from telescopes, and engage with virtual experiments via state-of-the-art interactive software. In lab exercises, you will graph and analyze data of real astrophysical systems as well as virtual simulations, and analyze the motions of stars and planets in the night sky from their firsthand observations.

Associated activities: In PH 206, you are required to perform laboratory experiments of four main types: (i) Data analysis: for example, for example, graph luminosity vs. temperature for observed stars (ii) Virtual experiments: for example, analyze models of the hydrogen atom using a PhET simulation to gain understanding of information apparent in stellar spectroscopy, (iii) Citizen-science labs: for example, classifying objects in our galaxy and analyzing images containing proto-stellar disks in our galaxy, (Zooniverse), (iv) Night Sky Journal: catalog weekly observations of the night sky. If directly viewing the night sky is a problem, virtual observations may be substituted.

Assessment: Lab reports are graded for completeness, thoroughness and quality of analysis, and the student's ability to draw conclusions regarding the fundamental nature of the system.

3. Demonstrate connections with other subject areas.

PH 206 focuses on astronomy as an application of general physics. Students learn basic physics principles such as Newton's laws and Kepler's laws, including mathematical applications. Students learn the basics of atomic fusion and heat transport.

Associated activities: Textbook readings, tutorials and web pages are devoted to the topics of fundamental physics and are accompanied by homework activities and a lab exercise. You can choose to research related topics in the weekly topical discussions.

Assessment: Homework exercises and discussions are graded for content, including open-ended questions regarding fundamental physics.

Evaluation of Student Performance

Your course grade is determined the distribution of points is as follows:

Midterm Exam 1: 15%
Midterm Exam 2: 15%
Final Exam: 30%
Homework: 10%
Discussion: 10%
Lab: 20%

At the end of the term, the lower cutoff for an A– will be set no higher than 90%, that for a B– will be set no higher than 80%, that for a C– will be set no higher than 70%, and that for a D– will be set no higher than 60%. The cutoff may go lower than this.

In order to pass the **course**, you must (1) take all three exams, (2) score a 50% or better on the homework component, (3) average at least 70% for the lab portion, **and** (4) obtain the lower cutoff for a D–. Not passing at least 70% for labs will result in a final grade of F. Coursework will not be accepted after the beginning of finals week.

Course Policies

Discussion Participation

Students are expected to participate in all graded discussions. While there is great flexibility in online courses, this is not a self-paced course. You will need to participate in our discussions on at least two different days each week, with your first post due no later than Wednesday evening, and your second post by Friday and third post due by the end of each week. The first week discussion posts are all due by Sunday.

Proctored Exams

This course requires that you take exams under the supervision of an approved proctor. Proctoring guidelines and registration for proctored exams are available online through the Ecampus testing and proctoring website. It is important to submit your proctoring request as early as possible to avoid delays.

Makeup Exams

Makeup exams will be given only for missed exams excused in advance by the instructor. Excused absences will not be given for airline reservations, routine illness (colds, flu, stomach aches), or other common ailments. Excused absences will generally not be given after the absence has occurred, except under very unusual circumstances.

Incompletes
Incomplete (I) grades will be granted only in emergency cases (usually only for a death in the family, major illness or injury, or birth of your child), and if the student has turned in 80% of the points possible and has a passing percentage of at least 70% on the work that has been turned in. If you are having any difficulty that might prevent you completing the coursework, please don't wait until the end of the term; let me know right away.

Lateness Policy
Late homework and labs will receive a 20% deduction for the first week late, and 20% deduction per week afterward. Discussion posts will receive a 10% deduction for each day late, and will not be accepted after the end of the week (Sunday).

Guidelines for a Productive and Effective Online Classroom
Students are expected to conduct themselves in the course (e.g., on discussion boards, email) in compliance with the university's regulations regarding civility.

Civility is an essential ingredient for academic discourse. All communications for this course should be conducted constructively, civilly, and respectfully. Differences in beliefs, opinions, and approaches are to be expected. In all you say and do for this course, be professional. Please bring any communications you believe to be in violation of this class policy to the attention of your instructor.

Active interaction with peers and your instructor is essential to success in this online course, paying particular attention to the following:

- Unless indicated otherwise, please complete the readings and view other instructional materials for each week before participating in the discussion board.
- Read your posts carefully before submitting them.
- Be respectful of others and their opinions, valuing diversity in backgrounds, abilities, and experiences.
- Challenging the ideas held by others is an integral aspect of critical thinking and the academic process. Please word your responses carefully, and recognize that others are expected to challenge your ideas. A positive atmosphere of healthy debate is encouraged.

Statement Regarding Students with Disabilities
Accommodations are collaborative efforts between students, faculty, and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 541-737-4098.

Accessibility of Course Materials
All materials used in this course are accessible. If you require accommodations please contact Disability Access Services (DAS). Additionally, Canvas, the learning management system through which this course is offered, provides a vendor statement certifying how the platform is accessible to students with disabilities.

Expectations for Student Conduct
Student conduct is governed by the university's policies, as explained in the Student Conduct Code.

Academic Integrity
Students are expected to comply with all regulations pertaining to academic honesty. For further information, visit Student Conduct and Community Standards, or contact the office of Student Conduct and Mediation at 541-737-3656.

OAR 576-015-0020 (2) Academic or Scholarly Dishonesty:

a) Academic or Scholarly Dishonesty is defined as an act of deception in which a Student seeks to claim credit for the work or effort of another person, or uses unauthorized materials or fabricated information in any academic work or research, either through the Student's own efforts or the efforts of another.

b) It includes:

(i) CHEATING - use or attempted use of unauthorized materials, information or study aids, or an act of deceit by which a Student attempts to misrepresent mastery of academic effort or information. This includes but is not limited to unauthorized copying or collaboration on a test or assignment, using prohibited materials and texts, any misuse of an electronic device, or using any deceptive means to gain academic credit.

(ii) FABRICATION - falsification or invention of any information including but not limited to falsifying research, inventing or exaggerating data, or listing incorrect or fictitious references.

(iii) ASSISTING - helping another commit an act of academic dishonesty. This includes but is not limited to paying or bribing someone to acquire a test or assignment, changing someone's grades or academic records, taking a test/doing an assignment for someone else by any means, including misuse of an electronic device. It is a violation of Oregon state law to create and offer to sell part or all of an educational assignment to another person (ORS 165.114).

(iv) TAMPERING - altering or interfering with evaluation instruments or documents.

(v) PLAGIARISM - representing the words or ideas of another person or presenting someone else's words, ideas, artistry or data as one's own, or using one's own previously submitted work. Plagiarism includes but is not limited to copying another person's work (including unpublished material) without appropriate referencing, presenting someone else's opinions and theories as one's own, or working jointly on a project and then submitting it as one's own.

c) Academic Dishonesty cases are handled initially by the academic units, following the process outlined in the University's Academic Dishonesty Report Form, and will also be referred to SCCS for action under these rules.

Conduct in this Online Classroom
Students are expected to conduct themselves in the course (e.g., on discussion boards, email postings) in compliance with the university's regulations regarding civility.

Tutoring
NetTutor is a leading provider of online tutoring and learner support services fully staffed by experienced, trained and monitored tutors. Students connect to live tutors from any computer that has Internet access. NetTutor provides a virtual whiteboard that allows tutors and students to work on problems in a real time

environment. They also have an online writing lab where tutors critique and return essays within 24 to 48 hours. Access NetTutor from within your Canvas class by clicking on the NetTutor button in your course menu.

OSU Student Evaluation of Teaching

Course evaluation results are extremely important and are used to help me improve this course and the learning experience of future students. Results from the questions are tabulated anonymously and go directly to instructors and department heads. Student comments on the open-ended questions are compiled and confidentially forwarded to each instructor, per OSU procedures. The online Student Evaluation of Teaching form will be available toward the end of each term, and you will be sent instructions via ONID by the Office of Academic Programs, Assessment, and Accreditation. You will log in to “Student Online Services” to respond to the online questionnaire. The results on the form are anonymous and are not tabulated until after grades are posted.

Course Content

All deadlines are 11:59 pm on the day indicated

Week	Topic	Reading Assignments	Learning Activities	Due Dates
1	Introduction EM radiation	Ch 1.3,1.6, 2.5, 2.6, 2.7, 2.8 Chapter 3	Discussion HW 0 Hw 1 Lab 1 begin Lab 8 observations	Th,Sun Sun Sun Sun
2	Spectroscopy	Chapter 4	Discussion Hw 2 Lab 2 Activity 1	W,F,Sun Sun Sun Sun
3	The sun	Chapter 16	Discussion Hw 3 Lab 3	W,F,Sun Sun Sun
4	The stars	Chapter 17	Discussion Hw 4 Lab 4	W,F,Sun Sun Sun
5	Interstellar medium	Chapter 18	Discussion Hw 5 Lab 8 first submission Midterm 1	W,F,Sun Sun Sun Proctored
6	Star formation	Chapter 19	Discussion Hw 6 Lab 5	W,F,Sun Sun Sun
7	Stellar evolution	Chapter 20	Discussion Hw 7 Lab 6	W,F,Sun Sun Sun
8	Stellar explosions	Chapter 21	Star Evolution small group discussion Discussion Hw 8 No lab	 Sun W,F,Sun Sun
9	Neutron stars and black holes	Chapter 22	Discussion Hw 9 Lab 7 Midterm 2	W,F,Sun Sun Sun Proctored
10	Review		Discussion Lab 8 second submission	W,F,Sun Sun
Finals			Final Exam (cumulative)	Proctored

Schedule dates are tentative and may be subject to change.