ASTR 498N *Stellar Structure and Evolution* Spring 2017 [3 credits]

Instructor: Prof. Suvi Gezari
Phone: (301) 405-6651
Email: suvi@astro.umd.edu

Office: PSC 1160
Office Hours: T 2-3pm, or by appointment
Lectures: TTh 12:30pm-1:45pm in CSS 2416

ALL e-mails MUST use "ASTR498N" as the "Subject" or they may be missed.

Textbook Required:
Theory of Stellar Structure and Evolution (2nd Edition) by Dina Prialnik
Cambridge University Press
ISBN 978-0521866040
Please note that while the textbook uses SI units, we will be using cgs units in class.

Course Website:
The course website is on the Enterprise Learning Management System that is used by the university. The URL is https://elms.umd.edu/. Once there, you will need to login with your university Directory ID and password. If you do not know your Directory ID, or you forget your password, there are instructions on the website about what to do. ***This syllabus, your homework assignments, homework solutions (after the submission date), lecture slides (after each lecture), and grades will be posted there.***

Course Description:
The goal of this course is to use known laws of physics to understand the structure and evolution of stars, and their observed properties. We will cover many topics about stars, including their:

- global properties (energetics and timescales)
- micro-physics (EOS, nuclear reactions, energy transport and opacity)
- equations of internal structure
- evolution as a function of stellar mass
- end states (white dwarfs, neutron stars, and black holes)
- binary interactions

Pre-requisites:
This course is designed for Astronomy and Physics majors. You must have completed ASTR320 (Theoretical Astrophysics) or obtained permission from the Astronomy Department.

Course Expectations:

Attendance: In order to succeed in this course, I expect you to attend the lectures and pay attention. ***It would really benefit you to not use your cell phone or laptop in class***. (Studies have shown that taking notes by hand is better for learning, even though typing is faster). Plus, lecture notes will be posted on ELMS after the lecture.

There is no need to copy them down verbatim. The material on the homeworks and exams are based upon the material covered in the lectures and the text. If you have to miss a lecture, be sure to check what you missed (ask a friend!) and make sure that you understand what was covered.

Grading: Grades are based on a point scale with different assignments weighted as shown in the table below. The points are distributed across a variety of exercises so that no single component will dominate your grade. However, this also means that it is imperative that you complete all assignments. Zeros on multiple homeworks will set you back in a big way!

Class Participation	100
Homeworks	200
Exam I	200
Exam II	200
Final	300
---	---
TOTAL	1000

Exams: You will be asked to write on exams: "*I pledge on my honor that I have not given or received any unauthorized assistance on this examination*."

Midterm Exams: There will be two in-class 75-minute midterm exams that will be held in CSS 2416 on Thursday, February 23 and Thursday, April 6. These exams are closed book with no notes, no calculators, and no other electronic devices allowed. These exams are incremental (i.e., non-cumulative) check-ups on how well you have learned the material. The schedule of lectures included in this syllabus shows what material will be covered on each exam.

Final Exam: According to University rules, **the final exam for this course will be held on Thursday, May 18 from 1:30pm to 3:30pm in CSS 2416**. The final exam is closed book with no notes, no calculators, and no other electronic devices allowed. This exam is cumulative.

Students who have a religious observance conflicting with class times during the semester should contact me as soon as possible. Students with a documented disability who wish to discuss academic accommodations should contact me as soon as possible.

Missed Exams: If you are not able to take an exam due to illness or other legitimate reason (as outlined in the Undergraduate Catalog) and you wish to take a make-up exam, you must:

1) contact me by email **before** you miss the regularly scheduled exam and
2) submit a valid **written** excuse for your absence within one week after the regularly-scheduled exam.

Make-up exams will be given within one week after you submit the valid written excuse.

Missed Final Exam: If you miss the final exam and have a **valid written** excuse, you must arrange for a make-up final within 48 hours after the scheduled exam.

Final Grades: Letter grades will be assigned based upon your cumulative score; there will be no letter grades for individual exams or assignments. The grading scale shown below is how your grade will be determined from your point total in the class. Depending on the class average, there may be some adjustment made to the **final** letter grades (not to the individual exam grades). However, any adjustment will be to lower the percentage ranges given below, never to raise them.

Grading scale used for final grades:

A+	100 – 97%
A	< 97 – 92%
A-	< 92 – 90%
B+	< 90 – 87%
B	< 87 – 82%
B-	< 82 – 80%
C+	< 80 – 77%
C	< 77 – 70%
C-	< 70 – 68%
D+	< 68 – 65%
D	< 65 – 60%
D-	< 60 – 57%
F	< 57%

Homework Assignments:
Homework is due at the beginning of lecture on the lecture date indicated. Electronic submissions will not be accepted. **Please show your calculations and any numerical problems and justify all written answers**. Even if you work together, no two papers can be identical – your paper should reflect your own work. The university's honor code will be enforced. Make sure that you read and understand these policies in the UG Catalog. Homework solutions will be posted on ELMS after the due date to aid in studying for the exams.

Lecture Schedule:

Jan. 26	Introduction; H-R diagram	Ch. 1
Jan. 31	LTE and Blackbody Radiation	Ch. 2.1
Feb. 2	Hydrostatic equilibrium	Ch. 2.3
Feb. 7	Virial theorem	Ch. 2.4
Feb. 9	Conservation of energy; conservation of A, Z	Ch. 2.2, 2.5-2.7
Feb. 14	Equations of stellar structure	Ch. 5.1-5.2 [HW #1]
Feb. 16	Polytropes and the Lane-Emden equation	Ch. 5.3
Feb. 21	Chandrasekhar mass; Eddington luminosity	Ch. 5.4-5.5

Feb. 23	EXAM I	
Feb. 28	Stellar evolution before the main sequence	Ch. 9.1
Mar. 2	The main sequence	Ch. 9.2
Mar. 7	Red giant phase; helium burning phase	Ch. 9.4, 9.5 [HW #2]
Mar. 9	Energy transport by radiation	Appendix A; Ch. 3.7
Mar. 14	Energy transport by convection	Ch. 6.5-6.7
Mar. 16	Opacities	Ch. 3.7
SPRING BREAK		
Mar. 28	Nuclear reactions: *p*-*p* chain	Ch. 4.3 [HW #3]
Mar. 30	CNO-cycle and subsequent reactions	Ch. 4.4
Apr. 4	The *s*- and *r*-processes	Ch. 4.8
Apr. 6	EXAM II	
Apr. 11	Cooling of white dwarfs	Ch. 9.8
Apr. 13	Evolution of massive stars	Ch. 9.9
Apr. 18	Core-collapse supernovae	Ch. 10.1-10.3,10.6 [HW #4]
Apr. 20	Thermonuclear supernovae	Ch. 10.5
Apr. 25	Pulsating stars	Ch. 9.6
Apr. 27	Stellar results from Kepler	See lecture notes
May 2	Mass transfer in binaries	Ch. 11.1-11.4 [HW #5]
May 4	X-ray binaries; novae; CVs	Ch. 11.5, 11.6
May 9	Neutron stars and black holes	Ch. 10.4, 10.6
May 11	LIGO results on gravitational waves	See lecture notes
May 18	FINAL EXAM (1:30 pm-3:30 pm)	