

ASTR 730

Stellar Astrophysics

Syllabus

Fall 2022

Prerequisites: PHYS 303 (Classical Mechanics), PHYS 305 (Electromagnetic Theory), PHYS 308 (Modern Physics with Applications); MATH 214 (Elementary Differential Equations)

Credits: 3

Date and Time: Wednesday from 4:30 PM to 7:10 PM

Location: Exploratory Hall 1004

Instructor: Prof. Jie Zhang

Contact Info: jzhang7@gmu.edu (e-mail); (703)993-1998 (phone),

Office Hour: 1:00 PM to 2:00 PM, Wednesday, or by appointment

Location: Planetary Hall 257

Description:

The purpose of this course is to provide the basic understanding of stellar structure and evolution. Topics include stellar evolution from observational perspective, equation of states for blackbody radiation, ideal gas and degenerate gas, Saha equations, radiative transfer, heat transfer by convection, stellar energy source, stellar modeling and stellar atmosphere

Content:

- Overview of Stellar Evolution
- Basic Principles
- Equations of State for blackbody radiation, ideal gas and degenerate gas
- Radiative and Conductive Heat Transfer
- Convective Heat Transfer
- Stellar Energy Sources
- Stellar Modeling
- Stellar Atmosphere

Homework: There are weekly assignments of homework, each of which consists of 2 to 5 short questions that require derivation, proof and calculation. Homework assignments will be made available on the class website on Blackboard. You need to work out the assignment on papers, and turn them in at the beginning of the classes.

Project: There is one comprehensive project. The project is aimed at using numerical models to solve essential equations to understand the structure and time evolution of stars of different masses.

Exams: There will be one midterm and one final exam. Both are open-book exams.

Grades: Homework (40%), Project (10%), Midterm (20%), Final Exam (30%)

Class URL: <https://mymasonportal.gmu.edu/>, which is so-called “Blackboard”

Text Book (required): “Stellar Interiors: Physical Principles, Structure and Evolution”, by C.J. Hansen, S.D. Kawaler and V. Trimble, 2nd edition, Springer-Verlag, 2004. ISBN 978-0-387-20089-7

Supplementary Book (not required): “The Observation and Analysis of Stellar Photosphere”, by David F. Gray, Third edition, Cambridge University Press, 2005. ISBN 0-521-06681-6