



國立清華大學
NATIONAL TSING HUA UNIVERSITY

11120ASTR510000
Stellar Astrophysics
恒星天文物理學

Syllabus

Instructor

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Office hours: by appointment

Class schedule

Lectures on Wednesday from 14:20 - 17:20 (W6W7W8)
General building II, R521

Teaching Assistant

TBA.

Preface

This is a theoretical astrophysics course that intended to cover advanced topics related to radiative process in stars, the structure of stars, and their interaction with environments. Prior knowledge on undergraduate level of "Electromagnetism", "Quantum physics", "Theoretical mechanics", "Thermal physics", "Applied mathematics", and "Introduction to astrophysics" are **highly recommended** but not required. There will be some numerical exercises that use the MESA stellar evolution code, available from <http://mesa.sourceforge.net/>. Therefore, a Unix-like (Linux/Mac) computer is required.

Homework assignments

We will have a few homework assignments during the semester. Each assignment contains written problems and/or numerical exercises using MESA. All homework assignments are required to be typed using LaTeX. We will use Google classroom to announce and collect homework assignments. You are encouraged to ask questions or discuss with your classmates in Google classroom as well.

Exams

- Midterm (April 19, 2023)



- Final exam (June 14, 2023)

Evaluation

Homework assignments (60%), midterm (20%), and final exam (20%). Extra bonus points from class participation will be added.

Tentative topics

1. Introduction to Stellar Physics
2. Equation of Stellar Structure
3. Polytropes
4. Equation of State
5. Radiation Transport and Conductive Heat Transfer
6. Heat Transfer by Convection
7. Stellar Energy Sources
8. Main Sequence & Post-Main Sequence
9. The MESA Stellar Evolution Code
10. Stellar Explosions & Compact Objects
11. Gravitational waves from compact objects
12. Binaries

Recommended textbooks

1. "Stellar Interiors: physical principles, structure, and evolution" written by Carl. J. Hansen, Steven D. Kawaler, and Virginia Trimble.
<https://www.springer.com/gp/book/9780387200897>.
2. "Stellar Astrophysics" written by Edward Brown.
A pdf copy is available at
<https://github.com/Open-Astrophysics-Bookshelf/stellar-physics-notes>.
3. "Radiative Processes in Astrophysics" written by G. B. Rybicki and A.P. Lightman.
A pdf copy is available at
<https://onlinelibrary.wiley.com/doi/book/10.1002/9783527618170>