國立清華大學
NATIONAL TSING HUA UNIVERSITY

10820ASTR660000

# Computational Astrophysics
# 計算天文物理

**Instructor**

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Class web page: https://kuochuanpan.github.io/courses/108ASTR660_CA

**Class Schedule**

Lectures on Thursday from 14:20 - 17:20
General building II, R521

## SYLLABUS

**Preface:**

This course does not require previous programming experience but with little knowledge on compiled languages and/or python is recommended. We will use mainly Fortran (or C/C++) with some python in the course. A Unix-like system (e.g. Linux, Mac OS X, or Windows 10 subsystem for Linux) is required. Students are required to bring a laptop to class.

**Course description:**

Lecture schedule

| Week | Date | Topics |
|---|---|---|
| 1 | 3/5 | Course overview / Shell language / Version control |
| 2 | 3/12 | Basic Fortran Programming |
| 3 | 3/19 | Basic Python Programming |
| 4 | 3/26 | Linear Systems |
| 5 | 4/2 | (*holiday*) **no lecture** |
| 6 | 4/9 | Non-linear equations |
| 7 | 4/16 | (*professor away*) **no lecture** |
| 8 | 4/23 | Initial Value Problems (Celestial movement) |

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| 9 | 4/30 | Boundary Value Problems (Stellar structure) |
| 10 | 5/7 | Project Proposal Presentation |
| 11 | 5/14 | PDE: Hyperbolic systems (Hydrodynamics I) |
| 12 | 5/21 | PDE: Elliptical systems (Gravity) |
| 13 | 5/28 | Parallel Programming with MPI / OpenMP |
| 14 | 6/4 | Parallel Programming with GPUs (Prof. Hsi-Yu Schive) |
| 15 | 6/11 | Final project presentation |
| 16 | 6/18 | (*final exam week*) **no lecture** |

**Teaching method:**

Weekly lectures with several homework assignments and a final project ( including a written report and a classroom presentation).

**Evaluation:**

Grades will be determined by homework assignments (70%), and the final project (30%).

**Text books:**

None

**References:**


1. "Numerical Recipe", by Press, W.H. (http://www.nr.com )
2. "Numerical Methods in Astrophysics", by Bodenheimer, P. et al.
3. "Scientific Computing: An introductory survey", by Michael Heath
4. "Introduction to Computational Astrophysical Hydrodynamics", by Zingale, M. (https://github.com/python-hydro/hydro_examples )
5. "The C Programming Language", by Kernigan, B.W.
6. "Finite Volume Methods for Hyperbolic Problems", by Leveque, R. J.
7. "Parallel Programming with MPI", by Pacheco P.