

## APC523/AST523: Scientific Computation in Astrophysics

### Intended Lecture Schedule:

| No. | Date     | Topic                                      | Reference                 |
|-----|----------|--|---------------------------|
| 1   | Sept. 11 | Introduction                               |                           |
| 2   | Sept. 16 | Computer Architecture                      | Hennessey & Patterson     |
| 3   | Sept. 18 | Programming Languages                      | Lupton                    |
| 4   | Sept. 23 | Basics of Numerical Analysis               | Neumaier                  |
| 5   | Sept. 25 | Systems of Linear Equations: Level pops.   | Neumaier, Press           |
| 6   | Sept. 30 | Systems of Nonlinear Equations             | Neumaier, Press           |
| 7   | Oct. 2   | Data Analysis I                            | Lupton                    |
| 8   | Oct. 7   | Data Analysis II                           | Lupton                    |
| 9   | Oct. 9   | ODEs: Initial value problems               | Press, Süli & Mayers      |
| 10  | Oct. 14  | Application: shock structure               |                           |
| 11  | Oct. 16  | ODEs: Boundary value problems              | Press                     |
| 12  | Oct. 21  | Application: Stellar structure             |                           |
| 13  | Oct. 23  | The $N$ -body problem                      | Hockney & Eastwood        |
|     | Oct. 28  | <i>Fall Recess</i>                         |                           |
|     | Oct. 30  | <i>Fall Recess</i>                         |                           |
| 14  | Nov. 4   | $N$ -body integrators                      | TBD                       |
| 15  | Nov. 6   | Force evaluation for large- $N$            | Hockney & Eastwood        |
| 16  | Nov. 11  | Application: galactic dynamics             |                           |
| 17  | Nov. 13  | PDEs I: Definitions and Elliptic equations | Press, LeVeque            |
| 18  | Nov. 18  | Particle-mesh codes for $N$ -body dynamics | Hockney & Eastwood        |
| 19  | Nov. 20  | Relativistic PIC codes                     | Spitkovsky                |
| 20  | Nov. 25  | PDEs II: diffusion equations               | Richtmyer & Morton, Press |
|     | Nov. 27  | <i>Thanksgiving</i>                        |                           |
| 21  | Dec. 2   | PDEs III: hyperbolic equations and CFD     | Press, LeVeque            |
| 22  | Dec. 4   | PDEs III: hyperbolic equations and CFD     | Press, LeVeque            |
| 23  | Dec. 9   | Numerical General Relativity               | Pretorius                 |
| 24  | Dec. 11  | Advanced Topics                            |                           |