

First-year PhD Astrophysics Reading Group

Syllabus

The name of the tutor for a given session is in brackets, with email address. Sessions are Tuesdays 4:00pm – 5:00pm, in the Lecture Theatre, unless the tutor agrees a different time and/or place. Solutions are to be handed into the tutor by noon the day before the relevant session.

To gain SUPA course credit you must pass 9 of the hand-in problem sets.

Further explanation of the reading group is at

<http://www.roe.ac.uk/ifa/postgrad/ReadingGroupSchedule.html>

Useful texts:

Armitage, Astrophysics of Planet Formation, Cambridge University Press, 2010
Binney & Merrifield, Galactic astronomy
Dyson & Williams, The physics of the interstellar medium
Jackson, Classical electrodynamics (3rd [SI] edition)
Lena, Observational astrophysics
Lawrence, Astronomical measurement, a concise guide (Springer)
Longair, High-energy astrophysics (2nd edition: 2 vols)
Peacock, Cosmological physics
Phillipps, The physics of stars
Press et al., Numerical recipes (2nd edition)
Prialnik, Theory of Stellar Structure and Evolution (2nd edition)
Rybicki & Lightman, Radiative processes in astrophysics
Seagar (edited by), Exoplanets, University of Arizona press, 2011
Sivia, Data Analysis: A Bayesian Tutorial, Oxford University Press, 2006

Dates and topics

Date: October 16 [John Peacock, jap@roe.ac.uk]

Topic: Radiation basics

Jargon: specific intensity; surface brightness; Planck function; Einstein coefficients; radiative transfer; optical depth; scattering; extinction

Reference: Rybicki & Lightman p1-39

Date: October 23 [Andy Lawrence, al@roe.ac.uk]

Topic: Astronomical measurements

Jargon: Celestial coordinates; parallax; proper motion; magnitudes; colours; K-corrections

Reference: Binney & Merrifield p26-61

Date: October 30 [Jim Dunlop, jsd@roe.ac.uk]

Topic: Line radiation

Jargon: recombination; forbidden lines; critical density; ionization parameter; doppler width; voigt profiles; curve of growth

Reference: Rybicki & Lightman ch10; Peacock p361-365 and 429-430

Date: November 6 [Eric Tittley, ert@roe.ac.uk]

Topic: Astronomical signals

Jargon: Fourier transform; sampling; Nyquist frequency; aliasing; convolution; FFT; filtering; signal-to-noise

References: Lena, Chapter 4 “Measurement and processing of signals”, 4.0, 4.1, 4.3.

Press et al. Chapter 12 “Fast Fourier Transform”, 12.0 to 12.2,

Press et al. Chapter 13 “Fourier and Spectral Applications”, 13.0 & 13.1

Date: November 13 [Joe Zuntz, jzuntz@roe.ac.uk]
Topic: Bayesian methods in cosmology
Jargon: probability distribution functions; likelihoods; priors; Monte Carlo Markov Chains
Reference: Sivia, Data Analysis: A Bayesian Tutorial – short, browse.
Trotta, "Bayesian Methods in Cosmology", <https://arxiv.org/pdf/1701.01467.pdf>
(read this paper)

Date: November 20 [Sadeqh Khochfar, sadeghk@roe.ac.uk]
Topic: Matter & radiation
Jargon: ideal gas; degeneracy pressure; radiation pressure; Saha equation
Reference: Phillips ch2

Date: November 27 [Philip Best, pnb@roe.ac.uk]
Topic: Detectors and spectrographs
Jargon: shot noise; dark current; flat field; background limit; noise temperature; brightness temperature; diffraction grating; blaze
Reference: Lawrence Chapter 5 [NB can be downloaded as PDF via the university library]

Date: January 15 [Ken Rice, wkmr@roe.ac.uk]
Topic: Planet formation
Jargon: planetesimals, planetesimal formation, aerodynamic drag, grain growth
Reference: Armitage ch4 (if this isn't easily available, you could also read *Section III. Planet Formation* of these lecture notes <https://arxiv.org/abs/astro-ph/0701485>).

Date: January 22 [Beth Biller, bb@roe.ac.uk]
Topic: Exoplanets
Jargon: radial velocity, transits, direct imaging, hot jupiter, mini-neptune, super-earth
Reference: Seager, Part 1: Introduction to Exoplanets, Part 2: Radial Velocity Techniques for Exoplanets, Part 2: Exoplanet Transits and Occultations, Part 2: Direct Imaging of Exoplanets

Date: January 29 [Ross McLure, rjm@roe.ac.uk]
Topic: Active galaxies
Jargon: Seyferts; UVX; blazars; broad and narrow lines; superluminal motion; unification and tori; Magorrian relation; thin disks; accretion efficiency; Eddington limit
Reference: Peacock ch14; Longair ch16

Date: February 5 [Bob Mann, rgm@roe.ac.uk]
Topic: Energy generation & transport in stars
Jargon: pp chain; CNO cycle; Gamow peak; opacity
Reference: Phillips ch4

Date: February 12 [Avery Meiksin, aam@roe.ac.uk]
Topic: Stellar structure and evolution
Jargon: hydrostatic equilibrium; radiative diffusion; polytrope; Main Sequence; Hertzsprung-Russell diagram
References: Prialnik 2nd ed pp70-77; pp116-129; pp151-155; pp160-176; pp182-188;
Longair Vol.2 pp52-67

Date: February 19 [Andy Taylor, ant@roe.ac.uk]
Topic: Observational cosmology
Jargon: RW metric; comoving distance; Friedmann equation; density parameter; luminosity distance
Reference: Peacock p65-92

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