

Liverpool John Moores University

Title: OBSERVATIONAL ASTROPHYSICS
Status: Definitive
Code: **7003ASTPHY** (120800)
Version Start Date: 01-08-2018
Owning School/Faculty: Astrophysics Research Institute
Teaching School/Faculty: Astrophysics Research Institute

Team	Leader
Ricardo Schiavon	Y
David Bersier	
Iain Steele	
Philip James	

Academic Level: FHEQ7 **Credit Value:** 30 **Total Delivered Hours:** 48
Total Learning Hours: 300 **Private Study:** 252

Delivery Options

Course typically offered: Semester 1

Component	Contact Hours
Online	45

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	Exam	End of module exam	50	3
Test	Test	open book test	10	
Report	Write Up	practical write up	40	

Competency	Viva
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Aims

Students should conclude this module with an in-depth understanding of the fundamental concepts underlying observational astrophysics. They should be

capable of performing detailed procedures of research in observational astrophysics: astronomical data reduction, data analysis, error inference, interpretation of results and write up of scientific report in the format of a journal paper.

Learning Outcomes

After completing the module the student should be able to:

- 1 Demonstrate an in-depth knowledge of fundamental concepts of observational astrophysics (e.g., radiometry, statistics and error analysis, telescopes, detectors)
- 2 Discuss and demonstrate the techniques involved in research in observational astrophysics (imaging, photometry, spectroscopy, adaptive optics, radio and sub mm astronomy)
- 3 Conduct data reduction and analysis and describe results and conclusions in a scientific report.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

End of module exam	1	2	
open book test	1	2	
practical write up	1	2	3
Viva	1	2	

Outline Syllabus

- 1 *Astronomical units and coordinate systems*
- 2 *Fundamentals of radiometry: Intensity, Flux, Luminosity; Blackbody radiation; Wien and Stefan-Boltzman Laws; Wien and Rayleigh-Jeans approximations; Radiative transfer; Magnitudes; Earth's atmosphere*
3. *Basic statistics and error analysis of astronomical data: Measurement, precision, accuracy; Errors; Probability distributions (binomial, Poisson, Gaussian)*
4. *Telescopes: Basic optics and definitions (Fermat's principle, Laws of reflection and refraction, lenses, diffraction, Fourier transforms (definition, special functions, convolution, Resolution theorem, sampling, aliasing); Aberrations (chromatic, achromatic); Telescope designs and mounts*
5. *Detectors: Important properties; Infrared detectors and arrays; CCDs; Photomultipliers and image intensifiers; Digitization*
6. *Imaging: Optical and infrared imagers; Imaging techniques: dithering, drizzling; CCD image reduction (bias, flat field, fringing)*
7. *Photometry: Aperture photometry; PSF photometry; Photometric systems; Photometric calibration*
8. *Spectroscopy: Principles of spectroscopy; Spectrographs; Resolving power; Long slit, Echelle, MOS, fiber-fed spectroscopy; Spectral reduction (flat field, sky*

subtraction, extraction, wavelength and flux calibration)

9. Adaptive Optics; Important concepts; Fried model, isoplanatic angle, Strehl ratio; Wavefront sensors; Basic layout of AO system; NGS, LGS, MCAO

10. Submm, Radio, Interferometry; Radio telescopes; Submm and radio detectors: bolometers, antennas, superheterodyne receivers; Two aperture interferometer; Optical and radio interferometers; Aperture synthesis

Learning Activities

Distance learning with tutorial support

Learning materials delivered by Virtual Learning Environment (Blackboard) to include directed reading, online lectures, online assessments with feedback, online discussions

Notes

There will be particular emphasis on developing independent learning skills and undertaking practical exercises. Data reduction and analysis would employ professional astronomical software.

Students will be expected to take astronomical data; analyse it and make inferences using astrophysical literature.

Module delivered by distance learning

Please note that the assessment of this module will include a recorded viva examination to assess competency.