Liverpool John Moores University

Title:	ASTRONOMICAL TECHNIQUES
Status:	Definitive
Code:	**7013ASTPHY** (124776)
Version Start Date:	01-08-2021
Owning School/Faculty:	Astrophysics Research Institute
Teaching School/Faculty:	Astrophysics Research Institute

Team	Leader
Toby Moore	Y
Steven Longmore	
David Bersier	

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: 50 %

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	3000 to 4000 practical write up	40	

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 a literature review.

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 a literature review 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	
project write up	1	2	3

Outline Syllabus

1 Astronomical units
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; diffraction, Fourier transforms (definition, convolution, resolution theorem,
sampling, aliasing); Aberrations; Telescope designs and mounts
5. Detectors: Important properties; Infrared detectors and arrays; CCDs; Digitization; Noise; the Orrey Equation
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, fibre-fed spectroscopy; spectroscopic data reduction
9. Adaptive Optics; Important concepts; Fried model, isoplanatic angle, Strehl ratio; Wavefront sensors; Basic layout of AO systems; NGS, LGS, MCAO
10. Submm, Radio, Interferometry; Radio telescopes; Submm and radio detectors: bolometers, polarimetry, 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 (Canvas) to include directed reading, online lectures, small-group tutorials, online assessments with feedback, online discussions

Notes

There will be particular emphasis on developing independent learning skills and undertaking practical exercises. Students will be expected to make inferences using astrophysical literature.

Module delivered by distance learning