Module Proforma

Approved, 2022.04

Summary Information

Module Code	7013ASTPHY
Formal Module Title	Astronomical Techniques
Owning School	Astrophysics Research Institute
Career	Postgraduate Taught
Credits	30
Academic level	FHEQ Level 7
Grading Schema	50

Module Contacts

Module Leader

Contact Name	Applies to all offerings	Offerings
Toby Moore	Yes	N/A

Module Team Member

Contact Name	Applies to all offerings	Offerings
Matthew Darnley	Yes	N/A
Stacey Habergham-Mawson	Yes	N/A

Partner Module Team

Contact Name	Applies to all offerings	Offerings

Teaching Responsibility

LJMU Schools involved in Delivery
Astrophysics Research Institute

Learning Methods

Learning Method Type	Hours
Online	45

Module Offering(s)

Offering Code	Location	Start Month	Duration
SEP-CTY	CTY	September	12 Weeks

Aims and Outcomes

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:

Code	Description
MLO1	Demonstrate an in-depth knowledge of fundamental concepts of observational astrophysics (e.g., radiometry, statistics and error analysis, telescopes, detectors)
MLO2	Discuss and demonstrate the techniques involved in research in observational astrophysics (imaging, photometry, spectroscopy, adaptive optics, radio and sub mm astronomy)
MLO3	Conduct a literature review and describe results and conclusions in a scientific report.

Module Content

Outline Syllabus
1 Astronomical units2 Fundamentals of radiometry: Intensity, Flux, Luminosity; Blackbody radiation; Wien and Stefan-Boltzman Laws; Wien and Rayleigh-Jeans approximations; Radiative transfer; Magnitudes; Earth's atmosphere3. 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 mounts5. Detectors: Important properties; Infrared detectors and arrays; CCDs; Digitization; Noise; the Orrey Equation6. 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 calibration8. Spectroscopy: Principles of spectroscopy; Spectrographs; Resolving power; Long slit, Echelle, MOS, fibre-fed spectroscopy; spectroscopic data reduction9. Adaptive Optics; Important concepts; Fried model, isoplanatic angle, Strehl ratio; Wavefront sensors; Basic layout of AO systems; NGS, LGS, MCAO10. Submm, Radio, Interferometry; Radio telescopes; Submm and radio detectors: bolometers, polarimetry, antennas, superheterodyne receivers; Two aperture interferometer; Optical and radio interferometers; Aperture synthesis

Module Overview
This module aims to develop your in-depth understanding of the fundamental concepts underlying observational astrophysics. It enables you to perform detailed procedures of research in observational astrophysics: astronomical data reduction, data analysis, error inference, interpretation of results and the write up of scientific reports in journal format.

Additional Information
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

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Learning Outcome Mapping
Test	End of module Test	50	3	MLO1, MLO2
Test	open book test	10	0	MLO1, MLO2
Report	project write up	40	0	MLO1, MLO3, MLO2