LIVERPOOL JOHN MOORES UNIVERSITY

# Module Proforma

**Approved, 2022.04**

## Summary Information

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|---|---|
| **Module Code** | 7014ASTPHY |
| **Formal Module Title** | Cosmology |
| **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 |
|---|---|---|
| Ivan Baldry | Yes | N/A |

### Module Team Member

| Contact Name | Applies to all offerings | Offerings |
|---|---|---|
| Jaime Salcido Negrete | Yes | N/A |
| Stacey Habergham-Mawson | Yes | N/A |
| Andreea Font | Yes | N/A |
| Matthew Darnley | 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 |
|---|---|---|---|
| JAN-CTY | CTY | January | 12 Weeks |

## Aims and Outcomes

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|---|---|
| **Aims** | To describe the theoretical background required to understand various cosmological models including the favoured CDM model. To provide students with a full and rounded understanding of modern observational cosmology. To enable the students to make detailed cosmological measurements from galaxy or cluster survey data. |

## Learning Outcomes

**After completing the module the student should be able to:**

| Code | Description |
|---|---|
| MLO1 | Demonstrate systematic knowledge and understanding of the concept of curved space time and metrics. |
| MLO2 | Develop a broad and up-to-date knowledge of the fundamental ideas, most important discoveries, modelling techniques and outstanding problems in cosmology. |
| MLO3 | Apply an in-depth knowledge of the techniques to calculate physical parameters and make predictions for a range of cosmological models and observational data. |

## Module Content

### Outline Syllabus

Introduction to CosmologyThe origin and fate of the Universe. From Pythagoras to Herschel. Assumptions underlying the modern cosmology. Isotropy and Homogeneity. Galaxies, clusters and superclusters. Geometry of the UniverseEuclidean and curved spaces. The Robertson-Walker (RW) metric. Expansion and the Hubble law. Redshift as a consequence of RW metric. Cosmological angular diameter-distance and luminosity-distance relations.Dynamical evolution The dynamical equations. The Friedmann models, open, closed, Einstein-de Sitter cases. Critical density and values. The age of the Universe. Proper luminosity and angular distances in terms ofH0 and z. Minimal angular diameter. Horizon size. Observations The distance scale. Standard candles. DL versus z diagram. Evidence for dark matter and dark energy or cosmological constant. Determinations of cosmological parameters. The Hot Big Bang. Matter and radiation dominated eras. Cosmic Background Radiation, aka. Cosmic Microwave Background (CMB). Brief history of the Universe from the Planck time to the present day.The New Cosmology Variations on the Standard Model. Inflation. Grand Unified Theories. Cosmic strings and monopoles. The Cosmological Constant. The Anthropic Principle. The History of Structure Density fluctuations at early times and in the CMB. Hot and cold dark matter. Results of numerical simulations. Matter on large scales. Dark matter problems. Clustering seen in various surveys. Gravitational lensing. Galaxy and cluster surveys. Flux and redshift measurements of galaxies. Correlation functions. Luminosity functions. Evolutionin luminosity and number density. X-ray cluster surveys. Sunyaev-Zeldovich effect. Halo mass measurements. Cluster mass functions. Latest understanding of galaxy evolution.

### Module Overview

This module provides the theoretical background required to understand various cosmological models including the favoured CDM model. It:

gives an understanding of modern observational cosmology

enables you to make detailed cosmological measurements from galaxy or cluster survey data

### Additional Information

This modules will teach students the fundamentals of and recent developments in cosmology. There will be particular emphasis on developing independent learning skills and IT capability to access and extract relevant scientific information via Canvas and databases available from LJMU.Module delivered by distance learning

## Assessments

| Assignment Category | Assessment Name | Weight | Exam/Test Length (hours) | Learning Outcome Mapping |
|---|---|---|---|---|
| Essay | Essay on Cosmological Topic | 35 | 0 | MLO3, MLO2 |
| Test | End of module Test | 65 | 3 | MLO1, MLO3, MLO2 |