Liverpool John Moores University

Title:	COSMOLOGY
Status:	Definitive
Code:	**7014ASTPHY** (124777)
Version Start Date:	01-08-2021
Owning School/Faculty:	Astrophysics Research Institute
Teaching School/Faculty:	Astrophysics Research Institute

Team	Leader
Ivan Baldry	Y

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

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Online	45

Grading Basis: 50 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Essay	Essay	<3000 word essay on cosmological topic	35	
Exam	Exam	End of module exam	65	3

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:

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

Learning Outcomes of Assessments

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

Essay on Cosmological Topic	2	3	
End of module exam	1	2	3

Outline Syllabus

Introduction to Cosmology
The 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 Universe
Euclidean 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 of
H0 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. Evolution
in luminosity and number density. X-ray cluster surveys. Sunyaev-Zeldovich effect. Halo mass measurements. Cluster mass functions. Latest understanding of galaxy evolution.

Learning Activities

Distance learning with tutorial support. Learning materials delivered by Virtual Learning Environment to include video lectures, directed reading, online assessments with feedback, online discussions

Notes

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