

The Age of the Universe

Start date	18 May 2018	End date	20 May 2018
Venue	Madingley Hall Madingley Cambridge		
Tutor	Dr. Sonali Shukla Dr. Ranjan Vasudevan Dr. Matthew Bothwell	Course code	1718NRX077

Interim Co-Directors of Public and Professional Programmes Dr Liz Morfoot
Dr Tom Monie

For further information on this course, please contact Public Programme Coordinator, Clare Kerr
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To book See: www.ice.cam.ac.uk or telephone 01223 746262

Tutor(s) biography

Dr. Sonali Shukla

Sonali holds a PhD in astrophysics from Vanderbilt University, USA. Her research areas include understanding the formation of young low-mass stars and disks around young stars and brown dwarfs. She spent a year as a pre-doctoral fellow at the Spitzer Science Center, Caltech, and continued her research as a postdoctoral researcher at Penn State University. She primarily serves in education and public outreach, having served most recently as the Astronomy Outreach Assistant at the Institute of Astronomy at the University of Cambridge. Previously, she served as Assistant Director for the physics department at the University of Maryland, where she developed novel outreach and educational programs, particularly to increase inclusion and diversity of students in the physical sciences. Sonali has developed inquiry-based practical exercises that incorporate real astronomical data whenever possible.

Dr. Ranjan Vasudevan

Ranjan obtained his BA and M.Sci in 2005 and his PhD in Astronomy in 2009, both at Cambridge, and conducted postdoctoral research at the Institute of Astronomy. Ranjan's research focuses on understanding the total energy created by matter falling onto supermassive black holes (accretion) at the centres of galaxies. This light is intense enough to blow away large quantities of matter and can control the very formation and evolution of galaxies and the stars in them. This happens despite the black holes' small size in comparison to their host galaxies. Ranjan works on gathering data from a number of different observatories to determine this energy in large galaxy catalogues. Ranjan has also recently begun working on optical telescope design for detecting extra-solar planets. He currently works as a data scientist in Cambridge for FeatureSpace.

Dr. Matthew Bothwell

Matt is currently the Astronomy Outreach Assistant at the Institute of Astronomy. He was formerly a postdoctoral researcher in the Astrophysics department of the University of Cambridge. He obtained his Master's degree at the University of Southampton, while carrying out research at the Harvard Center of Astrophysics. He then returned to the UK in 2007, completing his PhD at the University of Cambridge in 2011. After a year working as a researcher at the University of Arizona, he returned to Cambridge in 2012. Matt is an observational astronomer, who uses a range of state-of-the-art observing facilities to study the evolution of galaxies across cosmic time.

Course programme

Friday

Please plan to arrive between 16:30 and 18:30. You can meet other course members in the bar which opens at 18:15. Tea and coffee making facilities are available in the study bedrooms.

19:00	Dinner
20:30 – 22:00	Introduction to observational astronomy (Observing on lawns weather permitting)
22:00	Terrace bar open for informal discussion

Saturday

07:30	Breakfast
09:00 – 10:30	How do we know about the universe? Astronomical techniques across the spectra
10:30	Coffee
11:00 – 12:30	A historical perspective on the universe
13:00	Lunch
14:00 – 16:00	Understanding Hubble's constant: Group Practical Activity
16:00	Tea
16:30 – 18:00	Understanding Hubble's constant: Discussion
18:00 – 18:30	Free
18:30	Dinner
20:00 – 21:30	Time and space: an introduction to relativity
21:30	Terrace bar open for informal discussion

Sunday

07:30	Breakfast
09:00 – 10:30	A brief history of the Big Bang
10:30	Coffee
11:00 – 12:30	The age of the universe today
12:45	Lunch

The course will disperse after lunch

Course syllabus

Aims:

This course aims to

- 1) Provide an overview of the techniques astronomers use to study the universe.
- 2) Give an overview of the history of how astronomers determined the age of the universe and how it has evolved over time.
- 3) Illustrate how astronomers really use data with a practical activity utilising data from actual telescopes.

Content:

The universe is 13.7 billion years old, but how do astronomers know that so accurately? In this course, you will explore the different techniques - starting with dating rocks and meteorites – that scientists have used over the centuries to come up with the current age estimate of the universe. You will even have a chance to use real astronomical data to try and determine the age of the universe yourself. Weather permitting, this course will offer a short observing session of the night sky.

Presentation of the course:

This course will consist of a combination of Tutor-led lectures and group discussion. Weather-permitting, there will be short Tutor-led observation session of the night sky. No computer experience is required, however a portion of this course will involve a group practical activity to determine the age of the universe.

As a result of the course, within the constraints of the time available, students should be able to:

- 1) Understand current astronomical techniques and their limitations
- 2) Gain a broad perspective on what our universe is and how the definition of the universe has changed over time
- 3) Understand what astronomical data actually looks like and how it can be manipulated to better characterise our universe
- 4) Understand popular space news items and differentiate what makes an astronomy story newsworthy.

Reading and resources list

Listed below are texts that might be of interest should you wish to supplement your learning on the course. Any essential reading is marked with an asterisk *

Author	Title	Publisher and date
Weintraub, David	<i>How old is the Universe?</i>	Princeton University Press 2011

Note Students of the Institute of Continuing Education are entitled to 20% discount on books published by Cambridge University Press (CUP) which are purchased at the Press bookshop, 1 Trinity Street, Cambridge (Mon-Sat 9am – 5:30pm, Sun 11am – 5pm). A letter or email confirming acceptance on to a current Institute course should be taken as evidence of enrolment.

Information correct as of: 26 April 2018