

Astronomy day: Galaxies and the Expanding Universe

Start date 13th November 2016 **Time** 10:00am – 16:45pm

Venue Madingley Hall
Madingley
Cambridge

Tutor Dr Judith Croston **Course code** 1617NDX009

Director of Programmes Emma Jennings

For further information on this course, please contact Public Programme Co-ordinator, Clare Kerr
clare.kerr@ice.cam.ac.uk or 01223 746237

To book See: www.ice.cam.ac.uk or telephone 01223 746262

Tutor biography

Dr Judith Croston is ICE Teaching Officer and Academic Director for Physical Sciences, and also holds a part-time position as Principal Research Fellow in the astronomy group at the University of Southampton. She obtained her MSci in Physics with Astrophysics from the University of Bristol, followed by her PhD in the area of extragalactic astrophysics from Bristol in 2004. She has previously worked as a postdoctoral researcher in the Service d'Astrophysique, Commission d'Energie Atomique, Saclay, as an Associate Lecturer with the Open University, and as a Research Fellow at the University of Hertfordshire. She currently leads several international research projects investigating jets from supermassive black holes using ground and space-based astronomical observatories, and is involved in planning for next-generation instruments and observatories.

Course programme

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|---------------|---|
| 9:30 | Terrace bar open for pre-course tea/ coffee |
| 10.00 – 11:15 | Introduction to galaxies: their ingredients & diversity |
| 11.15 | Coffee |
| 11:45 – 13:00 | From near to far: galaxies from the Milky Way to the distant Universe |
| 13:00 | Lunch |
| 14:00 – 15:15 | Exotic galaxies: quasars and jets |
| 15:15 | Tea |
| 15:30 – 16:45 | The expanding Universe |
| 16:45 | Day school ends |

Course syllabus

Aims:

- To explore the basic properties of galaxies, the variety of galaxy types found in the Universe, and the observational methods used to study galaxies.
- To introduce the basic ideas of cosmology, our place in an expanding Universe, and the observational evidence underpinning these ideas.
- To enable students to explore the limits of our current understanding of galaxies and learn about current and future advances that will help to fill in some of the gaps

Content:

The course will take a non-mathematical approach, beginning with an introduction to galaxies and how they relate to other types of astronomical objects. In the first session we will explore what a galaxy is (and how it differs from other types of astronomical object), the ingredients of galaxies and how we can measure them. We will then consider why galaxies come in different types, exploring their variety of appearance and what this can tell us. Starting with our own galaxy, the Milky Way, we will explore what we can learn about galaxies in the nearby Universe, before moving out to larger and larger distances, discussing the most distant known galaxies and what we can learn from them about how galaxies form and grow. The third session will focus on the most exotic types of galaxies, the quasars and radio galaxies with active black holes, and how they have changed our understanding of the nature and scale of the Universe. This will lead into our final session, which will introduce the fascinating topic of cosmology: the past and future of our expanding Universe. We will consider the wide range of different types of observations that have led to the currently favoured model of an accelerating Universe, containing large amounts of dark matter and even more mysterious dark energy, and we will finish by discussing the future prospects for resolving some of these mysteries.

Presentation of the course:

The course sessions will consist of an interactive talk, with lots of opportunities for questions, and some short activities. A respectful environment will be encouraged in which, irrespective of previous knowledge, everyone should feel confident to ask 'silly' questions (which usually aren't).

Outcomes:

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

- Discuss the ingredients of a galaxy and how these vary for different types of galaxy
- Explain how the Milky Way is similar to and differs from other galaxies
- Discuss how various types of observation and computer simulations are used to study galaxies
- Summarize at a basic level our current best model for the past and future evolution of the Universe and its observational basis
- Engage with popular science articles in the media discussing recent results in galaxy research and new observatories and space missions

Reading and resources list

Listed below are a number of texts that might be of interest for future reference, but do not need to be bought (or consulted) for the course.

| Author | Title | Publisher and date |
|---|---|---------------------------------|
| Geach, J. | Galaxy: mapping the cosmos | Reaktion books 2014 |
| Gribbin, J. | Galaxies: a very short introduction | OUP 2008 |
| Mackie, G. | The multi-wavelength atlas of galaxies | CUP 2011 |
| Jones, M.H., Lambourne, R.J.A. and Serjeant, S. | An introduction to Galaxies and Cosmology, 2 nd ed. | CUP 2003 |
| Croswell, K. | The Alchemy of the Heavens: Searching for meaning in the Milky Way | Random House SA 1995 |
| Overbye, D. | Lonely Hearts of the Cosmos | Little, Brown & Company 1999 |

Website addresses

There is a wealth of good information on the web about astronomy, although there is also a lot of sensationalist and inaccurate reporting of press releases and new discoveries. Wikipedia articles generally provide a reliable introduction to topics in astronomy, although sometimes veer into advanced mathematics, which may or may not be to your taste.

Chromoscope (<http://www.chromoscope.net/>) is a beautiful interactive tool to explore the Milky Way across the electromagnetic spectrum, from radio waves to energetic X-ray and gamma rays.

The Galaxy Zoo project (www.galaxyzoo.org) allows members of the public to participate in a large research project classifying galaxies from the Sloan Digital Sky Survey and other scientifically important datasets.

Additional information

Venue

Details of how to find Madingley Hall can be found on our website:
<http://www.ice.cam.ac.uk/who-we-are/how-to-find-the-institute>

Refreshments

Tea and coffee and lunch will be provided. If you have any specific dietary requirements or allergies and have not already advised us, please inform our Admissions Team on ice.admissions@ice.cam.ac.uk or +44 (0)1223 746262.

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: 08 September 2016