UNIVERSITY OF CAMBRIDGE

Institute of Continuing Education

Black holes 101

Start date	28 October 2018	**End date**	28 October 2018
Venue	Madingley Hall Madingley Cambridge		
Tutor	Dr. Ranjan Vasudevan	**Course code**	1819NDX008

Director of Academic Centres Sarah Ormrod

For further information on this course, please contact Head of Academic Centre Administration, Zara Kuckelhaus zara.kuckelhaus@ice.cam.ac.uk or 01223 746204

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

Tutor biography

Ranjan obtained his BA and M.Sci in 2005 and his PhD in Astronomy in 2009, all at Cambridge, followed by postdoctoral positions in the USA (Pennsylvania State University and the University of Maryland) and back at the Institute of Astronomy, Cambridge. Ranjan's publications in astronomy research focus 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 control the very formation and evolution of galaxies and the stars in them, despite the black holes' small size in comparison to their host galaxies. He is currently working as a Data Scientist in Cambridge.

Course programme

09:30	Terrace bar open for pre-course tea/coffee
10:00 – 11:15	**The history of gravity and the idea of black holes**
11:15	Coffee
11:45 – 13:00	**Relativity and radiation**
13:00	Lunch
14:00 – 15:15	**Seeing the invisible: detection and the study of black holes**
15:15	Tea
15:30 – 16:45	**The diversity and influences of black holes**
16:45	Day-school ends

Course syllabus

Aims:

- Provide the historical and theoretical context for the idea of black holes, with an understanding of how a once theoretical idea became an observational reality of considerable interest in astronomy.
- Give an overview of key theoretical constructs relevant to understanding black holes, including Newton's and Einstein's theories of Gravity
- Summarise the observational techniques used to observe black holes in the Universe
- Provide a comprehensive overview of the real environments that host black holes in our Universe, along with a discussion of how black holes influence their surroundings in binary systems, active galaxies and galaxy clusters

Content:
We will begin this course with an account of the development of the theory of gravity and the evolution of the concept of a black hole. Starting with the earliest ideas of a black hole rooted in Newton's gravity, we will then understand how Einstein's relativity predicted a concrete framework for the idea along with definitive observational signals to expect. We will then undertake an overview of the real astronomical techniques used to detect and study black holes in modern astronomy, followed by an overview of how black holes, far from being invisible, have wide-ranging influences and consequences for their environments and for the evolution of the Universe itself.

Presentation of the course:
This course will consist of a combination of Tutor-led lectures and group discussion.

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

- understand the basic physics and astronomy of black holes
- gain a broad perspective on theories of gravity
- understand the advances in observing black holes in real astronomical situations
- be able to understand popular astronomy news items related to black holes

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
Russel Stannard	**Black Holes and Uncle Albert (popular science/suitable for children)**	**Faber & Faber, 1991/2005**

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: 11 October 2018