BAA Winchester Weekend

2025 April 11-13

Biographies and Abstracts of Speakers (in order of the program)

Prof David Rothery

David Rothery is Professor of Planetary Geosciences at the Open University, where he chairs the level 2 course “S283 Planetary Science & the Search for Life”. He has authored several books including both “Planets” and “Moons” for the Oxford University Press “Very Short Introductions” series. Older members may have come upon his 1992 book “Satellites of the Outer Planets: Worlds in their own right” or the 1999 2nd edition. His research these days is mostly on Mercury, in his role as co-leader of ESA’s Mercury Surface & Composition Working Group for the current BepiColombo mission.

Mercury and the BepiColombo mission

As revealed by NASA’s MESSENGER mission (in orbit 2011-2015), Mercury is a perplexing planet. Possibly robbed of most of its rock by a giant impact late in the planet-forming process, it is nonetheless rich in volatile elements that have enabled explosive volcanism to persist into the most recent billion years, and less violent loss of surface material to continue today via a process known as “hollow formation”.

A joint ESA-JAXA mission called BepiColombo has been on its way to Mercury since 2018. After a series of flybys, this is scheduled to get into orbit about Mercury in November 2026. I will show images from the flybys, but the real science begins from orbit where BepiColombo’s science payload will become fully operable. This includes a UK-led X-ray spectrometer (MIXS) that will measure elemental abundances across the surface much better than MESSENGER was able to do, and may enable us to properly fingerprint those mysterious “volatiles”.

****

Prof Mike Edmunds

Mike Edmunds is Emeritus Professor of Astrophysics at Cardiff University, and the immediate past-President of the Royal Astronomical Society. He was educated at Cambridge, but has lived and worked in Wales for fifty years. His research career involved the determination and interpretation of the abundances of the chemical elements in the Universe – particularly through spectroscopy of galaxies - and investigation of the origin of interstellar dust. Later work has been in the history of astronomy, including the ancient Greek Antikythera Mechanism. He was a member of two UK Research Councils. He is a Vice-President of the Herschel Society and an Honorary Vice-President of the Society for the History of Astronomy. He can occasionally be seen in his one-man play about Newton - 'Sir Isaac Remembers…'. He was the subject of BBC Radio 4’s 'The Life Scientific' in April 2024, and appeared on "In Our Time" in November 2024.

The Chemistry of the Universe

There is the real and fascinating probability that in the future we will be confronted with extraterrestrial worlds whose physical conditions and compositions result in chemistries radically different from our own. I will briefly outline our current knowledge of the origin and distribution of the elements in the universe, as we try to push as far as we can into astronomical environments where complex chemistry is taking place. Currently we believe we have a reasonably good understanding of the processes and astronomical sites that have led to the formation of the elements in the periodic table. Except for hydrogen, some helium and a little lithium, all of them have been synthesised since the beginning of the universe. Recent spectroscopic observations to high redshifts are enabling us to follow their build up in galaxies from back in the earliest times to the present. The discovery of many planetary systems beyond the Solar System, and the investigation of dense interstellar environments, imply a huge unexplored range of chemical possibilities and may lead to profound implications for life in the Universe.

****

Prof Tony Freeth

Tony Freeth is Honorary Professor in the Dept of Mechanical Engineering, University College London. His academic background is in Mathematics, with degrees in pure mathematics at Cambridge University (UK) (MA, MMath) and mathematical logic at Bristol University (MSc, PhD). Subsequently, he trained as a filmmaker at the prestigious National Film School and had a twenty-five year, award-winning career making documentary films for TV and independent productions. He is currently making a film about Focused Ultrasound for the treatment of tumours. In 2000, Tony Freeth proposed new scientific investigations of the Antikythera Mechanism — finally carried out in 2005 with an international research team. This revolutionized Antikythera research with his discoveries both of eclipse prediction and the extraordinary way the Mechanism calculated the variable motion of the Moon. This and subsequent work resulted in two papers as lead author in Nature (2006, 2008) as well as other publications in many leading journals. Recent research with the UCL Antikythera Research Team has concentrated on building a model of the Cosmos at the front of the Mechanism, which matches all the surviving evidence—research that has had an extensive impact since publication in 2021, with more than 400,000 views to date. He is actively pursuing further research on the Antikythera Mechanism together with a team at UCL. He has given many presentations on the Antikythera Mechanism — most recently at Oxford University, Athens and the Rutherford Appleton Laboratory. A presentation at Stanford University was released on YouTube and has had 8.9 million views to date. He has produced several prize-winning films on the Antikythera Mechanism, which have had wide international TV circulation. He recently contributed visual materials for the Antikythera section of a major exhibition in Frankfurt. He plans to distribute this exhibition internationally.

The Antikythera Mechanism: Nearly Impossible

In 1901, Greek sponge divers recovered a corroded lump from an ancient shipwreck near the tiny island of Antikythera, between Crete and mainland Greece. Subsequently, it split apart and revealed tiny precision gearwheels — a shocking discovery for ancient Greece. More than a century later, we know that the Antikythera Mechanism was a highly sophisticated astronomical calculating machine, constructed from bronze gearwheels. We also know that it originally included three gears with 53 teeth! How is that possible? It was described by Richard Feynman as being "nearly impossible". The latest model shows indications for the Sun, Moon and planets as well as eclipse prediction. How confident can we be in this reconstruction? How much is certain? How much is conjectural? What is the history of research that has led to these conclusions? What are the implications of this technological revolution?

****

Prof Stephen Wilkins

Stephen Wilkins is a Professor of Astronomy and Public Understanding of Science at the University of Sussex. Stephen obtained his Masters in Physics from the University of Durham before receiving his PhD from the University of Cambridge. Stephen then worked as a research fellow at the University of Oxford before joining the faculty at Sussex in 2013. Stephen's main research focuses on understanding the formation and evolution of galaxies, particularly the first stages in the distant early Universe. To do this Stephen combines observations from telescopes including Webb and Hubble with supercomputer simulations. Outside his research Stephen is also a keen advocate of public understanding of science, including founding a small science education charity.

Exploring the End of the Dark Ages

According to the big bang model our Universe expanded from an incredibly hot, dense state roughly 14 billion years ago. A few hundred thousand years after its formation the Universe entered a period known as the "cosmological dark ages" where there were no sources of visible light. However, during this time dark matter and gas, attracted by the force of gravity, developed into structures, eventually leading to the formation of the first stars and galaxies, lighting up the Universe. This earliest period of galaxy formation is now accessible thanks to the James Webb Space Telescope (Webb). Webb observations combined are now transforming our understanding of this critical period of the Universe's history, throwing up challenges to current galaxy formation models. In this talk I will introduce the work of my team in this area.

****

Prof Patrick Irwin

Born and raised in Wiltshire, Patrick Irwin was both an undergraduate and postgraduate at the University of Oxford at Keble College and became a University Lecturer and Fellow of St Anne's College, Oxford in 1996. He is now a Professor of Planetary Physics and has more than 30 years' experience in remote sensing of planetary atmospheres from satellite and ground-based observations. He was a Science Team member on NASA's Galileo mission to Jupiter, and a Co-Investigator on NASA's Cassini mission to Saturn. He is the originator and lead developer of the NEMESIS radiative transfer and retrieval code and leads an active programme of ground-based spectroscopic observations (and interpretation) of solar system planetary atmospheres. In recent years he has devoted much of his time to the study of the Solar System's 'Ice Giants' – Uranus and Neptune, but as a co-investigator of the MAJIS instrument on ESA's JUICE mission to the Jovian system, he is now concentrating his research more on Jupiter's atmosphere. Since 2016 he has been conducting an ongoing programme of Jupiter observations in support of NASA's Juno mission using the MUSE instrument at the European Southern Observatory's Very Large Telescope in Chile.

Jupiter and its Turbulent, Fascinating Atmosphere

Jupiter, the 'king' of the Solar System planets, is just over eleven times larger, and roughly 318 times more massive than Earth. Orbiting at roughly 5.2 AU from the Sun, its disc is easily observable from the Earth and astronomers have been fascinated by its ever-changing dark belts, light zones and 'storms' (e.g., the Great Red Spot) ever since Galileo Galilei first observed Jupiter with a telescope in 1610. Our understanding of Jupiter has been completely transformed in the last fifty years, by: 1) spacecraft encounters (Pioneer, Voyager: 1979, Galileo, Cassini, Juno); 2) space-based telescopes (e.g., Hubble Space Telescope, James Webb Space Telescope); 3) the increasing size and sophistication of professional ground-based telescopes such as the European Southern Observatory's Very Large Telescope; and 4) observations made by 'amateur' astronomers with backyard telescopes. In this talk

I will survey what we have learnt about the temperature, composition, cloud structure, dynamics and appearance of Jupiter's turbulent atmosphere. I will also show how our understanding is currently being transformed by NASA's Juno mission and observations with the James Webb Space Telescope, and how 'amateur' observers can help map and monitor Jupiter's ever-changing atmosphere.

****

John Rogers

John Rogers has been Director of the Jupiter Section of the BAA for over 30 years, analysing and reporting on amateur observations of Jupiter. He regularly posts reports on the BAA web pages, and has authored many articles and papers about Jupiter, including in professional journals and conferences. His book 'The Giant Planet Jupiter' was published by CUP in 1995. In recent years he has been working closely with the imaging team on NASA's Juno orbiter, and also collaborating with other professional planetary scientists. All this work is in an amateur capacity. Professionally, Dr Rogers was a lecturer and researcher in molecular neurobiology at the University of Cambridge, until he retired in 2014 so as to devote himself full-time to Jupiter research.

Jupiter & Juno in 2024-25

Jupiter's atmosphere is a source of continual fascination because of its balance between chaos and order: unpredictable short-term changes turn out to fit into long-term patterns, and 'spots' tracked in regular currents turn out to be dazzlingly intricate when viewed by spacecraft. The BAA Jupiter Section integrates the observations from numerous amateurs worldwide and from the camera on NASA's long-running Juno orbiter. This talk focus on phenomena of interest on the planet in 2024-25, as well explaining how Juno's views are changing as its orbit evolves. In 2024 the planet has been largely quiet, but with large-scale cycles proceeding in the North Equatorial Belt (which expanded northwards and began to develop new circulations) and the Equatorial Zone (which had been whitish for a year or two, but began to develop coloration again). We will discuss how these changes fit into multi-year cycles, and whether any new outbreaks are attracting attention in 2025. Meanwhile Juno is getting closeup views of the high northern latitudes, including features that amateurs can now track, and also extending up to the north pole where JunoCam continues to monitor the remarkable polygon of cyclones.

****

Martin Lewis

Martin has had a fascination for all things in the sky since he was young. He is a professional engineer and part-time planetary imager, telescope builder, and deep sky sketcher. He images using his home-built 444mm and 222mm Dobsonian telescopes, both used on a home-built equatorial platform, from his garden in St. Albans, Herts. Martin has been shortlisted in the Astronomy Photographer of the Year for the last 8 years, primarily in the Planets section, and has been a category winner twice. He is treasurer of the West of London A.S. (WOLAS) and an equipment advisor in the BAA's Equipment and Techniques section.

Capturing Clouds

Jupiter is a highly rewarding object in the eyepiece due to its large angular size and ever-changing cloud structures. The modern technique of high speed digital video imaging allows amateur instruments to capture wonderful views and, in the right conditions and with the right techniques, to produce astoundingly detailed images. This talk gives a quick overview of the principles of digital video imaging and gives practical tips to help you produce better images of the planet.

****

Rob Bullen

Born in Bognor Regis in 1971, I started my interest in astronomy at the age of 10, and meeting Patrick Moore (who lived not far from me) in November 1981 was a real catalyst for my interest. Within the many areas for study in the field of astronomy, I settled on observing the major planets and comets from the late 1980's through the 1990's and began contributing to the BAA through the medium of drawing, particularly focusing on Jupiter. I made the leap to digital imaging of the planets in 2013 with a C8 Edge HD and basic colour camera and now use a C11 to image the planets using mono cameras. I joined the JUPOS project in 2016; they are a small virtual team that analyse images from Jupiter observers around the world and produce drift data on the giant planet's ever-changing features. In turn, this data is used help support the production of reports and contributes to the study of Jupiter by the BAA and professional organisations around the world.

JUPOS analysis of Jupiter images

Brief comment on my visual history of observing Jupiter and my transition to digital from 2013 onwards. Introduction about the JUPOS team, the application itself and its major functions. Sourcing observers' images and measuring them. Analysis of image data through the creation of drift charts. Overview of producing maps.

****

Prof David Rothery

David Rothery is Professor of Planetary Geosciences at the Open University, where he chairs the level 2 course "S283 Planetary Science & the Search for Life". He has authored several books including both "Planets" and "Moons" for the Oxford University Press "Very Short Introductions" series. Older members may have come upon his 1992 book "Satellites of the Outer Planets: Worlds in their own right" or the 1999 2nd edition. His research these days is mostly on Mercury, in his role as co-leader of ESA's Mercury Surface & Composition Working Group for the current BepiColombo mission.

Io's volcanoes

Io is the Solar System's most volcanically active body. It has maybe 400 active volcanoes, of which dozens are typically erupting at any one time. Activity ranges from explosive eruption plumes, to lava flows, to persistent lava lakes. Temperature measurements demonstrate that that the lava lakes and lava flows are genuine molten rock, rather than just sulfur as was once suggested, but sulfur and sulfur dioxide are likely the volatile phases whose violent expansion drives the explosive eruptions. This activity is powered mostly by tidal heating, thanks to Io's 4:2:1 orbital resonance with Europa and Ganymede, which has prevented Jupiter's enormous gravity from dragging Io into a circular orbit. Io's orbit is only slightly eccentric, but this forced eccentricity results in changes in both distance to Jupiter and orbital speed sufficient to cause the tidally-raised bulges to grow (when close) and subside (when far) and to librate to and fro (while orbital speed changes) with the result that the interior is continually flexed and heated. The recent Juno flybys of Io have given new insights into the nature and persistence of some of the volcanism.

****

Chris Hooker

I am a retired laser physicist who worked for many years on high-powered lasers for plasma physics research. I have been interested in astronomy and spaceflight since childhood, and after the Shoemaker-Levy comet impact on Jupiter in 1994 I bought myself a 20cm Schmidt-Cassegrain telescope, at first for visual observing and later for lunar and planetary webcam imaging. From there I moved on to more challenging imaging projects, for which my practical experience of optics was very helpful in developing special devices and techniques. My latest projects include imaging Mercury and its tail and more recently recording the sodium clouds associated with Jupiter's volcanic moon Io. I am the Mercury co-ordinator of the BAA Mercury and Venus Section, and the author of the BAA Mercury Observing Guide.

Imaging Io's sodium cloud

Volcanic activity on Io injects material into its tenuous atmosphere, predominantly sulphur and its oxides but also a few percent of other elements including sodium. The material does not reach escape velocity but can be stripped from Io's atmosphere when the moon passes through a torus of plasma that rotates around Jupiter with its magnetic field. The ejected material forms clouds and jets of varying shapes. The sodium in the clouds has a large cross-section for absorbing and re-emitting sunlight at 589.0 and 589.6 nm (the sodium D lines), and thus imaging the inner part of the Jovian system at those wavelengths allows us to visualise the location of the material and study its behaviour. I will describe the techniques required to make these observations and present results obtained during the 2024-25 apparition of Jupiter.

****

Dr Alvaro del Moral

Alvaro del Moral is a post-doctoral research associate at the Open University where he recently completed his PhD on the habitability of icy moons. He has a multidisciplinary background in microbiology and biophysics, studying different aspects of extremophile bacteria. At the moment, his research is focused on planetary protection, from cleanroom microorganisms to the contamination of icy moons by spacecraft missions.

Europa's ocean and prospects for life

Two missions (JUICE, from ESA and Europa Clipper, from NASA) are on their way to study the icy moons of Jupiter and their potential for habitable environments. Europa is one of the most promising targets for the search of life amongst the icy moons of our Solar System. Its tidally heated, liquid water ocean is likely to be in contact with the silicate interior of the moon. The products from water-rock reactions might create the necessary conditions to sustain microbial life. On Earth, microorganisms present the biggest diversity in terms of metabolisms and adaptability to extreme conditions. Studying some of these microorganisms under Europan conditions will help us understand what kind of biosignatures we might expect to find on the surface of the moon.

****

Mike Foulkes

Mike has been a member of the BAA since 1970. He is on the committee of the BAA Jupiter Section and is also the Director of the Saturn Uranus and Neptune Section. He enjoys observing the Moon and planets and has also been to a number of total solar eclipses. Professionally he has worked in the spacecraft industry on both communication satellites and scientific spacecraft.

Fifty years of looking at Jupiter

This talk presents a brief personal view on observing Jupiter over the last 50 years, including how the observation of Jupiter has evolved over this time and some highlights of what has been recorded.

****

Prof Jocelyn Bell Burnell

Jocelyn Bell Burnell inadvertently discovered pulsars as a graduate student in radio astronomy in Cambridge, opening up a new branch of astrophysics - work recognised by the award of a Nobel Prize to her supervisor. She has subsequently worked in many roles in many branches of astronomy, working part-time while raising a family. She is now a Visiting Academic in Oxford, Department of Astrophysics. She has been President of the UK's Royal Astronomical Society, in 2008 became the first female President of the Institute of Physics for the UK and Ireland, and in 2014 the first female President of the Royal Society of Edinburgh. She was one of the small group of women scientists that set up the Athena SWAN scheme. She has received many honours, including a $3M Breakthrough Prize in 2018. The public appreciation and understanding of science have always been important to her, and she is much in demand as a speaker and broadcaster. In her spare time, she gardens, listens to choral music and is active in the Quakers. She has co-edited an anthology of poetry with an astronomical theme – 'Dark Matter; Poems of Space'.

We are made of star stuff

In this talk I will describe how the atoms that are now found in our bodies came into existence and came to be in our bodies.

****

Steve Knight

I've had a lifelong passion for Astronomy but did not become a BAA member until 2011. I am also an active member of both Newbury Astronomical Society and Chipping Norton Amateur Astronomy Group. I was elected a Fellow of the Royal Astronomical Society in 2018 and was recently elected to the BAA Council. I am currently a remote student at the University of Central Lancashire studying for a degree in Astronomy.

Astronomy with a Smart Scope

I was more than a little sceptical regarding Smart Telescopes when they were originally introduced in 2018. My scepticism was of course reinforced by their high cost. Over time they became more affordable, and I decided that six telescopes may not be enough so I purchased a Seestar S50 in November 2023. I have over 20 years' experience of Astrophotography so was interested to find out what they were and were not capable of.

****

Prof Boris Gänsicke

Boris Gänsicke studied Physics at the Technical University in Berlin, followed by a PhD in Astronomy at the University of Goettingen. He then moved to Southampton as a PPARC Advanced Fellow, and finally started the Astronomy and Astrophysics group at the University of Warwick alongside Tom Marsh in 2003. His research focuses on white dwarfs in a range of contexts, including the progenitors (and remnants) of thermonuclear supernovae and the late stages of planetary systems.

How the worlds will end

Less than 30 years ago, we did not know whether planets exist outside our solar system. Fast forward to 2024, astronomers have discovered well over 5000 planets orbiting other stars similar to our Sun, including some that may have the right conditions to host life. As we learned that the formation of planets seems to go hand-in-hand with the birth of stars, we begin to wonder:

- What happens to planetary systems when their host stars run out of fuel, and turn into Earth-sized white dwarfs?
- Are those systems, if they exist, detectable?
- What will happen to our solar system, and to the Earth?
- And what are the possible implications for life?

I will discuss the late evolution of planetary systems, the observational fingerprints of planets and their debris orbiting white dwarfs, and how studying these exotic systems improves our general understanding of the formation of planets.

****

Prof Lucie Green

Lucie is a Professor of Physics based at the Mullard Space Science Laboratory, UCL's Department of Space and Climate Physics and studies activity in the atmosphere of our nearest star, the Sun. In particular, looking at immense magnetic fields in the Sun's atmosphere which sporadically erupt into the Solar System. If these eruptions reach the Earth, they can drive major space weather events. She is interested in how the magnetic configuration of the eruptions can be used to understand the physical processes that underly each eruption and whether these eruptions can be forecast to help mitigate the risks of their arrival at Earth. Lucie is also President of the Society for Popular Astronomy and has received the Royal Society's Kohn award and the Institute of Physics' Lise Meitner Medal for her work in public engagement.

Seeing total solar eclipses from space

Seeing a total solar eclipse is an experience that you never forget. For a brief moment in time, the extended atmosphere of the Sun becomes visible as the bright disk of the Sun is entirely covered by the Moon. Day becomes night, the stars come out and you are able to view the Sun directly and safely. Total eclipses are also of huge scientific value and astronomers will take their telescopes to far-flung places to catch a glimpse of the Sun during this time. Now, a new mission has been proposed that will fly a spacecraft into the shadow of the Moon in order to create total solar eclipse conditions in space. And it will do this once per month. This talk will discuss why total eclipses are so important for scientists and why an international team has been put together to create a new generation of eclipse viewing.

****