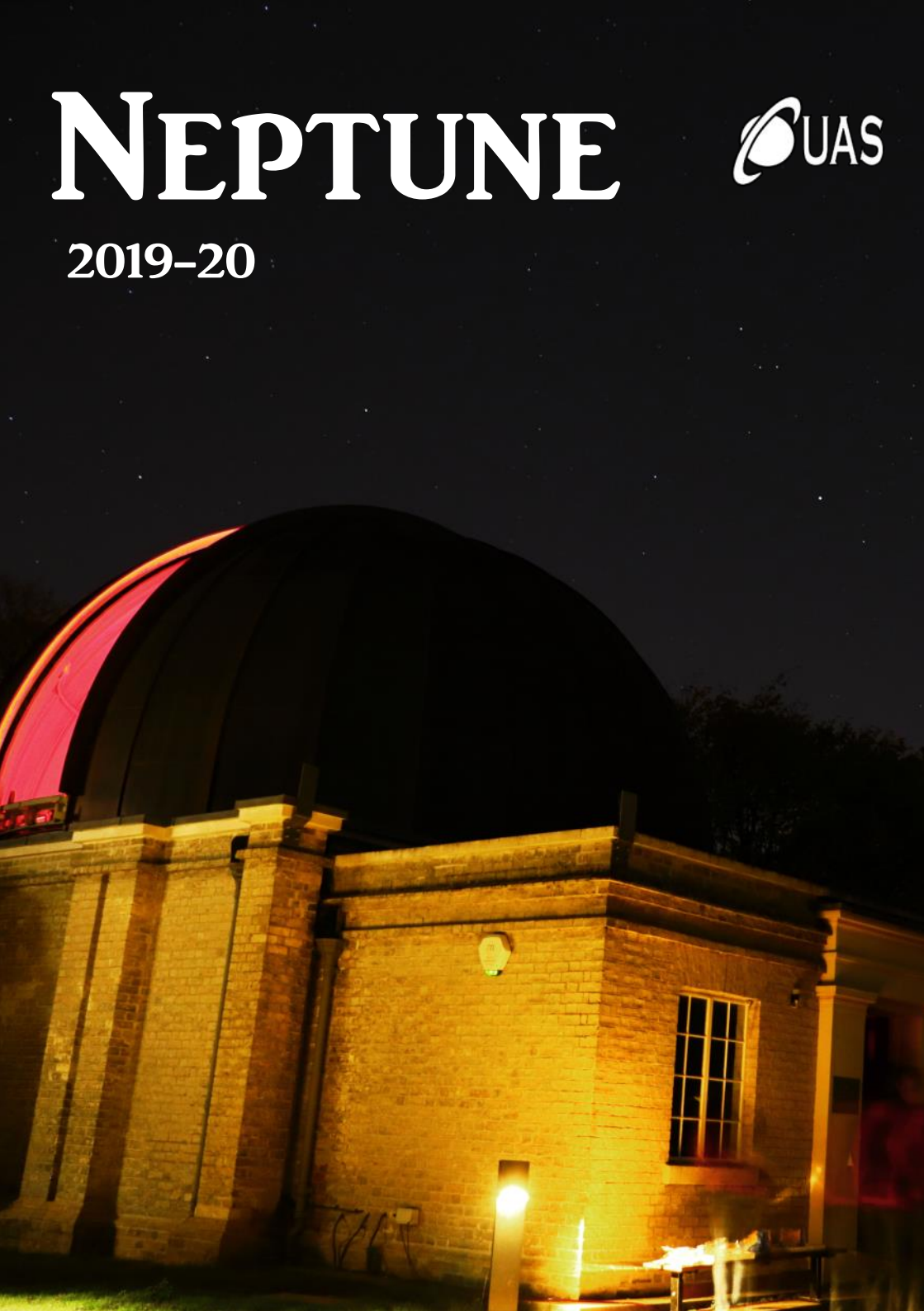
Neptune

2019–20



Welcome!

Apparently the process of editing Neptune last year was not too traumatic, as we find ourselves doing it again, despite some of our concerns last year. A year's experience has definitely made the process faster, but probably increased the amount we have badgered people for articles. Yet again, it has been a pleasure to write it and to organise the materials so kindly sent in. As both of us are leaving committee this year, this may be our last time editing this magazine, giving it something of a bittersweet note for us. We trust our successors to take good care of it, though, and look forward to getting to read it, hopefully without having to write it or sneak peeks at the content.

As well as (semi-mandatory) submissions from the committee, we have had contributions from our members and alumni - such as a collection of photos of the transit and the group observing the society co-hosted. Articles have been on a wide range of topics, including the history of astronomy, a guide to astronomy mnemonics and a collection of limericks. This year the weather has been very uncooperative, much to the disgruntlement of our ObsSecs, but it was very helpful for observing the transit from Cambridge. We had a lovely afternoon watching Mercury travel across the face of the Sun, and so have not had to rely on our better travelled alumni for photos. This has given this year's photos a strong solar system focus, but overall compared to last year, we have a more varied selection of photographs. Yet again, we are pleased to welcome several submissions from the youngest face in the society.

We hope you enjoy reading this as much as we have enjoyed putting it together.

Hannah Sanderson (Chair 2018-19) and James Rawson (ObsSec 2019-20)

Cover photo: Northumberland on Fresher's ObsNight by Rodrigo Cordova-Rosado

Chair's Review of the Year

It never seems to take long, and yet another year of CUAS has indeed passed. As ever, the year began with the Science Garden party, on this occasion held in the spacious if distant grounds of Churchill college. We have now had 15 talks this year, enjoying consistently strong attendance. Nearly 180 people attended our opening lecture from science writer Brian Clegg to hear about Dark Matter and Dark energy. Since then attendance has settled at around 40 each week, although the amount of snacks has only increased. Membership too has reached new heights, with 216 new members this year, all really encouraging signs for the society.

It has been a varied year for talks. A notable highlight for the year has to be the talk from Professor Didier Queloz on his Nobel Prize winning research, although it would grossly unfair to narrow it down to just a single talk. Dave Wealthy gave us an insight into the engineering challenges required to make a mission move from a concept to a reality with a talk on LISA Pathfinder. Professor Sanjeev Gupta of Imperial College entertained us in fascinating detail about the geology of Mars. Documentary film maker Dr Christopher Riley gave us an inspiring look back on the Apollo program to mark the 50th anniversary of the Moon landings. We have also been lucky enough to hear from three past CUAS chairs speaking on exoplanets, galaxy clusters and black holes.

This year has also been exciting for observing, despite the often frustrating weather we have been able to hold 5 ObsNights, and 71 people have attended their second ObsDemo. This has culminated in 45 ObsCards being issued to members. The Northumberland and Thorowgood domes have

all seen good use, the latter now sadly out of action.

Despite the overwhelming dread of the AV system failing at a crucial moment on Tuesday evenings, it has been immensely enjoyable and rewarding being Chair of the society this year. None of it would have been possible without the committee helping with the smooth running of all the events. Whether it's the faint rustle of the snacks being laid out after the Tuesday talks, or the reassuring confidence of our ObsSecs during an ObsNight, I am very grateful for all the hard work all the committee have put in to make this year a success. I wish the new committee the best of luck for the upcoming year and I trust that they will continue to make CUAS a success.

Oliver Normand, Chair 2019-20

2019-20 Committee

Chair: Oliver Normand

Secretary: Matthew Zhang

Treasurer: Zak Shumaylov

Observation Secretaries: Harry Metrebian, James Rawson

General Members: Amber Parsons (publicity), Tommy Tai, (events), Hannah Sanderson

Senior Committee: *President: Mike Irwin, Senior Treasurer: Jonathan Shanklin*

Incoming Committee

From left to right: Tingjing Xing, Steve Shen, Ralph Battle, Oliver Normand, Hrachya Zakaryan, Pascal Keller, Calvin Preston, Joseph Thornton

We are excited to announce the incoming committee for 2020-21

Chair: Hrachya Zakaryan

Secretary: Oliver Normand

Treasurer: Calvin Preston

General Members: Tingjing Xing, Steve Shen, Ralph Battle, Pascal Keller, Joseph Thornton

A strong recruitment drive has resulted in a committee of eight again next year, which is fantastic. There are lots of new faces on the committee and we look forward to getting to know them next year.

Heather Couper 1949–2020

Heather Couper, a talented astronomer and science populist, sadly passed away this year at the age of 70. As well as being an influential public figure, she has a personal connection with CUAS. She took her first steps in her career in astronomy becoming a research assistant at the Institute of Astronomy in 1969. She became involved in the the Challis Club (a social group of current and previous CUAS committee) through her friend Nigel Henbest and was a regular attendee at meetings in the mid 70's. Many alumni have fond memories of her at these meetings.

Heather was instrumental in making science, particularly astronomy, accessible for a wide audience. Professor Brian Cox said of her 'she was one of the pioneers in bringing astronomy to everyone, including me'.She was multi-talented: producing and presenting numerous tv documentaries and radio programmes and writing several books. She co-founded Pioneer Productions with her friend Henbest, which to this date has produced over 700 hours of programmes, distributed in 60 countries worldwide. Some of her most well-known TV appearances include BBC's The Sky At Night and Channel 4's award-winning documentary 'Electric Skies'. Her appearance on The Sky At Night was her first big break and had a nice circularity given one of her first interactions with astronomy had been writing a letter to Sir Patrick Moore. Having been inspired by seeing a green meteor as a child, later, aged 16, she wrote to him asking 'Is there any future for me in astronomy?'. He replied 'Of course there is.'.

There was more than a place for Heather in astronomy. She broke through many barriers becoming the first female president of the British Astronomical Association (BAA) in 1984 and the first female professor at Gresham College in 1993. This reflected her attitude that astronomy was not 'for shambolic old men in tweed jackets any more' and this is a belief her legacy will perpetuate, inspiring people of all backgrounds to study astronomy.

Astronomy Mnemonics Everyone Should

A mnemonic is a useful tool to remember sequences of letters. For example, one will remember the colours of the rainbow to be Red, Orange, Yellow, Green, Blue, Indigo and Violet by "ROY G. BIV" – a boy's name. Alternatively, a mnemonic for remembering the sequence of planets (and a dwarf planet) in the Solar System is "My Very Excellent Mother Just Sent Us Nine Pies" - for Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto.

Stars have been fantasized about since the early days. To the untrained eye, the only way to distinguish types of stars are their relative positions and their apparent brightness. A natural question to ask would be: "Can we classify stars?". The answer is – yes, we can!

Stars emit light (technically "electromagnetic radiation"). From the radiation these stars emit, we can deduce several inherent properties of the stars – chemical composition (what elements these stars are made of), temperature (how hot it is), and so on. The light we receive can be recorded as a spectrum.

Various astronomers have attempted to classify stars based on their spectra. The modern classification is the following – assign a star a spectral class, and a number within that class (conventionally represented by a roman numeral). The spectral class characterizes the temperature (and the color) of the star. Other stellar properties include mass and radius, and these can be deduced using other empirically determined correlations.

The classes, in order of decreasing temperature, are O, B, A, F, G, K and M. The most commonly used mnemonic is "Oh Be A Fine Girl/Guy, Kiss Me!"

Older favorite mnemonics for the spectral sequence include: "Oh Boy, An F Grade Kills Me" and the slightly self-deprecating, "Only Boring Astronomers Find Gratitude Knowing Mnemonics".

Two conjunctions of Venus and the Moon

28/01/2020: ‘The evening's conjunction was a crowd-pleasing sight for dog-walkers.’

27/02/2020: ‘It's been a stormy month everywhere but cloud and rain miraculously cleared at sunset on 2020 Feb 27 so I repeated the shot from last month. Azimuth of objects had moved, plus later time, so different angle of foreground and sky brightness.’

James Lancashire ObsSec 1990-91, Chair 1991-92

Astronomy in the Medieval Islamic World

The history of ancient and medieval astronomy is often taught in a very disconnected way. Ancient Greeks, such as Ptolemy, are often taught about in schools, perhaps along with some of his predecessors like Eratosthenes and Hipparchus. Then there is a large gap where it seems like nothing happened in the astronomical world, until the scientific revolution, the works of Copernicus, Kepler and Galileo and everything else that followed. It's not entirely true to say that this was an age of inactivity for astronomy in the western world, but it also was not an age of astronomical enlightenment like during the renaissance. However, the 'dark ages' for the western world coincide with the so-called 'Islamic Golden Age', ranging from the 8th to 14th century.

The Golden Age of Islam is closely tied with the founding of the House of Wisdom in Baghdad, then part of the Abbasid Caliphate. The House of Wisdom was a large library with many scholars both producing novel pieces of research, but also working to translate foreign texts into Arabic. These texts came from many different places, with many from Ancient Greece, India or Persia, meaning that the independent research of many different peoples and cultures was all being collected in one place of learning. The scholars of the House of Wisdom also had an observatory constructed in Baghdad, called the Maumtahan Observatory, which became the major observatory in the Islamic world.

The most famous scientific figure to come out of the Islamic Golden Age must be Alhazen (the most common transliteration of his name). Viewed as the father of modern optics, and also of the scientific method in general, there is no doubt that he is one of the most influential figures in shaping the history of science. As well as his work in optics, Alhazen wrote at great lengths about astronomy as well. One of these publications was entitled 'Doubts Concerning Ptolemy'. Ptolemy's theories of the motions of the planets in the sky and his model of the configuration of the planets were contradictory, by his own admission. Ptolemy believed that if his ideas could correctly predict observations, the contradictions did not matter. Alhazen expressed a desire to fix Ptolemy's model, and proposed his own in 'Model of the Motions of Each of the Seven Planets'. This model was still geocentric, like Ptolemy's, but was much more geometric and rigorous.

While Alhazen's work had failed to cast doubt on the geocentric model in his mind, others were beginning to have major doubts about the idea of a stationary, central Earth. Abu Sa'id Al-Sijzi was the first to suggest that the Earth rotates about its axis in the 10th century, an idea viewed as dubious, but difficult

to disprove, by many of his contemporaries. By the 12th century, astronomers in Al-Andalus (the name given to Islamic Spain and Portugal) such as Nur ad-Din al-Bitruji proposed non-Ptolemaic models for the planetary motions. These models were not heliocentric, but still aimed to remove the epicycle and eccentric aspects of Ptolemy's model, which had been introduced to explain phenomena such as the retrograde motion of the interior planets.

By the 13th and 14th centuries, the groundwork for Copernicus' heliocentric model was being laid down, particularly by Mo'ayyeduddin al-Urdi, Nasir al-Din al-Tusi and Ibn al-Shatir. Their models were still not heliocentric, but did contain mathematical techniques identical to those that Copernicus used in his model, such as the eponymous Tusi Couple and Urdi Lemma. By this time, al-Sijzi's idea of a rotating Earth was becoming popular among scholars since experimental evidence was mounting that the Earth was, in fact, rotating.

Plenty of work was being done in fields other than the model of the solar system. One of al-Sijzi's proponents and colleagues was Abu Rayhan al-Biruni, who performed the most precise experiment, at this point in time, to determine the radius of the Earth. This was done by measuring the dip angle from the top of a tall mountain, of known height, to a point on a flat plain below, producing a value of 6,339.6km which differs from the currently accepted value by only 17.2km. It was also the Islamic scholar Avempace who was the first to suggest that the Milky Way is made of many stars. Abd al-Rahman al-Sufi was the first documented observer of the Andromeda Galaxy, which he described as a 'nebulous smear' – it was almost a millennium later when it would first be identified as a galaxy rather than a nebula.

It was Aristarchus of Samos that first suggested a heliocentric model of the solar system, and it was Copernicus that created the first consistent model of a heliocentric solar system, but it was a whole host of Islamic astronomers that did the many experiments and constructed the mathematical models that were needed to build that model. Copernicus' model was the product of hundreds of people and their work, most of whom are unfairly overlooked in the western canon of science purely due to where the work was done. Some of them were credited in Copernicus' work, but many were not. Now, with a fuller modern study of the history of science, these great scientists can get the credit that they deserve.

Elliot Scott

Despite poor weather and tripod issues, once again James has taken some fantastic photographs.

Above: Surfboard Galaxy M108

Left: Owl Nebula M97

Above: Whirlpool Galaxy M51

Right: The Eastern Veil Nebula, NGC6992 and NGC6995

Overleaf: This smorgasbord of galaxies is one of the denser regions of the Virgo Cluster.
The Virgo Cluster is a cluster of galaxies largely in the constellation of Virgo, although some are in neighbouring Coma Berenices. This cluster is the core of the much larger Virgo Supercluster, the structure combining several galaxy clusters, including the Local Group.

This view contains M86 (the lower of the two brightest galaxies) and M84 (the upper), as well as countless smaller galaxies. Of particular note is the Eyes Galaxies (NGC 4435 and NGC 4438), the two at the bottom of the frame, as they are believed to be interacting with each other, leading to the disruption of NGC 4438 and the creation of its "tidal tail".

James Rawson, Observation Secretary 2019-20

The Transit of Mercury

November 11, 2019

It was a cloudy day and not many people were at the Institute of Astronomy but enough people where there to prove it was a popular event. The cloud covered most of the sky but there were quite a few clear patches but with the fast moving clouds it made viewing the transit difficult. There had been solid cloud cover just minutes before the transit was due to begin.

There were some telescopes out on the lawn of the IoA that I had never seen before. The old university favourites of the Northumberland, the Thorrowgood, and the 16 inch were also open and available for public use. The transit was seen through all the telescopes differently. If the Sun was a clock face and Mercury was the hour hand, through one telescope Mercury was at the 2 o'clock position while through another it was around 4 o'clock.

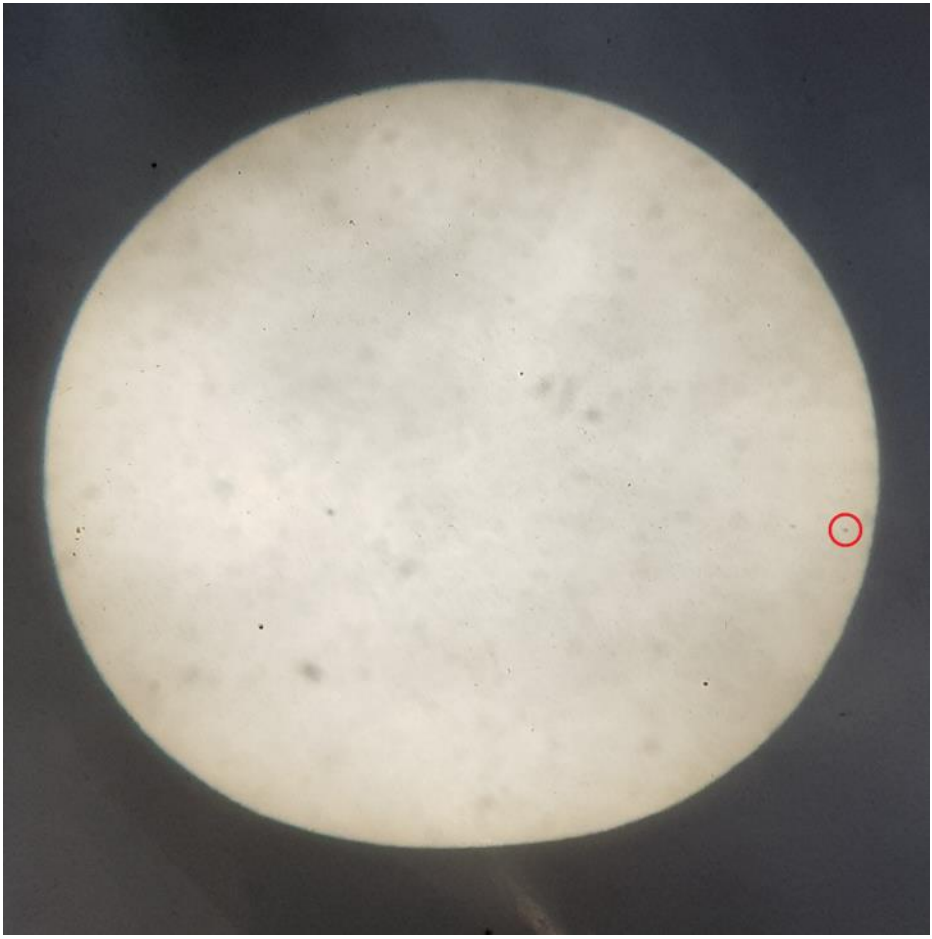
The transit began at 12:35 p.m. and was visible in Cambridge until around 3:00 when the setting sun dipped behind the trees, making observing difficult.

To all the people who took their telescopes and manned them and let everyone look through them, thank you. I enjoyed my second transit of Mercury.

Sebastian Thornton (age 10)

Observing the Transit of Mercury through the IoA's 16 inch telescope

Observing the Transit of Mercury through a lawn telescope at the IoA



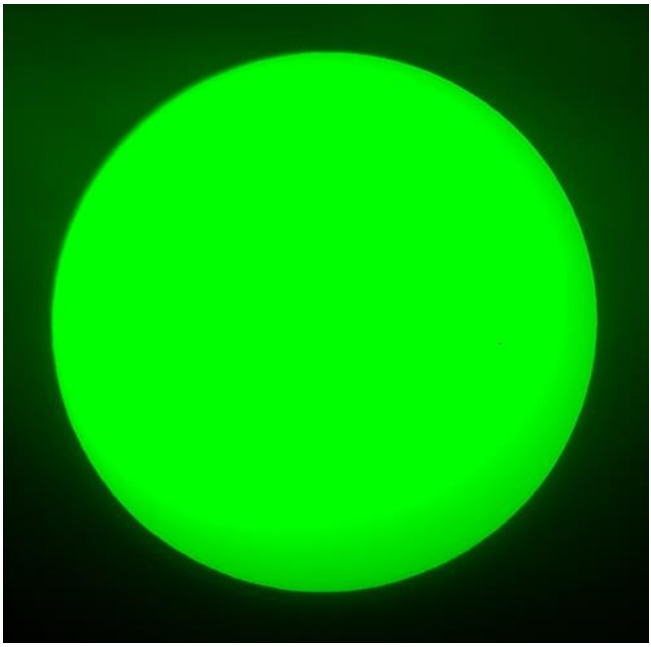
A projection of the Sun through the Thorrowgood. Mercury is the dot inside the red circle, everything else is dirt on the paper or in the eyepiece!

On 11 November 2019, there was a transit of Mercury across the Sun. CUAS, along with the IoA and the Cambridge Astronomical Association, held a special daytime observing session at the IoA. Several telescopes were set up, giving an excellent demonstration of the various ways of safely observing the Sun: the solar projection unit on the Thorrowgood scope was put to good use for once! We were very lucky to get some decent views of the transit, given that November in Britain is not known for its sunshine. In fact, the sky was cloudy until shortly before

the transit began at 12:35pm, and clouds periodically passed over through the afternoon, blocking our view from time to time. The Sun eventually set behind buildings and trees at 3:15pm, with Mercury around halfway through its transit.

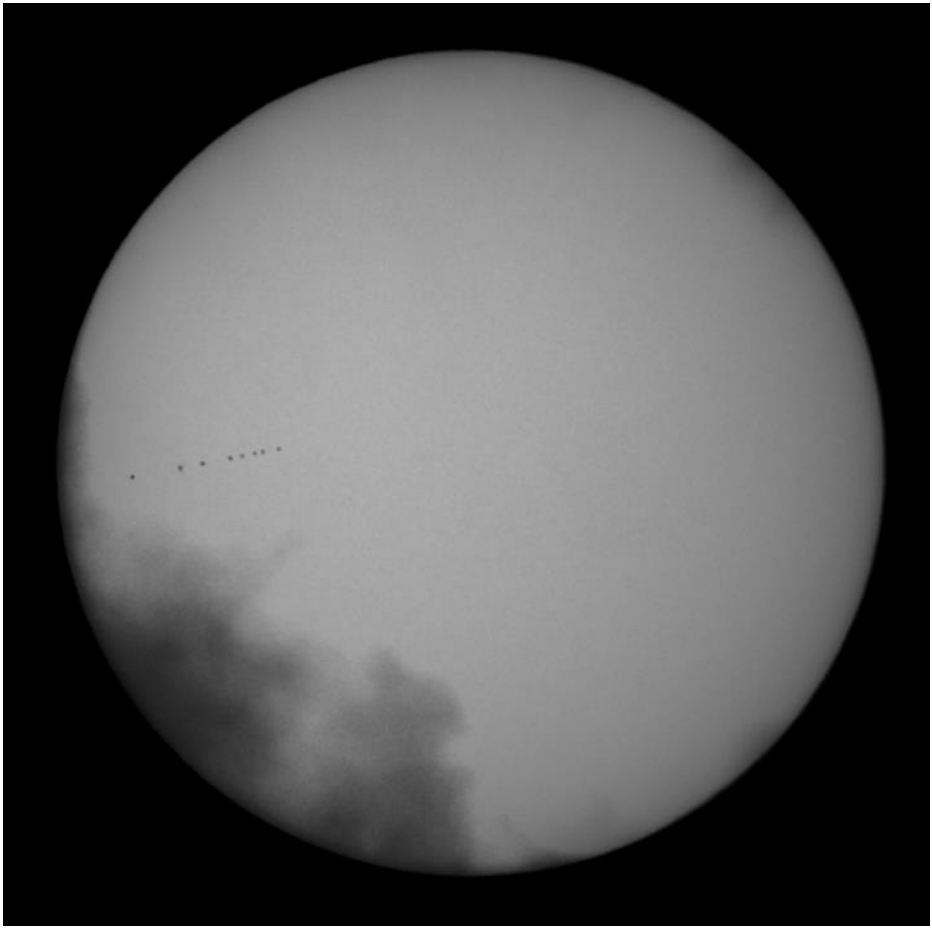
This was the first transit of Mercury since May 2016. I also saw that transit from the IoA – incredibly, both of the transits during my time at Cambridge have had good weather! One difference between the two transits is that in 2016 a couple of sunspots could be seen, whereas the 2019 transit took place very close to solar minimum and the face of the Sun was featureless, although there was a small prominence visible at the edge. There is a longer wait until the next transit of Mercury, which is in 2032 and will also be partially visible from Britain. Transits of Venus are much rarer. The last two were in 2004 (which I was fortunate enough to see at primary school) and 2012, but the next will not be until 2117 so mark your calendars!

Harry Metrebian ObsSec 2017-20



Left: The Sun taken through a telescope with a Herschel wedge. Mercury is visible on the right.

Right: Telescopes observing the transit on the IoA lawn.



Above: A composite photo taken in Cambridge by James Luis of the transit. 'The sky was quite cloudy but thankfully a few clear moments permitted me to put together this time lapse. I used a Skywatcher Startravel 80 with a Canon EOS 1100D SLR. To protect the camera, I closed down the aperture of the telescope and used a Hoya R72 infrared filter.'

Poetry and Astrophysics

At a seminar last term, the speaker was trying to explain the concept of viscosity, she quoted this poem by Lewis Richardson:

Big whorls have little whorls
That feed on their velocity,
And little whorls have lesser whorls
And so on to viscosity.

This was one of the best explanations I'd heard of viscosity and it stuck with me several days later. I was struck by the power of such a short poem to so memorably convey a confusing concept. This was in fact a parody of another poem by mathematician, Augustus de Morgan:

Great fleas have little fleas upon their backs to bite 'em,
And little fleas have lesser fleas, and so ad infinitum.
And the great fleas themselves, in turn, have greater fleas to go on;
While these again have greater still, and greater still, and so on.

De Morgan used this poem in his book 'A Budget of Paradoxes' to explore the apparent paradox of matter being made up of smaller and smaller particles. Lying awake at night, stressing about how I was ever going to find enough material for Neptune, I used these poems as inspiration to write some CUAS-themed verse of my own. I am definitely not a poet, so I opted for the safe structure of a limerick.

If you are someone
Who loves the setting of the Sun
Because of all the stars you see
Then CUAS is the place to be
Join us and have some fun!

However, one limerick is not nearly enough to fill Neptune! So I hope my poor attempts overleaf will be at least amusing and maybe provide some insight into this year's committee.

Hannah Sanderson, Chair 2018-19

Ollie

Ollie was this year's Chair
He's looked after CUAS with care
He was forced to run
By his college Mum
Which really was very unfair

Zak

There once was a Treasurer called Zak
Who carried the money around on his back
He counted the cash
And ordered the stash
And ensured there's nothing we lack

Harry

Harry was an ObsSec
Who every detail would check
He'd plan an ObsNight
For every clear night
Which the clouds would turn up and wreck

James

There once was an astronomer named James
Good photos were one of his aims
He'd stay up all night
With a tripod and flashlight
Stacking up thousands of frames

Amber

Amber has told us this year
Who and what we will hear
For every event
In Michaelmas and Lent
Her posters have brought people near

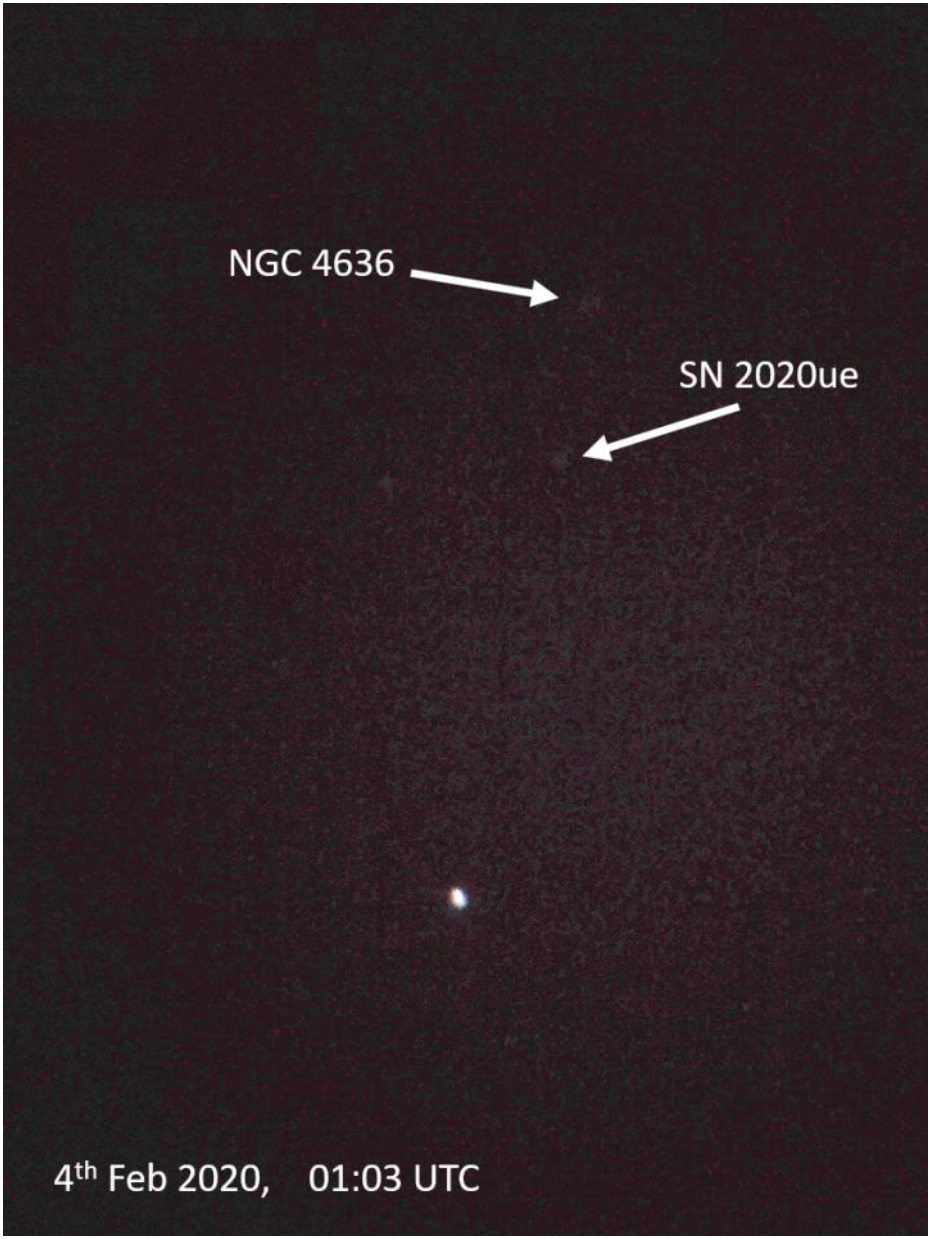
Hannah

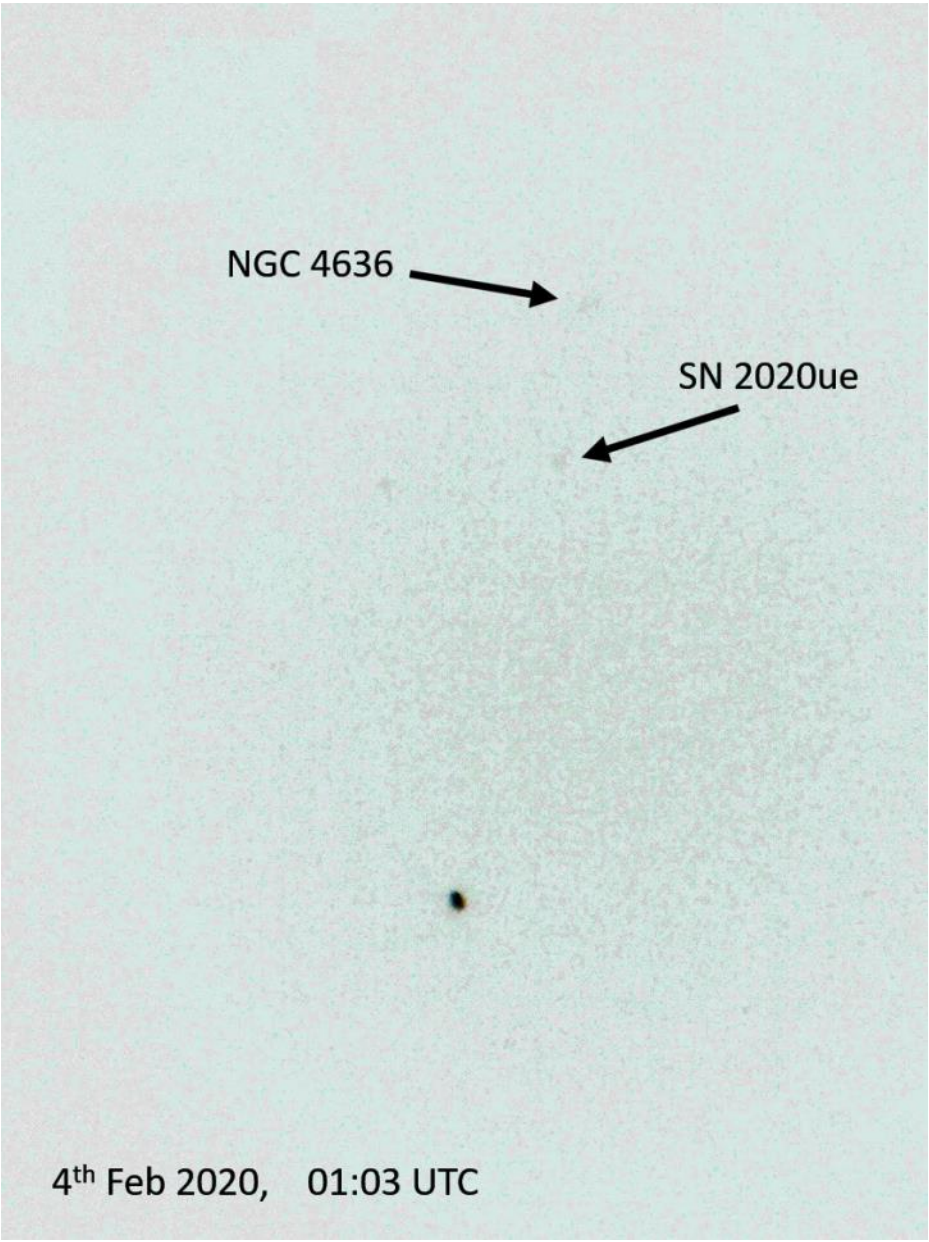
Hannah decided to write the magazine
As an excuse to stay on the scene
Since she likes to snack
On the doughnuts at the back
During the questions when she can't be seen.

Matthew and Tommy

Matthew and Tommy were gritty
They ran for more than one committee
It was pretty rough
Time was never enough
So they had to rush all over the city

OBSERVING A SUPERNOVA




NGC 4636
SN 2020ue
4th Feb 2020, 01:03 UTC

The faint smudge in the photos on the previous two pages marked SN 2020ue is a supernova that took place in the elliptical galaxy NGC 4636, around 16 Mpc (53 million light-years) away from Earth. It's a Type Ia supernova, which occurs when a white dwarf in a binary star system gains enough mass from its companion or merges with it, triggering an explosion.

I took this photo with my phone camera through the 16" telescope at the Institute of Astronomy. Even from the light-polluted suburbs of Cambridge, it's possible to watch the death of a star about the size of Earth in a distant galaxy.

Adam Dillamore

Astronomy Jokes

After the popularity of his article last year, the youngest member of our society, Sebastian Thornton (10) has given us his latest selection of jokes.

A Higgs boson goes into a church.
Priest: We don't allow Higgs bosons here.
Higgs boson: But without me there is no mass.

A photon walks into a bar and orders a drink.
Bartender: Do you want a double?
Photon: No, I'm traveling light.

I was up all night wondering where the sun had gone … then it dawned on me.

After his first meal on the moon, the 22nd century astronaut said the food was good, but the place lacked atmosphere.

Two atoms bump into each other. One says “I’ve lost an electron.” “Are you sure?” “Yes, I’m positive.”

Orion’s Belt is a big waist of space!

Black holes are most commonly found in black socks.

I’m reading a book about anti-gravity… it’s impossible to put down!

Q: Why didn’t the Dog Star laugh at the joke?
A: It was too Sirius.

Q: How does the man in the moon cut his hair?
A: Eclipse it.

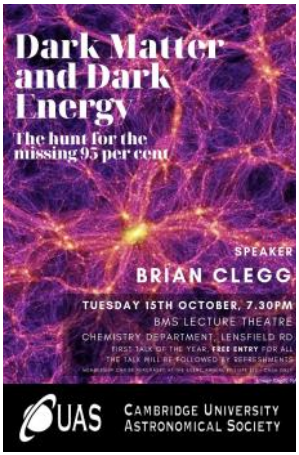
Q: How do you get a baby astronaut to sleep?
A: You rocket!

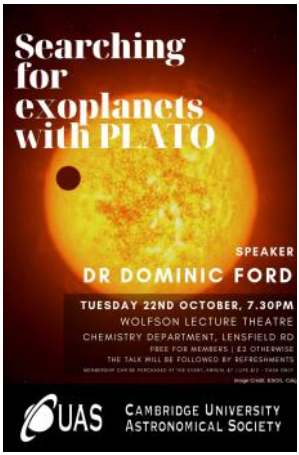
Q: What do you call an alien with three eyes?
A: An aliiien!

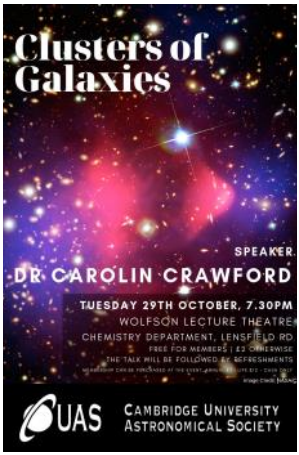
Q: How does Jupiter hold up his trousers?
A: With an asteroid belt.

Q: What type of songs do the planets sing?
A: Nep-tunes!

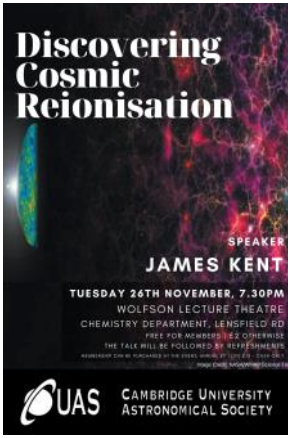
Q: What did Mars say to Saturn?
A: Give me a ring sometime!

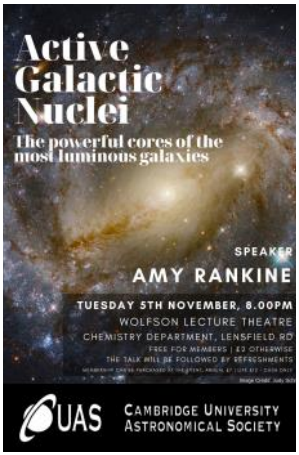


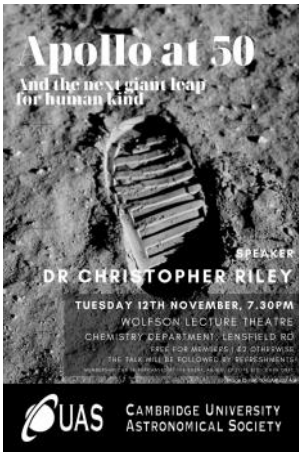


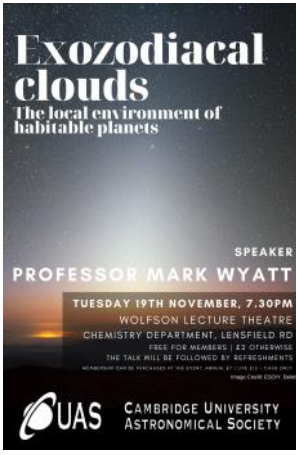


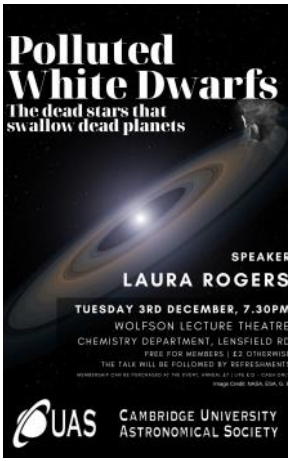
Posters for the 2019–20 talks produced by Amber Parsons

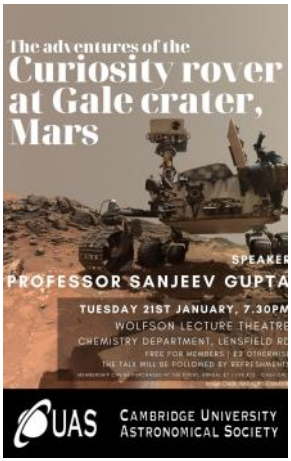


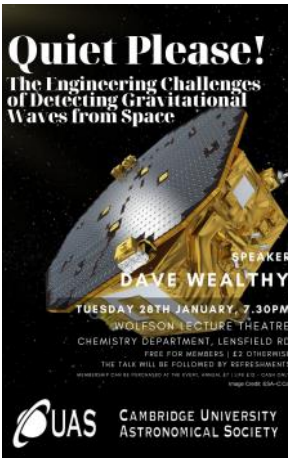


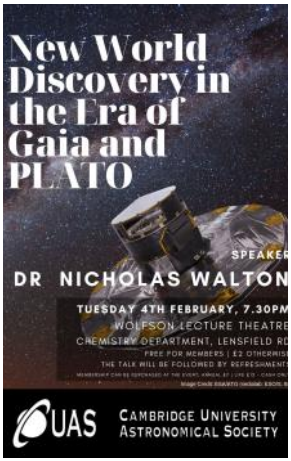





Polluted White Dwarfs
The dead stars that swallow dead planets
SPEAKER
LAURA ROGERS
TUESDAY 3RD DECEMBER, 7.30PM
WOLFSON LECTURE THEATRE
CHAMBERS DEPARTMENT, LENSFIELD RD
FREE FOR MEMBERS | £2 OTHERWISE
THE TALK WILL BE FOLLOWED BY REFRESHMENTS
UAS
CAMBRIDGE UNIVERSITY ASTRONOMICAL SOCIETY


The adventures of the
Curiosity rover at Gale crater, Mars
SPEAKER
PROFESSOR SANJEEV GUPTA
TUESDAY 21ST JANUARY, 7.30PM
WOLFSON LECTURE THEATRE
CHEMISTRY DEPARTMENT, LENSFIELD RD
FREE FOR MEMBERS | £2 OTHERWISE
THE TALK WILL BE FOLLOWED BY REFRESHMENTS
UAS
CAMBRIDGE UNIVERSITY ASTRONOMICAL SOCIETY


Quiet Please!
The Engineering Challenges of Detecting Gravitational Waves from Space
SPEAKER
DAVE WEALTHY
TUESDAY 28TH JANUARY, 7.30PM
WOLFSON LECTURE THEATRE
CHEMISTRY DEPARTMENT, LENSFIELD RD
FREE FOR MEMBERS | £2 OTHERWISE
THE TALK WILL BE FOLLOWED BY REFRESHMENTS
UAS
CAMBRIDGE UNIVERSITY ASTRONOMICAL SOCIETY


New World Discovery in the Era of Gaia and PLATO
SPEAKER
DR NICHOLAS WALTON
TUESDAY 4TH FEBRUARY, 7.30PM
WOLFSON LECTURE THEATRE
CHEMISTRY DEPARTMENT, LENSFIELD RD
FREE FOR MEMBERS | £2 OTHERWISE
THE TALK WILL BE FOLLOWED BY REFRESHMENTS
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The Moon's craters
A record of Earth's violent past
SPEAKER
PROFESSOR GARETH COLLINS
TUESDAY 11TH FEBRUARY, 7.30PM
WOLFSON LECTURE THEATRE
CHEMISTRY DEPARTMENT, LENSFIELD RD
FREE FOR MEMBERS | £2 OTHERWISE
THE TALK WILL BE FOLLOWED BY REFRESHMENTS
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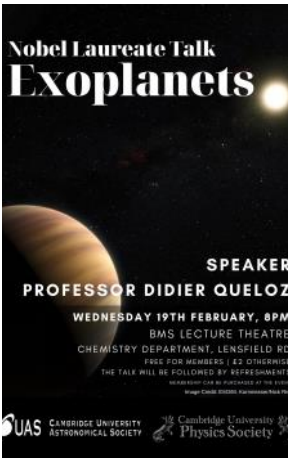
Nobel Laureate Talk
Exoplanets
SPEAKER
PROFESSOR DIDIER QUELOZ
WEDNESDAY 19TH FEBRUARY, 8PM
BMS LECTURE THEATRE
CHEMISTRY DEPARTMENT, LENSFIELD RD
FREE FOR MEMBERS | £2 OTHERWISE
THE TALK WILL BE FOLLOWED BY REFRESHMENTS
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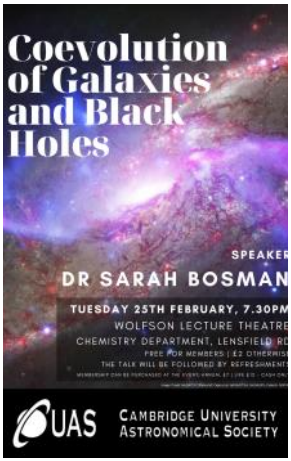
Cambridge University Physics Society


Coevolution of Galaxies and Black Holes
SPEAKER
DR SARAH BOSMAN
TUESDAY 25TH FEBRUARY, 7.30PM
WOLFSON LECTURE THEATRE
CHEMISTRY DEPARTMENT, LENSFIELD RD
FREE FOR MEMBERS | £2 OTHERWISE
THE TALK WILL BE FOLLOWED BY REFRESHMENTS
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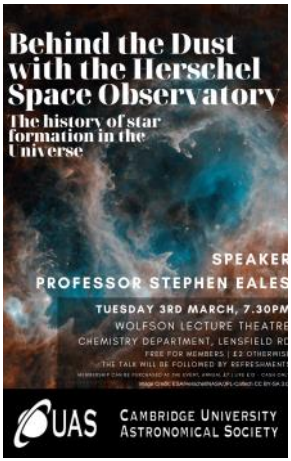
Behind the Dust with the Herschel Space Observatory
The history of star formation in the Universe
SPEAKER
PROFESSOR STEPHEN EALES
TUESDAY 3RD MARCH, 7.30PM
WOLFSON LECTURE THEATRE
CHEMISTRY DEPARTMENT, LENSFIELD RD
FREE FOR MEMBERS | £2 OTHERWISE
THE TALK WILL BE FOLLOWED BY REFRESHMENTS
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Sounds of Space
9 kHz
8 kHz
7 kHz
6 kHz
5 kHz
4 kHz
3 kHz
2 kHz
SPEAKER
DR NIGEL MEREDITH
TUESDAY 10TH MARCH, 7.30PM
WOLFSON LECTURE THEATRE
CHEMISTRY DEPARTMENT, LENSFIELD RD
FREE FOR MEMBERS | £2 OTHERWISE
THE TALK WILL BE FOLLOWED BY REFRESHMENTS
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