



*Astronomy, and the musical family  
that did so much to pioneer it.*

### Chairman's Report on 2024 to Herschel Society AGM on 15 March 2025

Our major event in 2024 was the John Herschel weekend of 7-9 June, with the Royal Society event in London on the Friday celebrating the digitisation of their John Herschel archive; the BRLSI Conference we organised on the Saturday based on the recently published Cambridge Companion; and the visit and discussion at the Herschel Museum on the Sunday. There is a full account of these events in our Autumn 2024 Journal. This weekend was a prime example of the convening power of our Society. The CUP Companion and RS digitisation projects were happening anyway. Our added value was to create mutually supporting events based on them which fed into a wealth of ideas for the future of the Museum. They also fed into thinking about our own future focus which we are discussing later.

As usual, we have enjoyed a steady stream of new connections, often via the Museum. We have had useful discussions with our colleagues at Armagh Planetarium and Observatory about possible collaboration on the upcoming 2031 anniversary. I have enjoyed interesting visits to the Harry Ransom Center in Austin Texas, and a private visit to Collingwood House. And I have tried but failed to get the Herschel Supply Company in Vancouver to take an interest in us.

The Caroline Herschel Prize Lectureship continues to help women astronomers early in their careers, illustrated this year by the winner getting a slot on BBC's Sky at Night programme on the strength of her win.

Our lecture programme managed by Tony Symes provided a varied and stimulating diet of talks – detail at Annex A. The Spring 2025 issue of our Journal, also put together by Tony, should also provide members with plenty of interest.

The steady stream of interest in William's music continues - detail at Annex B

I am very grateful for the help and advice of our Committee, which brings together a wealth of knowledge and experience on the Herschels and related matters. The relative paucity in numbers of those Committee members there primarily to undertake administrative tasks remains the only significant threat to our future. We need more of them for resilience and to share the load!

Charles Draper

Chairman



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## Annex A Lecture report for 2024

In 2024 our programme included 11 lectures, including 2 for the BRLSI Extraordinary Women theme, and additionally an all-day conference on John Herschel<sup>1</sup>. All these lectures were delivered to a remote audience via Zoom, and given by the lecturer either in-person at the BRLSI or remotely. Note that most lectures are recorded and freely available on the BRLSI YouTube channel one month after the event and are most easily accessed via the Events page of the HS website.

The yearly average attendance figures (excluding the CH Prize lecture and all-day events) are:

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Lectures	10	9	8	7	9	8	6	8	8	8	10
Attendance	40	41	56	57	51	50	43	44	57	64	85

### Decoding the biographies of binary black holes with gravitational waves

Date: Friday 5 January 2024

Lecturer: **Dr Isobel Romero-Shaw**

Attendance: 121

This was our best audience ever, thanks partly to the Mayor, the mother of the lecturer, attending in her official capacity wearing her chain of office, and to social media activity by Bath Astronomers.

The introduction took us over the life cycle of stars with their ultimate fate as neutron stars or black holes, then the history of ideas about gravity from Isaac Newton (1687), John Michell (1783) who postulated that light cannot escape from a sufficiently massive object, Einstein (1915-6) etc. In 1972 Cygnus X -1 became the first identified black hole and Hulse and Taylor discovered the first binary pulsar. In 2002 the LIGO gravitational wave detector started and in 2015 the first waves from a binary black hole were seen.

Now gravitational waves are detected by two LIGO detectors in the U.S., enhanced by Virgo in Italy and KAGRA in Japan which together provide the direction of the source. The number detected so far is 91, many from binary black holes. Black hole mergers could result from separate evolution of stars which then come together, or dynamically from binary systems where third bodies interact and remove energy, allowing their orbits to become more eccentric and closer. Waves become detectable only towards the end of the merger process and at this stage they happen to enter the audible frequency range which increases rapidly as the merge completes. In the future, gravitational wave detections are set to become both much more numerous and accurate. LISA will consist of 3 trailing GW detectors following the Earth in orbit.

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1 Described in the Journal of the Herschel Society 23.2, Autumn 2024



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## **Johannes Kepler 1571-1630: his life and work**

Date: Friday 2 February 2024

Lecturer: **Nick Pallett**

Attendance: 87

Johannes Kepler was born in 1571 into the medieval geo-centric world at Weil der Stadt, then part of the Holy Roman Empire. He had difficult parents and a sickly childhood but was impressed by the Great Comet of 1577 and a lunar eclipse.

In the *Mysterium Cosmographicum* he described his theory that the distance of the 6 planets was explained by nesting in the 5 platonic solids. In 1601 he moved to Prague where he had a difficult working relationship with Tycho Brahe until Tycho died in after 18 months and Kepler was appointed imperial mathematician.

Kepler continued Tycho's work to catalogue all known stars and planets in the Rudolphine Tables, and came up with the 3 laws of planetary motion, setting the ground for Newton's theory of gravity.

1. Planetary orbits are elliptical, not circular
2. The line from the planet to the Sun sweeps out equal areas in equal time
3.  $(\text{orbital period})^2 = (\text{mean distance})^3$

In 1610-30 he also produced a short novel, *Somnium*, about a trip to the Moon, the first sci-fi novel?

## **Extraordinary Women: From Algebra to the Secrets of the Universe: the Fascinating Life of Mary Somerville 1780 - 1872**

Date: Friday 1 March 2024

Lecturer: **Elisabetta Strickland, University of Rome**

Attendance: 63

Mary Somerville was brought up in Fifeshire, remarkably with virtually no education until the age of 9. After a year in a very difficult school her education improved and she asked for books on Astronomy, Algebra, then, aged 13, Euclid.

In 1804 she met her first husband Lieutenant Samuel Greig. They had two children but it was an unhappy marriage and he died in 1807. Her inheritance from this marriage gave her the freedom to pursue her studies, including the mathematics of Laplace. In 1812 she married Dr William Somerville who encouraged and aided her studies. She became friendly with William Herschel and later with his son John Herschel.

In 1831 she published her translation of *Mécanique Céleste* by Pierre-Simon Laplace, and included considerable notes of her own. She published her own work *On the Mechanism of the Heavens* and *On the Connexion of the Physical Sciences*.

From 1833 she and her husband followed a nomadic existence in Italy. She met and was recognised by many influential people and corresponded with Alexander von Humboldt and Charles Darwin.



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## **Extraordinary Women: Ada Lovelace 1815-1852 – the Making of a Computer Scientist**

Date: Monday 4 March 2024

Lecturer: **Ursula Martin**

Attendance: 127

Ada Lovelace was born to George Gordon Byron and Anne Isabella Millbank and christened Augusta Ada. Because her parents separated soon afterwards, and her mother was anxious to keep custody, her mother kept an extensive archive of every part of her upbringing.

Ada was tutored by Mary Somerville who introduced her at age 18 to Charles Babbage, starting a lifelong friendship. In 1835 she married William Lord King who became the Earl of Lovelace, making Ada the Countess of Lovelace.

In 1841 Augustus de Morgan taught Ada Lovelace advanced Maths through a correspondence course. In 1840 Babbage gave a seminar at the University of Turin about his Analytical Engine. Luigi Menabrea, a young Italian engineer and future Prime Minister of Italy, transcribed the lecture into French and published it in 1842. Charles Wheatstone commissioned Ada Lovelace to translate the paper into English. She not only translated it, but added copious notes which showed the depth of her understanding. In particular Note G describes a procedure for calculating Bernoulli numbers which some regard as the World's first computer programme. Ursula Martin disagreed with this characterisation, saying that a computer programme is rather different from the procedure described.

## **Introduction to John Herschel 1792 - 1871**

Date: Friday 5 April 2024

Lecturer: **Dr Emily Winterburn**

Attendance: 56

Much of the source material about John Herschel is held at the Royal Observatory, Greenwich and at the Adler Planetarium, Chicago. John Herschel had a stimulating childhood with astronomy, chemistry, carpentry etc active around him. His father's friend, William Watson, was his godfather and lifelong mentor. His schooling was chosen to enhance his scientific education and supplemented by tutors who taught him German and continental Mathematics using the Leibniz notation in Calculus instead of the Newtonian. He studied at St John's College, Cambridge.

In 1812 he formed the Analytical Society with Charles Babbage and George Peacock to encourage continental Maths and the Leibniz notation. He spent the next years studying, travelling, networking and publishing papers including on Maths and Chemistry. In 1820 he co-founded the RAS.

In 1829 he married Margaret Brodie Stewart; they were to have 12 children – 3 sons and 9 daughters. In 1833 the term Scientist was coined by his friend William Whewell. From 1834 to 1838 he was mapping the Southern skies at the Cape of Good Hope with his family. From 1850 to 1855 he was Master of the Mint, a position which caused him considerable stress. John Herschel was influential in getting Science recognised and taught.



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## **The Caroline Herschel Prize Lecture: How can A.I. help us find exploding stars and hungry black holes?**

Date: Wednesday 20 November 2024

Lecturer: **Dr Heloise Stevance**

Dr Heloise Stevance of the University of Oxford was the winner of this year's Caroline Herschel Prize and gave her lecture at the University of Bath. She started by explaining NASA's ATLAS (Asteroid Terrestrial-impact Last Alert System) which currently uses four 0.5 meter robotic telescopes to cover the whole night sky 4 times per night. This is designed to detect near-Earth objects which might impact Earth in the near future, but is well placed to detect transient events at any distance.

Transient events which may last only hours or days include high mass supernovas, kilonovas which result from neutron star mergers (and make heavy elements including gold and rare earths), and black hole tidal disruption events which enable black holes to be "seen".

Heloise Stevance explained that what we call A.I. is better described as Machine Learning and is essentially a combination of statistics and computer vision. She recalled its development from Convolutional Neural Networks in the 1990s which could recognise handwritten digits through to Facebook's A.I. Lab in 2013.

Sky surveys like ATLAS produce 10,000 differences which need to be filtered by a convolutional network to 100. Virtual Research Assistant can reduce this to 10s of alerts for human inspection.

## **From the discovery of Uranus to the astronomical observatories of Ireland: An Astronomical Adventure Story**

Date: Thursday 21 November 2024

Lecturer: **Professor Michael Burton**

Attendance: 28

The discovery of Uranus on 13th March 1781 led to Archbishop Richard Robinson founding the Armagh Observatory and Museum in 1790 initially with a 10 ft Herschel telescope (later sold). In 1795 the Observatory was equipped with a Troughton equatorial telescope, now the oldest telescope anywhere in its original dome. In all 6 generations of telescopes have been installed at Armagh, and most are still in place.

Dunsink Observatory near Dublin was founded in 1785 and William Parsons, the 3rd Earl of Rosse, started observing at Birr Castle in 1845 with a 3 ft telescope (note that this refers to the diameter of the primary mirror, not the focal length as with Herschel telescopes). He then went on to build the 'Leviathan' a 6 ft (diam) telescope based on the Herschel 40 ft telescope. The 6ft telescope remained the largest telescope in the World for over 70 years. With this telescope, William Parsons drew the Whirlpool Galaxy (M51) showing its spiral nature and its small companion, and starting a debate about the nature of galaxies.

J L E Dryer at Armagh used the Herschel data to survey the sky more accurately with the Grubb 10 inch refractor (1885) to produce the NGC.

Michael Burton finished by describing a combined application for UNESCO World Heritage status for the three observatories in Ireland. This is now 3 years into what is a 10 year journey. He gave examples of other bids and the criteria on which this bid would be based.



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## **Crystallising white dwarfs, spinning minor planets, and our Galaxy's dark matter halo: some new results from Gaia**

Date: Friday 6 December 2024

Lecturer: **Professor Michael Perryman**

Attendance: 48

Michael Perryman started with a brief history of astrometry starting with Hipparchus of Nicaea who was observing around 150 BC. In 1718, Edmond Halley observed that Aldebaran, Sirius and Arcturus had moved compared to the observations of Hipparchus, but it wasn't until 1838-9 that the parallax of stars was first measured. Accuracy of measurement of stellar positions increased slowly up to 1600 with Tycho Brahe, but then the introduction of telescopes created more rapid improvements. A further step change was achieved with ESA's Hipparcos space observatory which measured the position of 120,000 stars to 1 milliarcsec. Gaia, launched in 2005, took this to 2 billion stars measured to 10 micro arcsecs.

Michael Perryman then described three areas (among many) of results from Gaia.

In our solar system, animation of asteroids and their orbits can identify various groups. The effect of solar radiation pushing an asteroid's orbit either inwards or outwards by the Yarkovsky Effect can be studied, and occultations of one orbital body (or distant star) by another can be predicted.

The distances and motions of 2 billion stars can be coupled with their spectral position on the Hertzsprung-Russell diagram. 97% of stars are less than 8 solar masses and will end their lives as white dwarfs. Our Sun will enter its red giant phase in about 5 billion years, then in another 5 billion years it will shrink to be a white dwarf with a radius similar to that of the Earth. In another 5 billion years it will start crystallising from the centre at a rate of 1-2 cms per year.

Finally he discussed stellar streams left by captured galaxies in and around our galaxy. Many of these streams are in our supposed dark matter halo. More than 100 such streams of stars have been discovered by Gaia, and this supports CDM (Cold Dark Matter) theory.





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## **Annex B     Report for Herschel Society AGM from Matthew Spring**

**1. Dionysus Ensemble.** The Slough-based *Dionysus Ensemble* have continued to champion Herschel's music both in new recordings, schools composition project and in their own concerts. They gave a concert at St Mary's Church, Slough, 25 October of Herschel's music together with new music created by students at Slough and Eton College and St Mary's Primary School inspired by the Herschels. This project was funded by the Heritage Fund. They released a new recording of Herschel's violin concert in C in mid-November to go with their existing Herschel recordings. They have plans to release further recordings and are willing to allow their editions to be put on the Society's website.

**2. Talks.** On 5 June 2024 I gave talk to packed audience at the ARC centre in Old Harlow tracing the Herschel's life in Bath with reference to their musical activities and developing interest in astronomy. This was a two hour talk with a break and questions. The talk prepared for the Oxford Florence Park Talks has been rescheduled for 2025.

**3. Advice and Music Copies to Ensembles wanting to perform Herschel.** I have supplied music or advised several groups wanting to perform Herschel's music where there no published versions available, among them: City Sounds Voices Choir Bath; Matt Finch; Robert Hyman previously of the Bath Pump Room Band. Hyman has communicated plans to perform in the Herschel Museum in future events.

**5. Catalogue.** I completed all the incipits and accompanying data for the complete Berkerley Collection of Herschel manuscripts that constitute most of William Herschel's chamber music. This has been passed to Matt Dicken at Bath Spa for inputting into the data base.