**IRISH ASTRONOMICAL ASSOCIATION 48th AGM**

**13th April 2022**

**SECRETARY’S REPORT:**

Dear IAA Member,

I hope you are keeping well and we are at the end of this pandemic. The lecture summary is below. Despite restrictions and lockdowns, our lectures continued via zoom and YouTube. The support and interest of our members have been magnificent. A big thanks to Danny and Andy, the President and Vice presidents for chairing the lectures and meetings. Paul has done great work both as webmaster, presenting his sky videos, talks, presentations and other essential admin work. Mary, our membership secretary has also done great work in organizing our member’s databases and actively communicating with members. Credit to Terry for arranging the lecture programme, for his newsletter emails, and continued outreach work. Praise to Vice President Andy for producing the excellent ‘Stardust’ Magazine and to everyone who has contributed, which is quarterly posted to over 200 of our members. Also a big thank you to Tony who helps with Stardust’s articles and distribution and Eve who contributes to the magazine. Applause to Pat for continuing his Treasurer position and who has worked so hard in looking after our finances. A big thank you to David Stewart our Observing Section Coordinator, Andy, Paul and John with others for succeeding in arranging successful and quality observing sessions even in these difficult times. Finally, thank you to all our members, old and new, for your support which makes the association what it is today. Hopefully, circumstances will improve in the near future and allow us to continue our live lectures, observing sessions, and year-round outreach events without restrictions or lockdowns.

Clear skies & best wishes.

Gerry Davidson

13th April 2022.

**IAA Lecture Programme Summary 2021-22:**

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| 1. **‘The Gravitational-Wave Optical 15/09/2021**   **Transient Observer and Cataclysmic Variables**’,  [:](https://irishastro.org/2019/08/27/iaa-public-lecture-25th-september-dr-mike-simms-um-1969-a-special-year-for-space-rocks-and-not-just-from-the-moon/) Christopher Duffy, Armagh Observatory and Planetarium.  In the first of the IAA public lecture series, Chris begins his interesting and engaging lecture by introducing this new frontier in multi-messenger astronomy which combines  Gravitational Wave and optical astronomy.  He begins by defining Gravitational Waves as stretching space-time. Interacting supermassive objects such as neutron star or black hole mergers create detectable gravitational waves. He outlined how these ultra-sensitive laser interferometer detectors such as LIGO can measure differences at around one-thousandth the diameter of an atomic nucleus. On the 14th of September 2015, a black hole merger event was detected with more events detected each year. To verify and reliably identify and localise events international collaboration is needed.    *Total Attendance and views:145* | 1. **‘Astronomy, Ireland and UNESCO 29/09/2021**   **World Heritage’,**  Professor Michael Burton, Director of Armagh Observatory and Planetarium  In his fascinating and engaging lecture, Professor Michael Burton outlined his reasons for applying to UNESCO for historic observatories across Ireland. He reviewed three 19th century sites, Armagh 1790, Dunsink 1785 and Birr 1787 detailing the scientific, historical and cultural importance of each. Birr was the world’s largest telescope. Other significant events were associated with the sites including observing the transit of Venus at Armagh in 1792 with its importance to navigation, observing the Whirlpool nebula in 1833 and the crab nebula at Birr. Including all three sites in the application would allow a transnational nomination. He outlined the strict criteria and lengthy procedure for application. This seemed a demanding task but a very worthwhile and noble cause, to identify and try to preserve such valuable and important sites.  *Total Attendance:71* |
| **03.’Habitability beyond our solar system’: 13/10/21**  Professor Chris Watson, *QUB*  Professor Watson’s fascinating and engaging lecture focused on exoplanets and what we mean by habitability or finding platforms for conceivably finding life outside our solar system. How do we define habitability and what does this look like when searching? We are getting to a period where we can find Earth-like exoplanets. He went on to calculate the classical habitable zone. Estimating a planet’s temperature depends on the star’s luminosity, and the planet’s albedo and orbital separation. In reality, comparisons are very different from estimates. This may be caused by atmospheric dynamics such as the Greenhouse effect and other factors such as internal heat sources. The galactic habitable zone was looked at which contains heavier elements and metals to enable core accretion and habitable planet formation. Too much or too little presence of metallic elements can also influence the formation of stable systems and habitable planets. Supernovae are also detrimental to life development. Other factors such as asteroid impacts and mass extinctions have to be considered. The rare Earth argument was mentioned highlighting Earth’s unique factors that increase a stable environment for life. Tidal locking and M dwarf type stars and high X-ray luminosities impact life development.  *Total Attendance and views: 133* | **04.’Gravitational waves and the hunt for 27/10/21**  **merging neutron star’:**  Dr Morgan Fraser, UCD  Dr Morgan Frazer’s exciting lecture covered three areas of gravitational waves. How do we find them; what examples of GWs we have seen; and what is the next phase of development in detecting GWs. They were theorised about 100 years ago owing to Einstein’s general theory of relativity. These waves stretch space-time. Measurements to detect them involve changes around 1000th the size of a proton. He described that GWs are created by objects with massive masses interacting such as neutron stars or black hole mergers. The first GW was detected on 14 September 2015. Since then there have been numerous events detected. Both LIGO and spectrum analysis is being upgraded and networked to collaborate and verify events. Wide field surveys using PANSTARRS, ATLAS AND GOTO are to be used to identify and confirm these cosmic events.  *Total Attendance and views: 85* |
| **05.’Earth’s Constant Companion’: 10/11/21**  Dr Donnacha O’Driscoll, UCD  Dr O’Driscoll began this impressive and captivating lecture by comparing the size of the moon in relation to the island of Ireland and its relative size to other planets and moons of our solar system. A very clear illustration of the lunar distance was shown by requiring over 5 months to drive there in a car averaging 60MPH. He showed that although it is on our doorstep in space it is still a very long distance in practical terms. He went on to describe its average distance, sidereal and synodic months and the concept of its common orbit point or barycentre. He further explained its elliptical orbit with apogee and perigee distances relating these to super moons and mini-moons. The cause of solar and lunar eclipses was described and their relative rarity was explained by the moon’s 5-degree inclined orbit. Then theories of the formation of the moon including the collision between Thea and the proto-earth supported by geological evidence from Apollo moon rocks.  Guides to observing the moon unaided to identify large features, take images and try to see the earthshine or ashen light.  He gave a brief guide on choosing proper telescopes and the misinformation as well as examples of equipment he uses and recommends.  The lecture finished by showing several images taken of features such as crater chains, rills and fault lines.  *Total Attendance and views:138* | **06. ‘The Active Sun – Observations of our 24/11/21**  **Closest Star’:**  ***Dr Laura Hayes,*** *(TCD)*  Dr Laura Hayes began this fascinating lecture by briefly describing the sun’s photosphere and chromosphere, very dynamic and diverse systems. She described sunspot activity’s 11-year cycle, solar flares and CME’s highlighting the importance of these to us. Our modern communications, transport and power rely so much on electrical technology. The sun’s activity causing geomagnetic storms may impair or damage these. Observations have shown other sun-like stars to be more unstable with some extreme flares and geomagnetic storms. She referred to the Carrington Event of 1859 to illustrate this. She then outlined how we may predict such storms and possible actions to minimise the enormous damage that they may cause. These may include some form of shielding or temporarily shutting down satellites and electrical grids and disconnecting transformers. Solar observations include the 1 LOFAR radio telescope array at Birr, the Swedish solar telescope and the ESA’s solar orbiter as well as many satellites in orbit specifically designed to study our sun. She finished by saying there are many important answers to find such as CME trigger mechanisms, transport and continuous energy release.    *Total Attendance and views:330* |
| **07. ‘Asteroids: the key to unlocking the 08/12/21**  **Solar System’**  *Dr Jamie Robinson, University of Edinburgh*  In this fascinating and engaging lecture, Dr Jamie Robinson starts by giving an overview of the solar system’s asteroids. They are composed mainly of gas and dust with a Keplerian orbit which may show eccentricity and inclination. He indicates the 2 main regions as the asteroid belt at 2 to 3 AU’s with predominantly rocky asteroids and the Kuiper belt at about 30 AU’s with icy asteroids. Using photometry, they can be identified by comparing images over time and spotting non-static objects. Their size, shape, surface texture, composition and orbits are studied. Phase angles effects are used to observe from the earth and derive information such as the shape. There are families of asteroids with similar origins or compositions such as V type and K types. Today high-quality electronic detectors and high-performance computers, are used in wide-field surveys to scan for transient sources such as asteroids and supernovas. ATLAS, telescopes are due to expand to South Africa and Chile. In 2023 the LSST, 8M telescope is due to scan for near-earth objects and many other new objects in unprecedented detail. Asteroid impacts are a fact but massive, extinction causing impacts are rare. He finished by outlining planetary defence strategies, including test exercises and options to avert impacts or minimise the damage. Caused,  *Total Attendance and views: 116* | **08. ‘Comets and their tales’ 05/01/22**  *Prof Antonio Carillo, UCD*  In the year’s first lecture, Prof Antonio Carillo began his fascinating and engaging lecture by briefly describing comets as icy planetesimals or dirty snowballs. They begin to sublime at distances from about 30AU’s to as little as 3AU’s where they can be easier to see. They have an ion tail and a dust tail where the ion tail may be up to 150 million Km Long The actual nucleus may only be about 10Km in diameter. Long-period comets have orbits of thousands or millions of years with hyperbolic trajectories, have high inclinations and are thought to originate in the Oort cloud. Short-period comets have a low orbital inclination with periods of hundreds of years and are thought to originate in the Kuiper belt. The role of Jupiter was mentioned as an attractor of planets and also a shield. The Rosetta mission to 67P was briefly described and the significance of deuterium to hydrogen ratio analysis. He explained why we should study comets including a possible source of water on earth and even seeding of planetesimals on early solar systems. They provide a larger gravitational body possibly speeding up planet formation. Finally, the professor speculated on possible astronomical phenomena to explain the Star of Bethlehem.    *Total Attendance and views:145* |
| **09. ‘The Webb: Well Worth Waiting for’ 22/01/22**  *Prof Tom Ray, DIAS*  Professor Ray gave a fascinating and captivating lecture about the James Webb Telescope and its 10-year mission. He began by giving an overview of its complex component parts and stages of deployment, unfolding like origami. Ge outlined the main parts including the design of the 18 mirror array and sun shield. This complex engineering feat was achieved by the cooperation and work of an international consortium over years to create this most powerful instrument. He explained the reasons it is designed to operate over a wide range of spectra especially infra-red to penetrate dust clouds and nebula. The resolution should be one hundred times that of the best telescope to date. Professor Ray also explained the four main instruments. These have a range of wavelengths and are ultrasensitive.  When fully operational there is a wide range of possible observations targets. These include the early universe and first stars; protoplanetary discs and solar system formation; gas movement in nebulae; and even exoplanets and their atmospheric composition.  *Total Attendance: 59* | **10. ‘Black Holes Across Cosmic Time’ 02/02/2022**  *Dr John Regan, Maynooth University*  In this interesting and engaging lecture, Dr John Regan discusses the history, types and detection of black holes. He began by giving a brief outline of black holes with the idea proposed by Karl Schwarzschild in 1916 based on Einstein’s General Theory of relativity. At this early stage, the concept of these objects was based more on mathematics than observational physics. For about 50 years there were no observations until the 1960s with X-ray objects detected. With observations of high mass X-ray binaries, Cygnus X1 the first black hole was detected. He went on to describe black hole formation and the use of gravitational waves to detect a merging black hole event in September 2015. Such observations have shown a numerical relating match to general relativity templates. Supermassive and intermediate black holes were defined with enormous masses millions of times that of our sun. The difficulty of detecting intermediate and non-active types is mentioned. Finally, the significance of these objects in galaxy formation and their abundance and detection including the detection of mergers.  *Total Attendance and views: 158* |

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| **11. ‘SETI and Adaptive Optics: A Match 16/02/2022**  **Made in the Heavens’**  *Ben McKeon, NUI Galway*  Ben began his interesting and exciting lecture by explaining the origin of SETI in 1959 based on radio telescopes and their subsequent development initiated by Frank Drake. He outlined their focus on the hydrogen 1420 MHz frequency and significant events such as the WOW signal in 1977. He highlighted difficulties and solutions in detection. Ben proceeded to define adaptive optics in improving and refining optical imagery. These are being used presently by some large observatories such as the Keck observatory. He outlined how these systems function and their complex components such as deformable mirrors, wavefront sensors and activators. as which add are expensive. He briefly explained pyramid wavefront sensors and the use of AI and in the future possibly Solar gravitation lensing to enable actually imaging exoplanets.  There were some interesting questions afterwards and during the follow-up discussion on the probability of extra-terrestrial life. There is a range of views in academia. Ben gave an optimistic view of the abundance and probability of some forms of life. This was measured against the cosmic vastness in distance and time.    *Total Attendance and views:116* | **12. ‘Star and planet formation: a 04203/2022**  **Whistle-stop tour!’**  *Dr Deirdre Coffey, UCD*  Dr Coffey began her lecture by referencing Laplace’s nebular theory in star and planet formation back in 1796. In the 1900s stars were thought to live forever and mechanisms of their nuclear processes had not been discovered. With the Hubble space telescope, in the 1990s and IR imaging, direct details could be observed of dust discs in star and solar system formation. Herbig and Haro catalogued nebula objects in the 1950s. Shocks and Jets were observed during star formation in the 1950s. These jets could appear asymmetric and wiggle. This may be linked to planetary matter distorting the jets and magnetic fields. Such observations may indicate information on these protoplanets or planets. Nearly 5 thousand exoplanets have been discovered that are widely diverse in type. Both the Radial Velocity and Transit methods were briefly explained in finding planets. The ESAs Cosmic Vision project was outlined and its mission is to look for planets that may show conditions favourable to life or indicate actual biosignatures. They would use techniques such as transmission spectroscopy and the use of dichroic filters.    *Total Attendance and views: 145* |
| **13. “Apollo 17 – Ron Evans and his 18/03/2022**  **Long Voyage to the Moon”.**  *Geoffrey Bowman*  Geoffrey began his interesting lecture by explaining that is based on his book on the biography of Ron Evans. He was a lesser-known. Apollo astronaut who passed away in 1990. Born in 1933 he grew up in the small rural town of St Francis in Kansas with a population of about 900. There were 2 major difficulties to cope with at that time, the  aftermath of the depression and the mid-west dust bowl era. Ron was noted for his abilities from an early age and later studied electrical engineering at the University of Kansas by getting a scholarship from the Naval Reserve Officers Training Corps. During his service in the navy, he was selected for officer training. He later opted for training as a Naval Aviator due to seasickness. During his service in Vietnam, he applied to NASA for astronaut training and the Apollo missions. Ron was the Command Module pilot on Apollo 17. He also worked on the development of the space shuttle. Through information, photos and anecdotes, Geoffrey showed the colourful and extraordinary life of this truly heroic figure.  *Total Attendance:23* | **14. “Eclipses, Transits and 30/03/22**  **Occultation’s – Some personal experiences”**  *Paul Evans, IAA*  Paul began his fascinating lecture by pointing out that the objects in our solar system generally lie in a flat plane. As a result, these objects may occasionally pass in front of others leading to eclipses, transits and occultation events. He went on to relate this experience to the last total eclipse in 1999 in Cornwall. Paul chalked this up to a learning experience in preparing well in advance to see an eclipse. He went on to describe other experiences to see eclipses including a 25-thousand-mile round trip to Cadena Australia to see a total eclipse on the 4th of December 2002. Other events were witnessed in Turkey, China and Larne to video and photograph transits and occultation’s. Some experiences and anecdotes involved his camera catching fire. Great discussion of eclipses afterwards from participant’s relating their memorable eclipse experiences.  *Total Attendance and views:82* |
| **With thanks to all the staff at the Astrophysics**  **Research Centre QUB for facilitating the events.** |  |

*Remember to visit the IAA website ‘irishastro.org’ for any future updates.*

**IAA Outreach Events 2021-22:**

**IAA outreach events have been cancelled for a couple of years due to Covid restrictions.**

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| **1. Official opening of OM/Davagh Observatory 02/06/21**  *155 Davagh**Road, Omagh*  Danny and Terry did a rocket launch event | **2. QUB Astrophysics Research Centre 12**  Beaghmore*. Cookstown, Co Tyrone*  Terry did an event at the centre | **/09/2021** |

*Thanks to all our members and guests for participating in the outreach events.*

**IAA Observing at Delamont Country Park, Killyleagh 2021-22:**

**IAA observing sessions have been cancelled for a couple of years due to Covid restrictions** but it was felt that with the situation easing it would be possible to hold observing sessions as long as guidelines were observed.

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| **Date** | **Type of observing** | **Telescopes** | **Objects viewed** |
| **04/12/21** | naked eye, binocular, telescopic and astro imaging | David’s 12” Dobsonian | Did a quick tour of Messier objects, M1, M31/32/110, M33, M34, Jupiter, M15, M81/82, M36, M37, M38, M35, the double cluster |
| **04/02/ 22** | naked eye, binocular, telescopic and astro imaging | Paul’s 8” SCT | Clear skies, had look at winter constellations with Orion and a variety of others**.** |
| **04/03/22** | naked eye, binocular, telescopic and astro imaging | David’s 12” Dobsonian  Chris’s Redcat 51 scope  Gerry’s 4-inch refractor | Messier objects including M81/82  Orion Nebula  Hyades and Pleiades  Binaries stars |

*Thanks to David Stewart the observing section coordinator, John and Andy for organising the observing sessions at Delamont.*