Meetings

The 2018 BAA Summer Meeting – 2018 July 7 at the University of Warwick

Exploring solar systems, near and far

The BAA Summer Meeting and the joint meeting of the BAA and the AAVSO (American Association of Variable Star Observers) were held at the University of Warwick on 2018 July 7. Separate lecture theatres were used for the two meetings, with the first and last talks of the day being plenary sessions with all the delegates present.

The meeting was opened by the BAA Vice President, Dr Jeremy Shears, welcoming the 150 delegates from 10 countries. Dr Shears emphasised that delegates were free to move from one session to another depending on their interest in the talks. The first plenary talk was given by Prof Giovanna Tinetti (University College London).

Chemical composition of planets in our Galaxy

Prof Tinetti began by discussing our Earth, as the most-studied planet within our galaxy. The Earth is a rocky planet composed primarily of silicates, with a mild temperature of average 15°Celsius. The atmosphere is 21% molecular oxygen, which is surprising since oxygen is very reactive and would not be expected to persist in an atmosphere. Its presence is indicative of a direct result of abundant life on Earth, which continuously replenishes the supply of oxygen.

In our Solar System, the rocky planets are found close to the Sun, then further out we find the gas giants Jupiter and Saturn. These are much more massive at around 100 to 300 times the mass of the Earth, and are mainly composed of molecular hydrogen and helium. Further out still we come to the ice giants Uranus and Neptune, about 15 times the mass of the Earth. These also contain a lot of hydrogen, but also ices and rock.

Only very recently, we have learned that on average every star in our galaxy hosts at least one planet, meaning there are at least two thousand million planets in our galaxy. These are known as exoplanets, i.e. a planet orbiting a star other than our Sun. We can only detect a tiny fraction of these exoplanets; roughly 3,800 discovered to date, but we are able to estimate the overall number of planets from the statistics of these detections. Surveys with new space telescopes, like NASA-TESS and ESO-PLATO, are expected to lead to the discovery of hundreds of thousands of exoplanets in the coming decade.

We also want to know more about the planets we have already discovered, especially the chemistry of their atmospheres. One way to obtain information about the atmosphere of an exoplanet is the transit method. This only works for planets whose orbits are aligned such that the exoplanet transits the disc of their host star as seen from Earth. A tiny fraction of the starlight passes through the planet’s atmosphere, and with very high precision photometry and spectroscopy it is possible to detect absorption due to the exoplanet’s atmosphere. This technique only results in a few points on the spectrum, with large error bars, but using it we have been able to detect the presence of water vapour in the atmospheres of giant exoplanets.

To perform detailed analysis of exoplanet atmospheres will require the next generation of space telescopes, such as the James Webb Space Telescope (JWST). Additionally, the ARIEL space telescope has been selected as the next ESO medium-class mission. It is a 1-metre telescope scheduled for launch in 2028. It will perform systematic spectroscopic observations of about 1,000 rocky and gaseous exoplanets. ARIEL is designed to give high quality spectra enabling determination of chemical composition and abundances.

Dr Shears and the audience thanked Prof Tinetti for her fascinating and thought-provoking talk. Following a short break, the Summer Meeting resumed with a talk by Dr Leigh Fletcher (Leicester University).

Exploring the weather of the giant planets via professional–amateur collaboration

Dr Fletcher began by discussing the familiar patterns of jetstreams and cloud formations in the Earth’s atmosphere, and the way they distribute heat around the world. Showing images of the cloud patterns on Jupiter, he explained that the same jetstream processes operate there and on Saturn to cause the bands and zones we see from Earth. Since the Voyager spacecraft returned a bland blue-green image of Uranus we had assumed that the remote icy giant planets did not share these processes, presumably due to their greater distance from the Sun, so it had been a surprise when images of Uranus from the Gemini telescopes on Earth showed a dynamic banded planet visible in infrared wavelengths.

Despite four decades of robotic planetary missions to the outer solar system, including the Voyager’s, the orbital missions of Galileo and Cassini–Huygens, and the targeted missions of Juno and JUICE (ESA’s forthcoming Jupiter Icy Moons Explorer), many crucial questions remain unanswered. Each of these missions are relatively short-lived glimpses – snapshots – of worlds that take decades to orbit the Sun. To fill the gaps, Dr Fletcher described collaborations between Earth-based professional planetary astronomers and amateur observers to explore the meteorology and climate of these worlds over long spans of time, and especially at present, to help with directing and analysing the data from NASA’s Juno mission to Jupiter. Dr Fletcher is a co-investigator on the Juno mission and brought us up to date on the dramatic and unexpected findings it has made so far.

The next speaker was Prof Sara Russell, the Head of Planetary Materials at London’s Natural History Museum.

Rocks from Space: Deciphering the formation of the solar system from meteorites and space missions

Prof Russell explained that most meteorites are fragments of asteroids that formed at the time of the formation of the solar system. Analysing them has revealed new information about how the planets formed and evolved.

The next step is to go into space to collect our own pieces of asteroids, and two current space missions, Hayabusa2 and OSIRIS-REx are doing just that. Prof Russell is a science team member for the OSIRIS-REx mission, due to return a piece of asteroid Bennu to Earth in 2023, and described the mission to us and what we hope to discover from it.

Following a lengthy lunch-break, which gave all participants in both sessions an opportunity to catch up with old friends and in particular to meet people who they may so far have only ‘met’ online, the Summer Meeting resumed with a talk from video astronomer Alex Pratt from the BAA.

Confessions of an amateur astronomer – A tribute to Melvyn Taylor

Alex said he had known his great friend Melvyn, who died last year, for over 45 years. He described his huge contribution to amateur astronomy, made only with the naked eye, binoculars and a 76mm refractor. As well as making more than 90,000 variable star observations and hundreds of reports of meteor showers, aurorae,