Stargazey Pie – February 2013

Society Notices

The Next HAS Meeting is on the 5th of March.

The “Youngstars” session for 8-14 year olds, before the main meeting, will run from 19:00 until 19:30 led by Pauline and Triona**.** John Rosenfield will be giving us his talk “*The Moons of Neptune”*, there will be a discussion group afterwards and dependent on the evening, also a beginner’s group session.

Observatory and Home Viewing.

Should you see an aurora, sprites or anything else of astronomical interest please alert Paul or Pauline

Evening Winter Observing –

Please feel free to bring your own telescope if you wish. Binoculars are available to borrow. Please feel free to ask any of the committee members if you have any equipment queries, they will be able to answer or to direct you to someone who can!

Date	For whom	Supervisors
Mar-08	public/members	Pauline and Alaine
Mar-09	members	Rhona
Mar-15	public/members	Gerry and Alaine
Mar-16	members	Paul and Maarten.

The rota for the following months will be made available shortly.

A special observing night was held on Friday the 15th of March to try and spot DA14 2012, the close approach asteroid. Sadly we didn’t manage to catch it, but here is the official information sheet which was attached to February’s meeting notices, which is now out of date but an interesting read nonetheless. (If you would like the full version, please e-mail me – cwoods89 at hotmail dot co dot uk)

CLOSE-APPROACH OF ASTEROID 2012 DA14

Here are some notes concerning the 'record-breaking' close-pass of asteroid 2012 DA14 which took place on Friday 15th February, 2013.

<u>This object is a record-breaker in several respects:</u>

1. Reaching 7th magnitude, it will be the brightest-ever NEO to be observed approaching the vicinity of our planet (<0.1 AU).

2. It is nominally 30x brighter and more than 150 times more massive than the next largest object to approach as close or closer to our planet in recent years and to be discovered: that one was 2012 MD.2012 DA14 will pass just 27,700 km from the Earth's surface. It will be travelling at 7.8 km/sec.

3. The last time an object as big or a little bigger than this one passed close to the Earth was more than 10 years ago when 2002 MN passed by unnoticed some 120,000 km away before being discovered 3 days after the event! See:http://www.newscientist.com/article/dn2444-asteroids-nearmiss-with-earth.html

Interestingly, object (99942) known as Apophis, which in early January was observed using the Herschel Space Observatory and found to have an average diameter of 325 metres (larger than previously thought), will pass almost as close as 2012 DA14 but that will happen on Friday 13th April 2029 when it will be visible to the naked-eye, if clear! See: http://www.bbc.co.uk/news/science-environment-20961003

Here's some background information on the latest record-breaker:

2012 DA14 was discovered by the La Sagra Sky Survey operated by a group of Spanish amateur astronomers on 2012 February 23 some seven days after it passed some 2.6 million km from the Earth. Its physical size is somewhere between 30-80 metres across: the actual value depends on its reflectivity or geometric albedo, which is likely to be in the range, 0.04-0.20.Up until a few days ago, the last observations made of this object were last May 12 and so its trajectory at closest approach was somewhat imprecise in that, although we could be sure it would pass closer than the distance to the geostationary satellites and would definitely miss the Earth, its position in the sky was known at best to the nearest 5 degrees or so.

Thanks to observers at Las Campanas Observatory, Chile, who imaged the space rock on January 9 and 11, the accuracy with which we now know its orbit has improved roughly 100-fold and so we can be confident that it will certainly pass no closer than 27,400 km. It's an Apollo asteroid, the orbit of which has a semi-major axis of 1.0017AU, i.e. very similar to that of the Earth and unsurprisingly its orbital period is 1.0026 years, i.e. very close to 1.0 year. After its close approach, its orbital period will be reduced to about 0.88 years.

2013, Friday 15th February

It is evident that this NEO will be readily visible and should be seen moving at a very appreciable rate even using a good pair of binoculars: a small telescope on a tripod or other mount would be even better. If you do not have a ‘goto’ telescope mount, then I would advise use of a wide-field eyepiece and to sit in wait near a particular feature (star, Messier object, etc.) a minute or two before it is due to pass. Once you see it, you can then keep it in the field rather like tracking an artificial satellite. You may wish to catch it as soon as possible after it rises above the eastern horizon. As more observations are made of the asteroid, its orbit will be known with improved accuracy. Further updates will be provided as we learn more about this object.

Richard Miles

Director, Asteroids and Remote Planets Section, BAA

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“Exoplanets and the SuperWASP Project” **by Grant Miller**

Grant, who has a PhD in exoplanetary astrophysics is acting director of St Andrew's University's largest telescope (James Gregory Telescope) used to search for exoplanets.

Grant began the talk with a little bit of history about astronomers who had, in some way, made contributions to discovering exoplanets. Even hundreds of years ago, people theorised that planets existed around other stars. In the 17 Century Giordano Bruno was burnt at the stake for this very belief for he felt that Earth could not be the only planet and that life must have existed elsewhere.

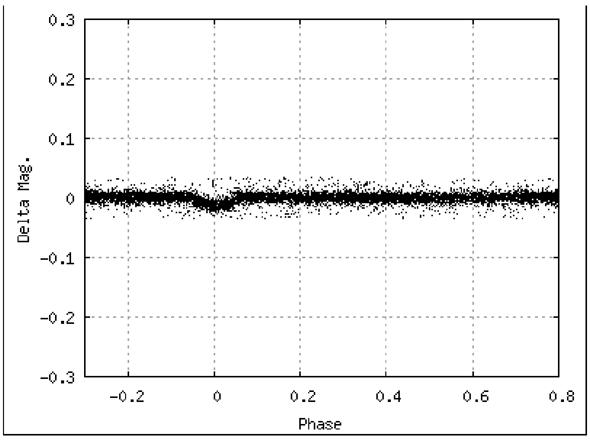
James Gregory worked at St. Andrew's university and was credited with the first design of the reflecting telescope (using mirrors) although he didn't actually build one, that was left to others but it was called the Gregorian Telescope. He also made a diffraction grating, which is used in the discovery of exoplanets. Gregorian Maksutovs are still produced and are very popular today. (http://www.opticstar.com/Run/Astronomy/Astro-Telescopes-Opticstar.asp?p=0_10_1_1_210 for example).

The first planets to be discovered with a telescope were actually within our own solar system: Uranus and Neptune. An astronomer named Otto Struve outlined why exoplanetary systems may not be identical to our solar system as well as how to find extra-solar planets using radial velocity and transits. Radial velocity is due to the star wobbling as a planet orbits it. Light appears to shift towards the blue end and then the red end of the spectrum as a planet first moves away and then towards us as it completes an orbit of its star. No one took any notice of his ideas and yet these are two methods we use today and it also gives us a way to work out the mass of a planet.

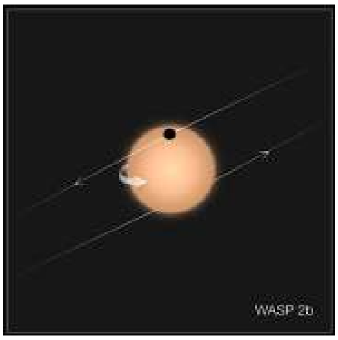
The first extra-solar planet was discovered in 1995 orbiting 51 Pegasi. It took a long time to find this planet because no one believed it was possible for a large planet (about the mass of Jupiter) to move around its star in days. Planets of this type became known as hot Jupiters.

The first planet found using the transit method, was in 1999 around the star HD 209458. The planet was called HD 209458b the letters indicate the order in which they are found. The letter 'a' is not used as this denotes the star.

Many transit searches have since taken place world wide including WASP (Wide Angle Search for Planets), which consists of two robotic observatories; one at St Palma and the other in South Africa. This project has been fully operational since 2004. It looks at the closest and largest stars using eight Canon 200mm f1.8 lenses (found on eBay) and searches a field of view of 500 square degrees. So far there have been 1600 nights spent using the observatories, 10 million images have been taken and 300 billion measurements of approximately 30 million objects. Website: http://www.superwasp.org/index.html



A computer looks for a particular light curve that suggests a planet is present but astronomers have to check the data to make sure the light curve is actually due to a planet. Then a photometric follow-up is required using a larger telescope, e.g. the James Gregory Telescope at St. Andrew's university. After this, a radial velocity follow-up is required to measure the planet's mass, otherwise you could be looking at a brown dwarf (which can be a similar size) instead of a planet. WASP has so far discovered 97 exoplanets although confirmation of 17 of these has not yet been officially released thus we were the first to hear! It is the most successful ground-based discoverer of exoplanets.



Finding planets by the transit method also allows astronomers to measure the misalignment of some of the planets. It is assumed that planets orbit their parent star in the same plane and direction as happens in our own solar system but some exoplanets do not do this. WASP discovered the first planet to have a retrograde orbit, Wasp 17b. It is therefore important to measure the alignment of all planets to try to find out why some are misaligned. So far it appears that the aligned planets orbit cooler stars (like our own Sun) whereas the misaligned planets orbit hotter stars but no one knows why.

Another question is why hot Jupiters end up so close to their parent stars. So far the possibilities involve disk migration, scattering (due to gravitational encounters between planets so one is thrown out of the system and the other towards the star) or a mixture of different processes. Each theory needs to take into account a misaligned orbit.

NASA's Kepler mission uses a space telescope which, in contrast to WASP, uses a smaller but deeper field of view and looks only for smaller, longer period planets. As these transits last just a short time the telescope must point continuously at one area of sky. Kepler is looking for Earth sized planets and multiple systems. It has made many exciting exoplanet discoveries so far. Kepler 11 has six known planets, five of which orbit very close (within the orbit of Mercury) to their star. Kepler 16b is a Saturn mass planet orbiting a binary star system and it has been likened to Star War's Tatooine, though being a gaseous world life would not be possible there – Force or no Force!

The majority of planets found so far are the size of Neptune and the second most common size is the super-Earth.

Alpha Centauri Bb is the first Earth-mass planet to have been found around a Sun-like star. However, it orbits closer to its star than Mercury and takes just three days to complete an orbit. This is only the first step to finding the first Earth-like planet because, as Grant pointed out, not all Earth-mass planets are habitable – look at Venus – Earth-mass but not Earth-like!

Useful websites are: www.planethunters.org (you can interpret light curves and discover a planet)
www.exoplanet.eu (the exoplanet encyclopedia)

Thank you Grant for a most interesting talk and for giving us first hand information of your results from the WASP project.

So until next time, when we will have John Rosenfield talking to us about the moons of Neptune, clear skies!

Pauline Macrae