SPACEWATCH

the newsletter of the Abingdon Astronomical Society

11th June 2007

Dr. Andrew Ball (Open University) – 'Planetary Landers: Exotic Spacecraft for Strange Places'

This is our last meeting of this season – our next meeting is on September 10th. While it becomes far more difficult to do astronomy over the light summer nights, there are still interesting items worth studying. If you haven't yet got yourself a solar filter why not consider buying one. The Sun is visible at more convenient times during the summer and even though it is nearing a solar minimum there are still sunspots to view, and if you buy an H-alpha solar filter prominences too. Alternatively why not project the Sun's image on to white card using a small telescope or binoculars? **REMEMBER:** NEVER look directly at the Sun, with or without a telescope or binoculars. Such equipment WILL blind you in seconds. And please put your filter over the large end of the telescope, not at the eyepiece where the heat is already concentrated.

Also I owe Gwyneth an apology: due to e-mail address changes as business trips away I missed her report last month of Darren Baskill's talk in April – so I have included it in this edition. Sorry, Gwyneth.

For those of you who missed the AGM, you missed a great video of some very dedicated guys in the USA filming Comet Hyakutake on its close pass by the Earth in 1996 in the days just before CCDs became generally available to amateurs. Some remarkable footage was captured which interested even the professional comet-studiers (are they "cometologists"?).

I wish you all a pleasant summer break. See you in September.

THE NIGHT SKY THIS MONTH

by Bob Dryden

Sun: The summer solstice occurs on 21st June at 18hr 6min UT, after which the nights are drawing in again! The Earth's orbit around the Sun is slightly elliptical, which means that are certain times we are nearer to the Sun than others. Believe it or not, on July 7th, when the Sun will be blazing down on us, we will be as far away from the Sun as we get each year. This point in the orbit is called aphelion, and Earth is then 152 million kilometres from the Sun, as opposed to 147 million kilometres when we are our nearest. This equates to an increased percentage difference of 3.4%, and the Sun is 6.5% less bright. Remember that when you are getting sunburnt on the beach.

Mercury: The present evening apparition of Mercury is now coming to an end and inferior conjunction occurs on June 28th. Mercury moves into the morning sky but this will be a fairly poor apparition as the planet never gets very high above the eastern horizon. Greatest western elongation is on 20th July at 20 degrees after which Mercury moves back towards the Sun to reach superior conjunction on 15th August. It reappears in the evening sky in early September but will be difficult to see, very low in the south west.

Venus: Just past greatest elongation (June 9th), Venus is now moving back towards the Sun and is getting lower in the evening sky as the weeks pass. The planet crosses the northern part of the Beehive cluster (M44) in Cancer from the 12th to 14th June which will make for interesting binocular and telescopic views. Venus will be gone by about the end of July and inferior conjunction occurs on 18th August. Before then though, keep an eye on both Venus and Saturn. Venus will be a very bright mag. -4.4 and Saturn a fainter, but still obvious, mag. +0.6 above and to the left of Venus. The two planets will get closer and closer through June until by 30th June/1st July they will be less than one degree apart. This means both planets will fit into the same telescopic field of view – an unusual and excellent sight. The two planets will be low in the west by this time. The other thing you should be watching on Venus is the changing phase. In June, the phase is 0.5 (in other words, half phase) but this gradually decreases to 0.2 by mid July when you will see a spectacular thin crescent. After inferior conjunction, Venus rapidly moves into the morning sky where it will still be a lovely crescent shape, only now, the crescent will be facing the opposite way.

Mars: Very little attention has been paid to Mars over the last few months because it has been both faint and low in the morning sky. However, things are gradually improving as the planet edges towards its spectacular showing in December. Mars brightens from +0.8 in June, to +0.2 by September and increases in apparent size from 2" to 9" in the same period. While it is still a bit difficult to see detail on the disc, it is not difficult to see that Mars has a phase at the moment. This happens when the angle between the Sun, Earth and Mars is close to 90 degrees which it is through summer and early autumn. As a result, in June Mars phase is 87%, which deceases to 86% in August/early September before it starts to increase again, reaching 100% in December.

Jupiter: Unfortunately Jupiter is rather low for the next few years but its bright magnitude (-2.4) makes it easy to find later in the night towards the south. Nearby, below and to the right, is the first magnitude star Antares. The brighter of the two 'stars' is Jupiter.

Saturn: Saturn is nearly at the end of its evening apparition now and it will be lost from view by about the end of June or early July. Conjunction with the Sun is on 21st August after which the planet reappears slowly in the morning twilight. If you have a clear eastern horizon, on the morning of 2nd September Saturn and the bright star Regulus will be close together which would be interesting in a telescope or binoculars. It will be a difficult observation however as they will only be a few degrees above the horizon as the Sun rises.

Uranus + Neptune: Both these planets are approaching opposition (Uranus on 9th September and Neptune on 13th August) but for most of this period they are only really visible well after midnight in Aquarius (Uranus) and Capricornus (Neptune).

Meteors: Undoubtedly, the highlight of the meteor showers this period are the Perseids. Active from July 23rd to August 20th, the maximum occurs on the morning of August 13th at 02.00UT. With a zenith hourly rate of about 80, realistically, you can expect to see about 40 an hour after midnight if it is clear. In practise, the Perseids often come in spurts so that you get several in quick succession, followed by a lull when you will just see one or two. There is no Moon at all to interfere with observations and as this is a very reliable shower, this year is one of the best opportunities you have to watch a meteor shower in action. While there are several other showers active during the summer, none have hourly rates higher than about 10 and are of little interest to the casual observer. The only one with higher rates is the Delta Aquarids which produces about 20 meteors an hour at maximum on July 29th. Unfortunately this is more of a southern shower as the radiant in Aquarius never gets very high above our horizon. You may see a few meteors though coming from that direction if you are out observing between July 15th and August 20th.

Comets: There is only one predicted comet during the summer that reaches above magnitude 10 and that is comet LINEAR C/2006 UZ13. By the 1st July it should be about 11th mag. crossing Cepheus, rising to about magnitude 9.8 through mid July as it moves across Draco and Bootes. It will be circumpolar during this period so you will have plenty of opportunity during the short nights to hunt for it. By the end of July it is passed its best, and it has starting to fade, probably about 10th mag, in Canes Venatici and then Coma Berenices. Early August sees the comet in Virgo at about 10.5 mag and by mid August it reaches a faint 11th mag and will be of little interest any more.

Asteroids: The two large asteroids, 1 Ceres and 2 Pallas are on view through the summer.
1 Ceres will brighten from +9 mag in Early August to +8.4 by mid September as it crosses Cetus and then Taurus. It will be much easier to see when it is brighter in November but this is your chance to hunt it down early in this apparition. 2 Pallas is a lowly +8.9 mag through September which is the brightest it is going to get this time around. It will be visible in Pegasus, just below the famous Square.

Occultations: This summer sees two particularly interesting occultations.

First, on June 18th there is a daylight occultation of Venus. Venus is visible during the day if you know exactly where to look, but most people do not know where that is. On June 18th, Venus will be right next to the Moon so if you can find the Moon, you will be able to see Venus. The occultation happens at 14.02UT and the planet reappear from behind the Moon at 15.22UT. The Moon will be only 3.7 days old at the time so will be a fairly thin crescent which may make it harder to locate. It will be about 55 degrees high in the south east.
Whatever you do, take great care not to accidentally look at the Sun if you are scanning for the Moon in your binoculars. Try and position yourself such that the Sun is behind something (such as a house or shed) so that you cannot possibly have any accidents and blind yourself, quite literally.

The second event on August 7th sees a gibbous Moon occult the Pleiades again. While this does not happen very often, this will be second time this year. The brightest star to be occulted will be +3.8 magnitude at 00.46UT, followed by +4.4 mag. at 01.06UT and +4.0 mag at 01.21UT. There will also be several fainter occultations throughout these times as the Moon crosses the cluster. The Pleiades will be about 20 degrees high in the north east at the time.

On 26th August, Eta Capricornus (+4.9 mag) is covered by the Moon at 20.45UT when it is about 15 degrees high in the south east.

September 7th sees Kappa Gemini both disappear and reappear from behind the Moon at 03.59UT and 05.00UT respectively.

Noctilucent cloud: While it is not possible to say exactly when you can see noctilucent cloud, it is possible to say that summer is the most likely time they will appear. They have become more common in the last few years and last year was one of the most productive yet, culminating in a fantastic display on 14th July. The usual advice is to look towards the northern horizon after dark, find the bright star Capella, and any noctilucent cloud will be below there. The 14th July display blew that advice out of the water as the highest part of the display was not that far below Polaris. Anyway, keep an eye towards the north during clear summer nights for bright, silvery coloured cloud when there should not be any visible (because it is dark) – that's noctilucent cloud.

MOON PHASES:

Full: 1st June; Last Qtr: 8th June; New: 15th June; First Qtr: 22nd June; Full: 30th June; Last Qtr: 7th July; New: 14th July; First Qtr: 22nd July; Full: 30th July;

Last Qtr: 5th Aug.; New: 12th Aug.; First Qtr: 20th Aug.; Full: 28th Aug.; Last Qtr: 4th Sept.

MEASURING PLANETARY DISTANCES

by Deborah Hambly

During the past few months I have been teaching an astronomy class entitled "Introduction to the Solar System" through one of our community education programs. I wanted to incorporate a couple of practical exercises into the course, to make it more hands on. My first project involved measuring the exact distance to a planet using the following formula:

$$\text{Distance} = \frac{\text{2 x Focal length of telescope x Radius of planet}}{\text{Measured diameter of the object through the eyepiece}}$$

Top line of the formula

Using my 8" SCT, I knew the focal length in mm was 2000. I looked up the radius of Jupiter, and noted the equatorial radius (the polar measurement is slightly larger). The diameter was listed in km (142,984km) so I divided by 2 and converted to the figure to millimetres (71,492,000,000)! I could now solve the top line of the equation.

Bottom Line of the formula

On to the bottom line, which is the relatively straightforward providing you have a useful astronomy measuring device. I happen to have one, and it is without a doubt the longest name of any astronomical accessory: "illuminated reticulated astronometric 12mm Plössl". I needed to use it to measure the apparent size of Jupiter in millimetres. I unscrewed the eyepiece and turned the lights on to illuminate a scale that was 50 notches long. There were no details in the instruction manual and I have been able to find no details on the web as to its precise measurement, but I estimated it to be approximately 5.9 mm in length. This would no doubt provide the largest source of measurement error. As the scale was divided into 50 notches, this meant that each notch measured approximately 0.118 mm in distance. (5.9mm/50 notches). I put the eyepiece in the telescope and focused on Jupiter. I lined Jupiter's equator up against the 50 notch scale. It appeared to measure approximately 3 and a half notches. (3.5 x 0.118mm = 0.413).

The formula was ready to be solved: The distance to Jupiter =

2x2000x71,492,000,000 / 0.413 mm =

285,968,000,000,000 / 0.413 mm =

= 692,416,465 km

I checked with a friend's astronomy software, not being able to find the precise information freely on the web to check exactly how far Jupiter was at that moment. It was 727,045,652, which meant I had a margin of error of approximately 5%! I was very excited to get an answer which was within this margin of error considering the roughness of the measurement of my astronometric scale. I have written a simple Excel spreadsheet so that students can quickly input their measurement in the observatory and see how they fared.

I would like to experiment with measuring lunar crater heights, but from my web and book research have found that this is generally done using photographs – (e.g. not at the eyepiece of the telescope. One method which does not use spherical trigonometry does not appear to be very accurate. Therefore it would appear I have some maths to learn to take this project further!

APRIL'S TALK

by Gwyneth Hueter

Darren Baskill (University of Leicester) talked about cataclysmic variables, stars which can suddenly brighten in a fairly short time.

Dr Baskill took us from the discovery of U Geminorum in 1855, which can change from its usual mag 14 to mag 9 in a week, and the well-known SS Cygni, which can do its thing in six hours (mag 12 to mag 8), to the present day theories involving accretion discs around stars, with material being dragged in and giving off x-rays.

Until the 1950s the spectra of these variables made no sense. Their emission lines were so wide that surely these stars should be spinning themselves silly and blowing themselves to bits. Up to that time it was thought that the star was a single star, but it did make sense when you realised that there were two stars, not one. Two stars orbiting each other, very close together, so their spectra couldn't be separated.

The latter part of the talk was about the nature of these systems, and why their variability is so variable. The central star is (usually?) a white dwarf which is pulling material off its neighbour and creating an accretion disc around itself. We sometimes see the disc eclipsing the star. Then the way the material is drawn off the outer star varies, so that a build-up of matter can suddenly cause a lot of fireworks including x-rays) and the disc can almost drain away until the next build-up and outburst.

NASA Space Place

THE IONS OF DAWN

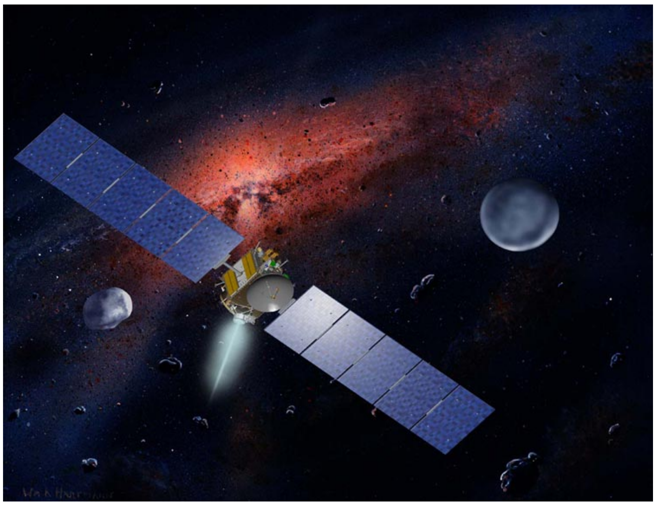
by Patrick L Barry

This summer, NASA will launch a probe bound for two unexplored worlds in our solar system's asteroid belt—giant asteroids Ceres and Vesta. The probe, called Dawn, will orbit first one body and then the other in a never-before-attempted maneuver.

It has never been attempted, in part, because this mission would be virtually impossible with conventional propulsion. "Even if we were just going to go to Vesta, we would need one of the largest rockets that the U.S. has to carry all that propellant," says Marc Rayman, Project System Engineer for Dawn at JPL. Traveling to both worlds in one mission would require an even bigger rocket.

This is a trip that calls for the *un*conventional. "We're using ion propulsion," says Rayman.

The ion engines for the Dawn spacecraft proved themselves aboard an earlier, experimental mission known as Deep Space 1 (DS1). Because ion propulsion is a relatively new technology that's very different from conventional rockets, it was a perfect candidate for DS1, a part of NASA's New Millennium Program, which flight-tests new technologies so that missions such as Dawn can use those technologies reliably.



Artist's rendering of Dawn spacecraft, with asteroids. Largest are Vesta and Ceres. Credits: Dawn spacecraft—Orbital Sciences Corporation; background art—William K. Hartmann, courtesy UCLA.

"The fact that those same engines are now making the Dawn mission possible shows that New Millennium accomplished what it set out to," Rayman says.

Ion engines work on a principle different from conventional rockets. A normal rocket engine burns a chemical fuel to produce thrust. An ion engine doesn't burn anything; a strong electric field in the engine propels charged atoms such as xenon to very high speed. The thrust produced is tiny—roughly equivalent to the weight of a piece of paper—but over time, it can generate as much speed as a conventional rocket while using only about 1/10 as much propellant.

And Dawn will need lots of propulsion. It must first climb into Vesta's orbit, which is tilted about 7 degrees from the plane of the solar system. After studying Vesta, it will have to escape its gravity and maneuver to insert itself in an orbit around Ceres—the first spacecraft to orbit two distant bodies. Dawn's up-close views of these worlds will help scientists understand the early solar system.

"They're remnants from the time the planets were being formed," Rayman says. "They have preserved a record of the conditions at the dawn of the solar system."

Find out about other New Millennium Program validated technologies and how they are being used in science missions at http://nmp/TECHNOLOGY/infusion.html . While you're there, you can also download "Professor Starr's Dream Trip," a storybook for grown-ups about how ion propulsion enabled a scientist's dream of visiting the asteroids come true. A simpler children's version is available at http://spaceplace.nasa.gov/en/kids/nmp/starr.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

DATES FOR YOUR DIARY

18th June 8pm. Beginners' Meeting in the Perry Room.

10th Sept. 8pm. Our first speaker meeting of next year's season.

Check our website for next year's programme:
www.abingdonastro.org.uk

The editor of "SpaceWatch" is Andrew Ramsey, who would very much appreciate your stories & contributions. Please send any news, observations, photos, etc. to:

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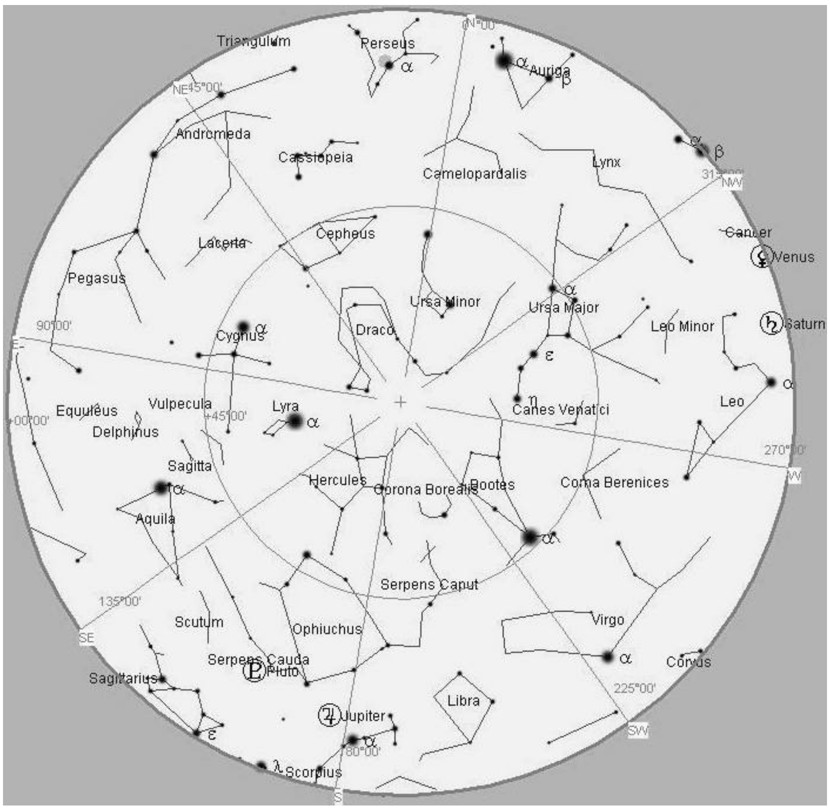
STAR CHART



The Night Sky at 11pm next Saturday (16th June)

Officially it never gets dark in June. Official twilight is the period when the Sun is less than 18° below the horizon, and since the Sun does not dip this far below the horizon in June, then officially it is twilight all night. However, if use binoculars or a telescope there is still plenty to see.

Jupiter is very low in the south, Saturn and Venus are low in the west and best seen earlier in the evening. The summer triangle of Vega, Altair and Deneb are high above.