Stargazey Pie – November 2012

Society Notices

Saturday 1st December HAS Christmas Dinner 19:00 for 19:30.

The dinner for members and partners will be held at the Beaufort Hotel, 11 Culduthel Road, Inverness IV2 4AG tel. 01463 222897. Cost is £25.00 per person inclusive of tip. Drinks should be paid for separately. Please sign the sheet tonight or contact Pat Escott if you wish to attend. Tel. 01463 239746 or mailto:Pat Escott (pmescott@btinternet.com)

Once you have signed up please ensure that you have paid in full by Tuesday 6th November. Cheques are to be made out to "Highlands Astronomical Society" and sent to Paul Jenkins, Meikle Kildrummie, by Nairn, IV12 5NY.

The Next HAS Meeting is on Tuesday 4th December 2012.

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. Main Talk – Paul's talk is entitled *Journey into Space.* After the tea-break, Arthur will test us with his annual Christmas Quiz.

Eastgate Outreach Day and Observatory Evening Viewing Sat. 12th January 2012.

Pat Escott will shortly be looking for volunteers.

Astrofest 2013

Is taking place on 8-9 February, 2013 at Kensington Town Hall, London. More information at http://europeanastrofest.com/

Observatory and Home Viewing.

Should you see an aurora, sprites or anything else of astronomical interest please alert Pat W. *(0793 0183 999),* Paul (*01667 456789) or* Pauline *(07751 112586).*

Evening Winter Observing –

The 14" LX 200 is back and working well. Thanks to Gerry, Paul, Pauline, Maarten, Steve and Arthur who dismantled it, packed it, sent it off and the remounted it. Thanks to LifeScan and Gerry, to complement the 'scope, we now have a wider screen to view images. Please feel free to bring your own telescope if you wish. Binoculars are available to borrow.

Date	For Whom	Time	Supervisor
Fri. 9th Nov.	public and members	20:00 – 23:00	Paul
Sat. 10th Nov.	members and guests only	20:00 – 23:00	Gerry
Fri. 16th Nov.	public and members	20:00 – 23:00	Pauline
Sat. 17th Nov.	members and guests only	20:00 – 23:00	Paul
Fri. 7th Dec.	public and members	20:00 – 23:00	Paul
Sat. 8th Dec.	members and guests only	20:00 – 23:00	Rhona

Main Talk on Mercury by Pauline Macrae

It was once a dull planet, but no longer – Mercury is changing the way we understand the Solar System.

Our November 2012 speaker was Pauline Macrae of HAS, who offered us a careful study of Mercury, the swift-footed God of Roman mythology, by taking us through the discoveries made by

NASA's MESSENGER (Mercury Surface, Space Environment, Geochemistry and Ranging) mission, the first to explore the planet since Mariner 10. Mariner had imaged just 45% of the surface, but Messenger has replaced the vivid imaginings of science fiction, having taken pictures some 98% of the whole.

With an orbital period of 88 days and a rotation period of 58.6, its 3:2 resonance means that a day on the smallest planet in the Solar System lasts two years.

Not that it was easy to get there – it took 7 years and flybys of Earth, Venus and Mercury before in March 2011, thrusters on the spacecraft used 31% of their total propellant in a 15 minute manoeuvre to establish Messenger in its primary science orbit. This passes close to the north of the planet and then loops away, so as to deal with the challenge of the immense heat close to the surface. Temperatures reach 370° on the outer part of the sunshade, but layers of ceramic cloth and other systems of heat management ensure that the operating temperature of the spacecraft remain at 20°.

The Messenger mission was set 6 scientific questions, and it is the answers to these that are changing our understanding of the planet.

Why is it so dense?

Mercury is remarkably dense for its size and a complete anomaly in the Solar System, where density is normally relative to overall size. Messenger has identified that its iron core occupies as much as 85% of the whole planet. There is a layer of solid iron sulphide around this core. The relationship of core to total planet was compared by Pauline to that of the fruit of a satsuma to its skin, contrasted with an avocado for the Earth, the stone representing the relative size of the core.

Why is the core so massive? There are 3 theories, of which the first and second assume that the planet was once as large as the Earth but that much of the material was either reduced by an impact or vaporised by the Sun. However, Messenger has established the presence of potassium and sulphur (both of which are volatiles) on the planet's surface, ruling out intense heat as a factor in the planet's earliest history. The third theory proposes that, before Mercury was formed, drag

within the inner solar nebula caused rocky grains to slow down, leaving iron grains to dominate the young planet.

What is the geological history of the planet?

Mariner 10 found a world that seemed very much like the Moon but with some strange features, including long cliffs, smooth areas and the so-called weird terrain.

The surface is puckered by impacts, both from the Late Heavy Bombardment 3.9 billion years ago some 500 million years later there was a period of volcanism. Lava covers 40% of the surface and is the dominant landform in the northern polar regions. There are ghost craters that have been flooded by lava and teardrop ridges and valleys carved by liquid lava where Messenger has identified source vents. Coloured images show different mineral compositions in different colours. Volcanism occurred on the planet for the first half at least of its history and there are some very young craters, e.g. Rachmaninoff (http://photojournal.jpl.nasa.gov/catalog/PIA12368) . Two kinds of volcanism can be distinguished from the evidence: effusive and explosive.

The largest single feature on Mercury is the Caloris Basin, the second largest impact crater in the Solar System. It is ringed by volcanoes and has a spider-like formation at the centre of the basin, which are a series of cracks and radiating troughs and is called the Pantheon Fossae (see http://messenger.jhuapl.edu/gallery/sciencePhotos/image.php?page=1&gallery_id=2&image_id=830, also http://messenger.jhuapl.edu/gallery/sciencePhotos/image.php?gallery_id=2&image_id=992).

Long high ridges, cliffs and scarps across the planet also show evidence that the core has been contracting and cooling. Mercury has been shrinking and it shows its wrinkles.

The most amazing discovery has been the areas of bright, reflective terrain on crater floors and walls. These are small, irregularly shaped and shallow, little depressions that cluster together. They are thought to have contained volatiles that have vaporised, leaving a spongy soil, giving a 'Swiss cheese' appearance(http://messenger.jhuapl.edu/news_room/telecon7/Blewett05_lg.jpg, also http://messenger.jhuapl.edu/news_room/telecon7/Blewett04B_lg.jpg). Some are near sites of explosive volcanism.

What is the nature of Mercury's magnetic field?

Another astonishing fact about Mercury is that it has a magnetic field. Discovered by Mariner 10, it implies that Mercury has a partially liquid core like the Earth, despite the planet's small size. It is not easy to study due to the interference of charged particles of solar wind, but Messenger has confirmed its existence. The magnetic field is a miniaturised version of the Earth's with a dipole field. But the magnetic equator is offset by some 480km to the north of the geographic equator. There is no explanation for this yet.

The magnetosphere is weak but very active. There is leakage that allows the solar wind to funnel in and create magnetic tornadoes. The solar wind at the poles has the effect of knocking off sodium atoms, and there is much more space weathering in the south than in the north.

What is the structure of the core?

It is a large and iron-rich, partially molten, with a solid centre surrounded by a liquid area. It is thought that the liquid iron contains sulphur, lowering the melting point. Surrounding this liquid part is a layer of solid iron sulphide, then the silicate mantle and crust.

What is the icy material at the poles?

Large bright areas have been imaged by Messenger in craters at the poles that are partly in total shadow. Because the planet's rotational axis is almost perpendicular to its orbit, the sun's heat never touches these zones, allowing for water ice to endure under a thin layer of regolith (http://www.nasa.gov/mission_pages/messenger/multimedia/messenger_orbit_image20120322_3.html). The water has probably come to Mercury from comets and meteorites.

What volatiles are important on Mercury?

The planet has a tenuous exosphere, and the few atoms do not collide so much as bounce around the surface. The gases are unstable and are being lost to space, so something is replenishing them. The hydrogen and helium come from the solar wind, but the oxygen, sodium, potassium, calcium, and (discovered by Messenger) magnesium must come from some surface process. Possibilities include evaporation by sunlight, ion spluttering, release caused by micrometeorites and diffusion from the interior. The pressure of the solar wind scoops them into a comet-like tail of which the major component is sodium.

All the way along, then, Mercury has been surprising us. The Messenger mission has overturned Mariner's impression of a dull planet. We now know that Mercury is unmatched in the Solar System with a unique surface chemistry and features found nowhere else. It forces us back to the drawing board to re-work theories of planetary formation and subsequent geological processes. Messenger's mission has been extended until March 2013 and possibly beyond. Meanwhile, it is posing new questions for the ESA-JAXA BepiColumbo mission to the planet, due to be launched in 2015.

Observatory Report from Gerry

LX200

The Meade LX200 has been returned to us after having had the home sensor repaired and is now back on its pier inside the dome. I have re-aligned the telescope and the GOTO system appears to be working. On the first attempt the objects appeared on the edge of the field of view, but since then I have trained the drives. Should we need to, we can calibrate the sensors to further improve the accuracy of the telescope.

TV/WALL MONITOR

The Samsung TV has been mounted on the wall and connected to the computer which should enable us to view objects from the wide field refractor in the viewing room via the video link. The TV can also be used to show computer programs such as Stellarium, or we can used the DVD player to show educational documentaries.

SKYWATCHER MAKSUTOV

I have fitted the small right-ascension motor to the `scope and it seems to be tracking reasonably well. My only concern is that it is a bit noisy when compared to the RA motor on the Lunt which runs silently.

COMPOUND FENCE: I am still hopeful that we can treat the bottom section of the fence before the year is out. If we get enough volunteers, we could do the job in a couple of hours.

EXTERNAL STORAGE

Paul has suggested that we look into the possibility of obtaining an external storage unit which we would use to store various pieces of durable hardware (including the case used to pack the LX200) thereby freeing up space in the office. One alternative is to use packing case itself as a storage unit, should it prove to be big enough.

Highland Skies – November 2012

November is a fantastic month for observing. The winter constellations are beginning to rise, we've adjusted to the new, improved (and earlier) times for nightfall, and to top it all off – Jupiter is back!

Jupiter is nestling between the horns of Taurus at the moment, and is a superbly rewarding target for any type of optical aid. Binoculars will show the steady dance of the four Galilean (or Medicean – Galileo dedicated the moons to the four brothers in the Medici clan, seeking to gain approval and patronage from Grand duke Cosimo II of Tuscany by so doing) moons around the planet itself. Be sure to mount them on a tripod so that you can have a steady view with no jiggle.

A small telescope of up to four or five inches aperture will show cloud detail on the disc of the planet itself, and may even reveal the moons to be tiny discs themselves. The belts and zones across the planet's disc contain a wealth of detail. To observe it most efficiently, wait until the planet is high enough above the horizon to be clear of the turbulent "seeing" caused by looking through a thicker layer of atmosphere. Also, make sure your telescope is cooled down to ambient temperature. If the air inside your telescope tube is warmer than the outside air, the image will shimmer and dance as the warmer air moves and cools. This applies to all types of telescope, though refractors tend to suffer less and cool more quickly than other types.

Large Schmidt-Cassegrains or Maksutovs are probably the worst offenders, as they have two large pieces of glass, which also have to cool; the corrector plate at the front of the telescope, and the mirror at the rear. A good trick to help these telescopes to cool more quickly is to take them outside earlier than you intend to use them, position them so that the rear end which holds the eyepiece is pointing upwards, and remove the rear cap or diagonal. This opens up a hole into the interior of the telescope tube, allowing the warmer air to escape more quickly. If you are concerned about dust, insects or small meteors falling inside the tube, simply put a piece of gauze over the aperture. The air will still get out but contaminants won't get in. Apart from the meteors, possibly.

The solution for Newtonian reflectors, which are open to the air at the front, is to simply leave them standing, or employ lower magnifications while waiting for the temperature to settle. Explore some open clusters or large star-fields, or even do some galaxy hunting while you wait for thermal

equilibrium to arrive. Once done, you'll find that the higher magnifications will yield much more stable images. You'll still have to contend with atmospheric seeing conditions, but at least your telescope will be doing the best that it can. Assuming it's collimated, of course…

Uranus is within reach of small to medium telescopes at the moment, sitting below the constellation of Pisces, in a fairly easy to find location. Be warned though, there's not an awful lot to see on it. Medium magnification with reasonable aperture and decent sky conditions will reveal the planet as a blue-tinted "fuzzy star". If you're able to get to higher magnifications, it will show an apparent disc, but that's really the best to hope for. Apart from the fact that you can then tell everyone that you've seen it, which counts for something as there are an awful lot of observers who have never observed Uranus with their own eye!

If that's too much planetary talk for you, well there are plenty of deep sky objects for you. Orion is rising, bringing with it a smorgasbord of objects all its own. Imagine if Orion was the only constellation in the sky – just that one giant hunter, all alone in the night sky and no other constellations anywhere else. There would still be plenty to keep you busy all winter long!

Antony