TRANSIT

The Newsletter of

Cleveland & Darlington Astronomical Society

05 February 2009

The spirit of IYA2009
(NASA APOD)

Front Page Image : Of course, everyone is concerned about what to wear to a solar eclipse. This is a great example though, especially for the first eclipse of the International Year of Astronomy 2009. In the picture, recorded during the January 26 solar eclipse from the grounds of the South African Astronomical Observatory at Cape Town, repeated images of the eclipse adorn a well-chosen shirt. The effect is familiar to eclipse enthusiasts as small gaps, commonly between leaves on trees, act as pinhole cameras to generate multiple recognizable images of the eclipse.

Last meeting : 09 January 2009 – Members night. The meeting started with the Society 2009 AGM covering the new Constitution and election of the Committee members.This was followed by short talks presented by members of the Society.

The Planetarium Director, Dr Ed Restall, announced that the Planetarium was still closed awaiting a final report. He also advised that bookings for the Parish Hall for the next two months would be wise. He then presented pictures and plans for a very large expansion of the Planetarium Complex and Observatories

Neil Haggath gave an illustrated talk on his visit to the Russian Space Centre in Moscow, arranged by a UK travel Organization. His enthusiasm and "awe" at seeing and "actually touching" revered space artifacts such as the Sputniks, Lunakhods, Vostoks, Voshkods and Soyuzes shone through

Michael Roe recounted his investigations into Globular Clusters. We were all inspired to find out more about these amazing celestial objects.

John Crowther gave us one of his typically personal and amusing talks on the "Shape of the Sky" and how perspective changes the apparent size of the Moon and the Starry Heavens. He had made a model, showing the flattened sphere shape the brain constructs from the visual information.

There were two new members, Colin Bacon and Richard Jackson, who were welcomed to the Society and given new member's information packs.

Next meeting : 13 February 2009, "X-Ray Astronomy" by Dr Tim Roberts, of Durham University

Please note the venue for the next meeting :-

7.15pm for a 7.30 pm start, Grindon Parish Hall (in Thorpe Thewles, our previous meeting place).

Letter to the Editor

From John Crowther

Slowly over the months, playing through my collection of 33 rpm LP records, (uncompacted discs!) I played the “Selections from the P.B.S. television series “Cosmos” by Carl Sagan.

On the inside of the record sleeve there is information about the music and small reproductions of six imaginary space art paintings. Perhaps Michael Roe did one!

I quote from the sleeve – “The first ships to sail the seas of space have been robot emissaries designed to reconnoiter the nearby planets. But some, like Voyager, will sail on outward bound and indestructible in the vacuum of space”.

So now far beyond those newly discovered Kuiper Belt bodies and journeying through interstellar space, Voyager and its information disc has just a minute chance of being found by an extra-terrestrial civilization.

If it was found would it be interpreted and understood? For our technology is rapidly changing and improving yet growing ever more complex. Yet to a superior civilization it would be perhaps be unbelievably primitive.

For instance I remember cylindrical records being played in the Physics Lab at school, worn and scratchy and difficult to hear. My friend had the next development, a wind-up gramophone with a horn speaker. I am behind myself now with just LPs and tapes. No CDs, I-pods or any other modern music machine.

In an H.G. Wells story set far into the future he mentions vertical spinning, talking discs. But even his vivid imagination didn’t foretell the reaching out of Pioneer spacecraft or the work of S.E.T.I. with radio telescopes.

Dear Editor,

From Neil Haggath,

A few comments, in response to Michael Roe’s article last month, “Why Pluto IS the Ninth Planet”.

Unlike Michael, I agree with the IAU’s decision to downgrade Pluto to a “dwarf planet”. After all, we have known for years now that Pluto is simply one of many Kuiper Belt Objects – and since the discovery of Eris in 2003, it has even lost the distinction of being the biggest! Surely the classification, or re-classification, of

astronomical bodies should be done for sound scientific reasons, not for reasons of history or pure sentimentality!

If we define a planet purely in terms of size, then it follows that if Pluto is a planet, then so is Eris (and any as yet undiscovered KBOs which might also be bigger than Pluto); conversely, if Eris isn't, then neither is Pluto. To say that any object bigger than a certain arbitrary size, and conveniently choosing that size limit so as to include Pluto, is contrived and absurd.

In contrast, the IAU's new definitions depend upon strictly defined physical critieria – though one of these is, as Michael pointed out, pretty badly worded. A quick recap: Both planets and dwarf planets must be in a state of hydrostatic equilibrium, i.e. big enough for their gravity to have formed them into a roughly spherical shape. Any body which doesn't meet this criterion is a "small body". The distinction between a planet and a dwarf planet, according to the IAU, is that the latter has "swept its orbit clear" of other smaller bodies. So far, the known bodies which meet the first criterion, but not the second, and are therefore classed as dwarf planets, are Pluto, Eris and Ceres for certain, and probably Quaoar and Sedna.

Now, while the *intention* of the "swept its orbit clear" criterion is quite clear, its wording is rather ambiguous. As Michael says, it's possible, by a deliberate misinterpretation, to argue that this excludes the Earth (which hasn't exactly "swept its orbit clear", because it has the Moon) and even Jupiter, due to the Trojan asteroids.

I would propose, therefore, that this criterion be replaced with "gravitationally dominates its orbit and its vicinity". This obviously *would* include the Earth, as the Moon is gravitationally bound to it, and Earth-crossing asteroids which come close to it have their orbits significantly perturbed. Ditto Jupiter, as the Trojans are held in their orbits by the interaction of its gravity and that of the Sun. This definition would remove any ambiguity; all of the eight major planets clearly do "gravitationally dominate" their vicinity, while Pluto, Eris and Ceres clearly don't.

I'll also mention a further curiosity about Pluto. Before its "demotion", Pluto and its large satellite, Charon, were often referred to as a "binary planet", rather than as a planet and satellite. Now, presumably, they are regarded as a "binary dwarf planet"! Does anyone know why this is?

Well, I'll tell you. For every other planet-satellite combination in the Solar System, the barycentre – the common centre of mass, around which both bodies revolve – is located within the body of the planet. Yes, this even applies to the Earth and Moon, as Earth has 81 times the mass of the Moon, but their separation is only 60 Earth radii. But Pluto and Charon are different; they are the *only* pair of bodies, whose barycentre lies in empty space between them.

Skylights - February 2009

from Rob Peeling

The Moon

02 Feb	09 Feb	16 Feb	25 Feb
First Quarter	Full Moon	Last Quarter	New Moon

For the sleepless, the Moon occults the Pleiades between 2 am and 3 am on Wednesday 4th February. You may hear about a penumbral lunar eclipse on 9th Feb, however this one will not be visible from anywhere in the UK. Penumbral eclipses aren't very spectacular so we shouldn't feel too hard done by. On Friday, 27th Feb, look out for the crescent new moon, very close and beneath Venus in the western sky.

Planets

Venus continues to be very prominent in the evening sky. As it is the 400th anniversary of the invention of the telescope, why not have a go at replicating Galileo's discovery of the phases of Venus. Try tracking the changing phase of Venus as the month passes. Notice the diameter of the planet also increasing by nearly 50% through the month. This is because Venus is approaching Earth and will overtake on its inside track around the Sun to become the Morning Star later in the year. Galileo's two surviving telescopes have magnifying powers of only x14 and x20. To do the challenge properly you are therefore restricted to using binoculars. Good luck!

Date	01 Feb	10 Feb	19 Feb	28 Feb
Phase	41%	35%	28%	20%
Diameter (arcsecs)	29.8	33.8	38.6	44.4

Data: Sky & Telescope Feb 2009

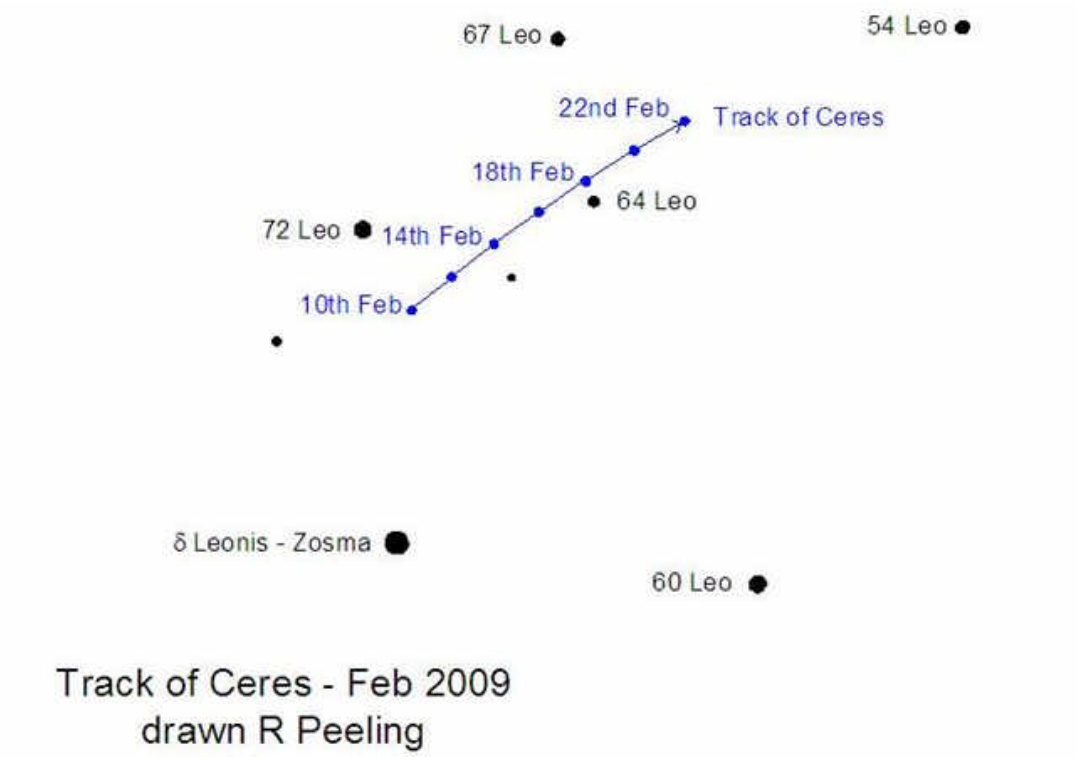
As a further experiment to experience Galilean astronomy, fit your highest power lens to your telescope and try to find Venus ***without*** using a finder. The concave objective lens in Galileo's telescope gave him a very narrow field of view. Increasing the power of your lens will limit the field of view with your telescope.

Saturn is rapidly becoming an evening object. It is well placed to the southeast at 23:00 on the 15th Feb and becoming increasingly convenient to observe from then on. This year the rings will be edge on viewed from the Earth. Dave Blenkinsop has already reported seeing them very nearly edge on (to me on 9th Jan). He remembered the last time this happened (14 years ago) that Saturn became like a paler version of Jupiter with obvious cloud belts. He thinks that glare from the rings makes the belts less obvious at other times. Look for it

beneath Denebola (β Leonis) and the triangular asterism that marks the hindquarters of Leo the Lion.

Dwarf Planets

No, I don't mean Pluto. This February is a good opportunity to track down another member of this new group of solar system bodies – Ceres. Giuseppe Piazzi discovered Ceres on January 1, 1801. Initially hailed as a new planet it was demoted even more quickly than Pluto as its small size became clear and further members of the asteroid belt were discovered in the following few years. Asteroid was the somewhat dismissive term that William Herschel (a famously successful planet finder!) gave the new objects.



Track of Ceres - Feb 2009
drawn R Peeling

I haven't seen Ceres yet, so I intend to follow my own advice. By 15th February, Ceres will be conveniently placed in the eastern sky at about 21:00. Look for the constellation of Leo. Look for the lion's backside that is formed by a clear asterism making a right angled triangle with beta Leo (Denebola) as the rearmost tip and the stars theta and delta making the short side. Delta Leo is the highest in the sky. From delta, look about 3° (about the width of two fingers held at arm's length) to the north i.e. up and to the left) for a 5th magnitude star 72 Leo. About 2° east of 72 Leo (a bit further up and to the right) is 7th magnitude 64 Leo.

Don't confuse it with 67 Leo which is a bit brighter and straight up in the sky from 72 Leo. On the 15th Feb, 64 Leo will appear to be a very wide and double star (both similarly bright) with Ceres lying about 60' closer towards 72 Leo. Ceres won't look any different to a star whatever magnification you try (that's why Herschel called it an asteroid i.e. "starlike thing"). The only way to be really sure you've found it is to look again another night. The movement of the dwarf planet should be obvious over two nights. Between the 10th and 22nd Feb Ceres will move from about 2° southwest of 72 Leo to 2° northwest of 64 Leo. At 7th magnitude Ceres should be easily seen in your finder or simply with binoculars. My old 8x40 pair would certainly do the job.

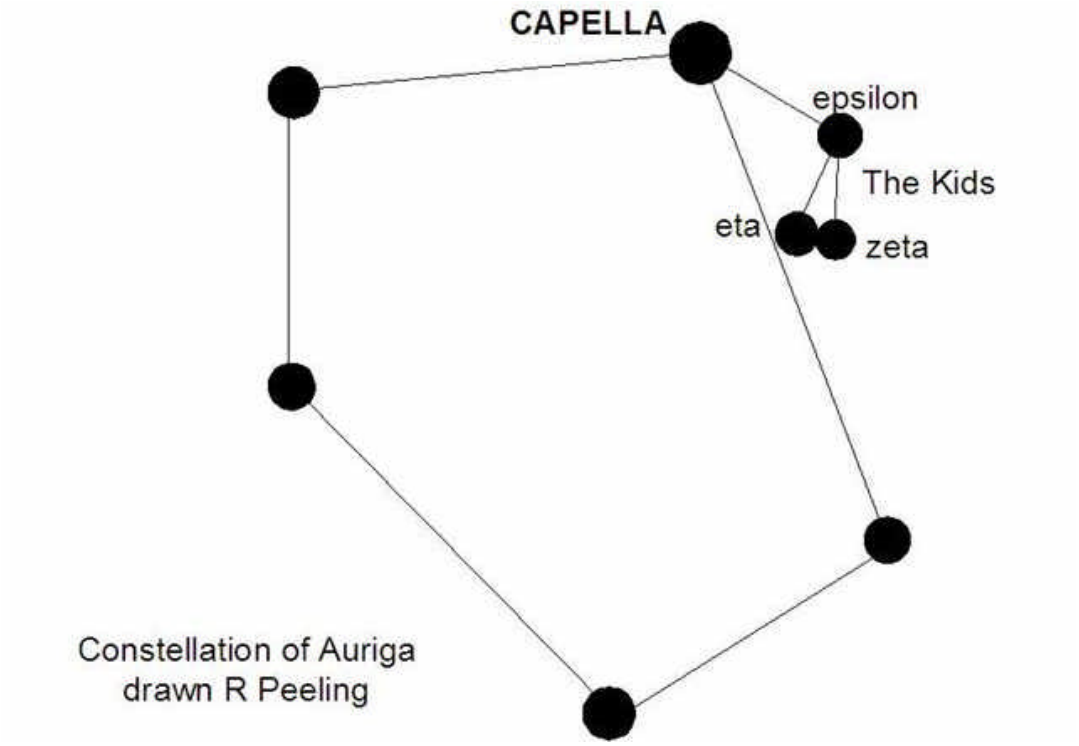
Meteors

There are no major meteor showers during February. The odd sporadic meteors (sporadic means not associated with any particular shower) may still, with luck be seen.

Deep Sky

Orion and its surrounding constellations will continue to dominate the sky in February (see Skylights for January). I will only draw your attention to one further star in this area of the sky this month. Take a close look at epsilon Aurigae. The eclipsing binary, Algol, the Demon Star in Perseus is well known and is one we frequently point out at public observing nights. ε Aur is also an eclipsing binary but that's where the similarity ends. For epsilon eclipses only occur every 27.1 years. The show is due to begin this year in magnitude 3.8. It will reach minimum around December when the constellation Auriga should next be easy to see after the summer. The star then remains at minimum until about May 2011. The change will be easy to see with the naked eye but you need to familiarise yourself with ε Aur normal appearance now when it is still high in the west so you can spot the change in the autumn when in reappears in the east in September.

ε Aur is one member of an obvious triangular asterism called the Haedi or Kids which lies close-by to the southwest of bright Capella. The Kids looks like a dart with ε Aur marking at the thin pointy end nearest to Capella. The other two stars are η (eta) to the left and ζ (zeta) to the right. Whenever you get the opportunity between now and about May when Auriga sets in the early evening, compare the brightness of ε Aur with η (magnitude 3.1) and ζ (magnitude 3.8).



At the moment you should be able to see that ε is very slightly brighter that η. When the constellation reappears in September, ε will have noticeably changed to lie between η and ζ. At minimum in December, ε and ζ will be closely matched and η will be the brightest of the Kids.

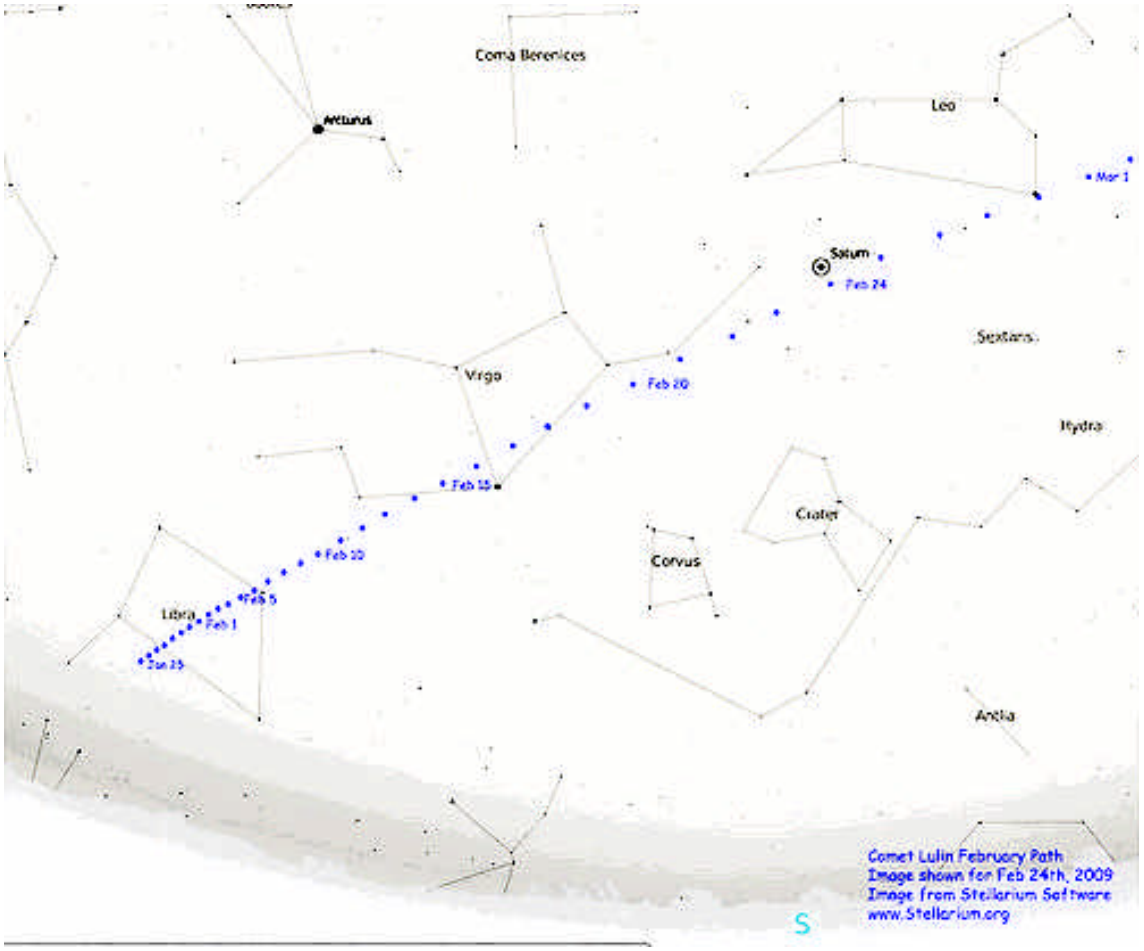
The best bit is that is very far from clear what exactly eclipses ε Aur. Astronomers hope to use this eclipse to clear up the mystery. ε Aur is a yellow supergiant and so whatever is obscuring it must be enormous. The best theory is a disk shaped cloud of dark, dusty gas which is held together by a binary star. It can't be a single star or it would shine through the cloud and have already been detected.

AN APPROACHING COMET – Lulin (C/2007 N3)

From Spaceweather.com

Comet Lulin (C/2007 N3), discovered in 2007 by a Strait-bridging team of astronomers from Taiwan and China, is swinging around the sun and approaching Earth. Amateur astronomer Gregg Ruppel sends this photo (below) taken Jan. 8th from Ellisville, Missouri:

"I caught Comet Lulin in morning twilight as it was passing 6th magnitude star 47 Librae," says Ruppel. "The image is a 24 minute exposure through my 10-inch telescope."



Comet Lulin is gliding through the constellation Libra in the southeastern sky before dawn: sky map. It glows like an 8th magnitude star, so a mid-sized backyard telescope is required to see it

Visibility will improve in February as the Earth-comet distance shrinks. At closest approach (0.41 AU) on February 24th, the comet should brighten to about 5th magnitude--dimly visible to the unaided eye and an easy target for binoculars: ephemeris.

Surprises are possible. The hyperbolic orbit of Comet Lulin suggests this could be the comet's first visit to the inner solar system. How it will react to increasing sunlight is anyone's guess. Stay tuned for updates in the weeks ahead

From Facebook (*whatever that is?)*

You know you're an astronomer when...

1. You see a very bright star and know that it's actually Venus.

2. You know the names of specific craters on the Moon.

3. You know the significance of the phrase "Oh Be A Fine Guy/Girl, Kiss Me" or as we knew it in my high school astronomy class... "Oh Boy, A Fat Girl Kicked Me".

4. You know the difference between an asteroid and a comet.

5. You have a personal vendetta against the weatherman.

6. You know that Olympus Mons is the tallest peak in the solar system and which planet it's on.

7. You've spent the night with your significant other... watching a meteor shower.

8. You've changed the lyrics of "Twinkle, Twinkle Little Star" to make them factually correct.

9. You know the phrase "a mere billion years" is not an oxymoron.

10. Someone mentions Jodie Foster and you think of Eleanor Arroway.

11. You've been in a debate over whether Pluto is a planet.

12. You know that Pluto really isn't a planet and shouldn't have been considered one to start (as sad as it may be).

13. You can give the mass of the sun, the average distance between the Earth and the sun, and the value of the gravitational constant off the top of your head.

14. You know the exact value of the speed of light.

15. You've decorated your room with a reproduction of your favorite portion of the night sky.

16. You've used Polaris to find the Big Dipper.

17. You know what NASA stands for.

18. A friend of yours thought you were studying Astrology.

19. You can pronounce Betelgeuse, Uranus, Charon, and Cassiopeia at least two different ways each.

20. You know the actual pronunciation of Uranus is "your a nus", not "your anus".

21. Someone casually wonders aloud how many planets out there might be able to support life you immediately think of the Drake equation.

22. You think the purpose of life is to study the sky.

23. You've ever wondered how much you'd be fined if you blew out all of the streetlights on your street so you could see the stars better and if its worth it.

24. You ask for a telescope for Christmas/Birthday/any other gift-giving holiday.

25. You pronounce "Maria" with the emphasis on the first syllable.

26. While observing in the middle of the night in an open area, policemen come up to you and want to know what you're doing.

27. You race to the bookstore when the new issue of Astronomy Magazine or Sky and Telescope comes out.

28. You have Astronomy podcasts on your ipod.

29. You know every line to Apollo 13, and have possibly read the book.

30. Your heroes include Galileo, Isaac Newton, Albert Einstein, Johannes Kepler, Tycho Brahe, Carl Sagan, and many others.

31. You're incredibly proud of your 2nd place medal in the local pub quiz when there were a lot of astronomical questions.

32. When you see a list of the zodiac and you get annoyed if they're not in the right order of procession.

33. If it's clear out and the seeing is good, observing takes priority over sleeping, eating, and tomorrow's workday!

34. You pack more observing equipment than clothes for a two week vacation.

35. You'll stand outside for hours in the 18 degree C weather to watch the lunar eclipse.

36. Whilst looking through hardware stores you look at the various utensils and containers wondering if it will come in useful for something !

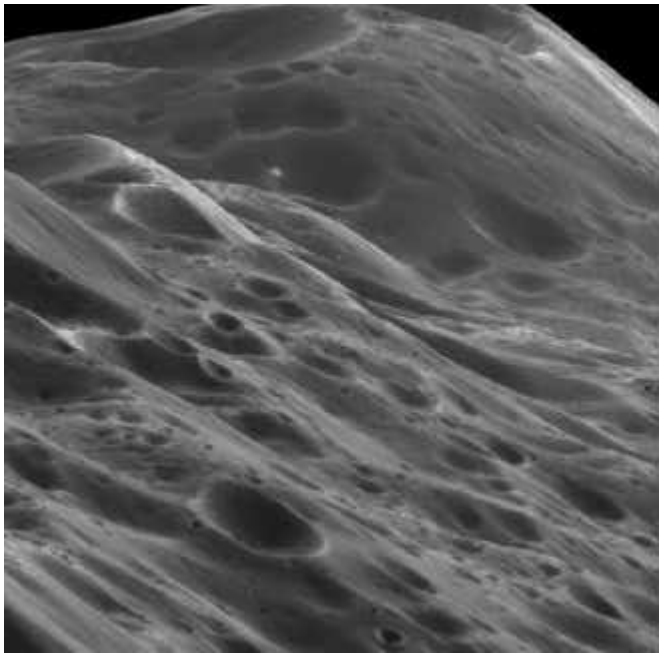
Can you think of anymore?

Transit quiz questions for the February 2009

From Rod Cuff

Where in the Universe? Photo quiz

Where in the Universe? A pictorial challenge. Of what, where and when was this image taken**?**



Q 1. Where in the Solar System are the following craters?
(a) Manson
(b) Manton
(c) Marca
(d) Marci
(e) Mark Twain
(f) Musa
(g) Mush

Q 2. Put these in order from the centre of the Sun:
chromosphere, convective zone, core, corona, heliopause, magnetopause, photosphere, radiative zone, transition zone

Q 3. What do these have in common:
dark matter, the Higgs boson, dark energy, Population III stars, and the Oort cloud?

Q 4. What are:
(a) a blue moon?
(b) a moon dog?
(c) a mock moon?
(d) a moon dial?

Q 5. Which stars have names that mean the following?
(a) the rival of Mars?
(b) the hand of Gemini?
(c) the follower?
(d) before the dog?
(e) female warrior?

Q 6. In November 2008, three star systems hit the astronomical (and some general) headlines for similar reasons. Why, and what systems were they?

A Life Under the Stars – Part 7

From Dave Blenkinsop

I have been thinking about the things I have seen and experienced in my life as a stargazer. How many things do you remember?

I start with Comet Arnold-Rowland seen in 1957, a bright naked eye object.

Do you remember Echo 1? What was Echo 1? It was a 100 foot diameter balloon made of a silvery material placed into low Earth orbit. It appeared at

approximately first magnitude. Later Echo 2 was placed in orbit, this was a 200 foot diameter, also made of a silvery material, seen as bright as Jupiter.
The balloons were used to reflect radio signals from Earth and then back to Earth. They were flown in orbit in the 1960's.

In the 1970's we could see Sky Lab. The satellite times and where to look in the sky were listed in the Daily Mail and the Sun, it was a big newspaper in those days.

One evening in the late 1960's I was walking in Middlesbrough, the sky was, I looked up at the crescent Moon but it looked the wrong way round.. As a stargazer I realised it was an ongoing lunar eclipse. So I went home to have a look with my 4.5" Newtonian.

Looking at the sky one evening and seeing a lot of meteors. That it was in the 1960's. I think it was the Geminids, they were coming from the east at a low angle and appeared to be slow moving.

Do you remember at about 1989 or 1990 there was a total eclipse of the Moon on the night of the Society meeting at the 6th Form Collage. The sky was clear and the Moon turned a pale copper colour. I had my 6" telescope with me and set it up. There was an 8" Schmidt set up too.. We did see totality.

We then went into the meeting but when we came out it was all over. Incidentally the lecture was about telescope optics.

What about the day we went to Alanheads. It was an organised meeting at the village school. It was cloudy but after dark it became clear, the sky was fantastic! The Bee Hive cluster was like a big faint full Moon to the naked eye.
I had Steve Sawdon and David Weldrake with me, I had also taken the 10" Dob and the 8" equatorial, it was a bit of a squeeze with the mounts in the car and the tubes on the roof rack. David Weldrake used the 10" and with the 8"
I found NGC891, an edge-on galaxy in Andromeda. Darran Bushnall and Eric Housely were there too.

Darran showed me the Pacman Nebula with his 8" "Dark Star" Dobsonian fitted with a nebula filter. Another object he showed me was IC434, that is a bright nebula behind the Horsehead Nebula and observed with a H beta filter, I didn't see the Horsehead. I own a H beta filter but it has shown me nothing at all. We also saw two comets, I don't recall which they were. We drove home the next morning in daylight.

Talking of light, what about the night we were coming home from Jodrell Bank? It was a cloudy day on the way but it was a clear night on the way back in the coach. We had a fantastic Aurora display.

One evening Steve, Paul and me were at Dave's house in the garden. That was just after Dave got his 12" Dobsonian. We couldn't use it because of the clouds but we were enjoying a fine warm summer evening. There were small gaps in the cloud and little bits of blue to be seen. I was looking down at the time when everything lit up. I said "lightning" but Paul and Dave said it was a meteor. What seemed like ages after we heard the sonic boom.

Some months later Steve, John Fadian, Mark Rice and I were at the Castle Eden Walkway to do an observing night when we saw a bright green meteor with sparks coming from it, it looked fantastic but there was no sonic boom this time.

And also the summer night when I saw the noctiluscent clouds. Then there was the day of a total solar eclipse as seen (or not seen!) from England. John and I were showing the public the Sun at the Castle Eden Walkway. It was a bright sunny day. The eclipse started at 10.00am, I got there just in time after working a night shift. I thought it would not go dark near totality but it did and it cooled down. It was an annular eclipse with a big white ring still visible around the Sun. This was because the Moon was at its furthest point on its elliptical orbit and didn't quite cover the Sun at the time of the eclipse.

On another fine summer day in 2003 there was a transit of Mercury across the Sun. I did a projection with my 6" scope just outside my front door and then I went back to bed as I was working the night shift.

In 2004 a number of our Society members were at the Castle Eden Walkway to observe the transit of Venus. When I looked through Rob Peeling's Mylar filte with the naked eye I could see Venus as a black dot. When I looked at Venus on projection or with the Mylar filter on the telescopes I could see a brownish border around Venus.

Here is one for Michael Roe. I was giving Michael a lift home after a Society meeting. When we were going along the Parkway Michael said he could see the Northern Lights, Aurora Borealis. When we got further up the road we were able to turn off into an open area where we had a clear site of the eastern sky. There was a beam of green light going from the zenith to the horizon. In the west was a red beam of light going from the horizon to the zenith. It was changing all the while then it went coronal, that is when a large oval of grey light appeared at the zenith with beams of light coming from it down to the horizon.

When we looked north there as a bow of grey light, somewhat like a rainbow but much shallower and much longer. Altogether it only lasted about ten minutes, less time than it took me to write about it.

As a telescope user and double star observer we know that when we look a6 some double stars we see contrasting colours and we know that some of the colours are contrast effects. Here is an interesting experience I had many years

back. I was in the back yard with the telescope when a bright satellite passed close to Vega. Vega was high up. When the bright satellite was near Vega the satellite looked yellow and Vega looked a strong blue. I kept looking at Vega and as the satellite moved away Vega slowly turned the usual white.

I was at Castle Eden many years ago to do an observing night with Charles Rees. I lifted the Dobsonian mount out of the car and was looking down when the ground lit up as if it were like a full Moon coming from behind a cloud. We looked up and saw an Iridium satellite flash as bright as Venus and the fast fading out, it was fantastic.

That is why we are astronomers!

Answers to the Quiz in January 2009 Transit

from Rod Cuff

Photo quiz - Where in the Universe?

Photo answer : . This was Comet Shoemaker-Levy 9 (named after its co-discoverers), which is often referred to as the "string of pearls" comet. It is famous because it collided with the planet Jupiter: the comet's original single nucleus was torn to pieces by Jupiter's strong gravity. The pieces are seen in this composite of Hubble Space Telescope images to be "pearls" strung out along the comet's orbital path. This image was taken in 1992, and in July of 1994 these pieces collided with Jupiter in a rare and spectacular series of events.

Q1. Here are some satellites that are or were in Earth orbit, each known by an acronym. What do the letters stand for, and what are/were the missions?

(a) IBEX
(b) INTEGRAL
(c) IRAS

A1. (a) Interstellar Boundary Explorer (www.nasa.gov/mission_pages/ibex): a NASA mission launched in 2008 to detect interstellar particles bouncing off the edge of the heliosphere (the outer edge of the Solar System). There's a video at http://uk.youtube.com/watch?v=fk6RIl_QA1Q
(b) INTErnational Gamma-Ray Astrophysics Laboratory (www.esa.int/esaMI/Integral): a European mission launched in 2002 to look at the gamma-ray sky, and in particular gamma-ray bursts.

(c) Infrared Astronomical Satellite (http://irsa.ipac.caltech.edu/IRASdocs/iras.html): a joint US/European mission launched in 1983 that was the first mission to survey the entire sky in the infrared. Although its mission lasted only 10 months, it's still up there ...
[To find out when you can see any of these from your back garden, got to www.heavens-above.com, click on 'Select a satellite' and type in the satellite name.]

Q2. What first (of many) was found on 1 January 1801? When and what was the next?

A2. Ceres (www.planetary.org/explore/topics/asteroids_and_comets/ceres.html), the first asteroid to be discovered, was found on this memorable date by a Sicilian monk, Giuseppe Piazzi (http://tinyurl.com/9ur22q). It's the largest known, and was recently reclassified as a dwarf planet, keeping Pluto and others company in that category (http://tinyurl.com/8btowo). The next to be discovered was 2 Pallas, by Heinrich Olbers on 28 March 1802.

Q3. What's this sequence of dates all about? Can you fill in the missing entry?

July 20, November 19???, February 5, July 30, April 20, December 11

A3. A half-trick question (the answer to the second part should be 'No' ...). Those were the dates when the Apollo missions from Apollo 11 onwards landed on the Moon (http://nssdc.gsfc.nasa.gov/planetary/lunar/apollo.html). The missing one was Apollo 13, which famously had to abandon the idea of landing and instead had much of the world crossing its collective fingers as its crew struggled back to Earth (http://tinyurl.com/7vyxqv , or, if you prefer, www.imdb.com/title/tt0112384).

Q4. Viewing other Solar System planets from Earth, what is:

(a) an inferior conjunction?
(b) a superior conjunction?
(c) opposition?
(d) a syzygy?

A4. (a) The moment when the planet passes approximately between Earth and the Sun (which can occur only with Mercury and Venus). If the three bodies are exactly in a straight line, it's a transit (for the 2004 and 2012 transits of Venus, see www.transitofvenus.org; and for transits of Mercury, see http://eclipse.gsfc.nasa.gov/OH/transit06.html).
(b) The moment when Earth and the other planet are on opposite sides of the Sun, but all three bodies are again nearly in a straight line. This can occur with any other planet. There are many conjunctions in 2009: see www.rasnz.org.nz/SolarSys/09Planets.htm

(c) (Here 'opposition' is really a shorthand for 'opposition to the Sun'.) The moment when Earth passes between the other planet and the Sun -- in other words, when a watcher on the other planet would see Earth as in inferior conjunction. So neither Venus nor Mercury can be in opposition [to the Sun].
(d) Any of the above, and then some ... It's the alignment of three or more Solar System bodies: e.g., Sun, Earth, Saturn; Earth, Sun, Mercury; Earth, Mars, Jupiter.

Q5. For most CaDAS members, what do the members of each set of constellations have in common?
(a) Cassiopeia, Cepheus and Draco?
(b) Centaurus, Carina and Tucana?
(c) Carina, Puppis and Vela [for a reason different from that of (b)]?

A5. a) They're all circumpolar -- in other words, at UK latitudes they never set (http://tinyurl.com/8492xp).
(b) ... and these never rise -- they're all near the South Celestial Pole (www.vimeo.com/1894786).
(c) These three, plus Pyxis, once made up the single constellation of Argo Navis ("The ship Argo", sailed in by Jason and the Argonauts when searching for the Golden Fleece: see www.mythweb.com/heroes/jason). It was split up by De Lacaille in 1763 (http://tinyurl.com/8y3lno). Carina means 'keel'; Puppis, 'stern' or 'poop'; Vela, 'sails' (and Pyxis, 'compass'). Try to figure it all out from www.usno.navy.mil/library/rare/bayer9.jpg

Q6. What are these, and where would you find them?
(a) A Crab?
(b) A horse's head?
(c) An Owl?
(d) Tiger stripes?

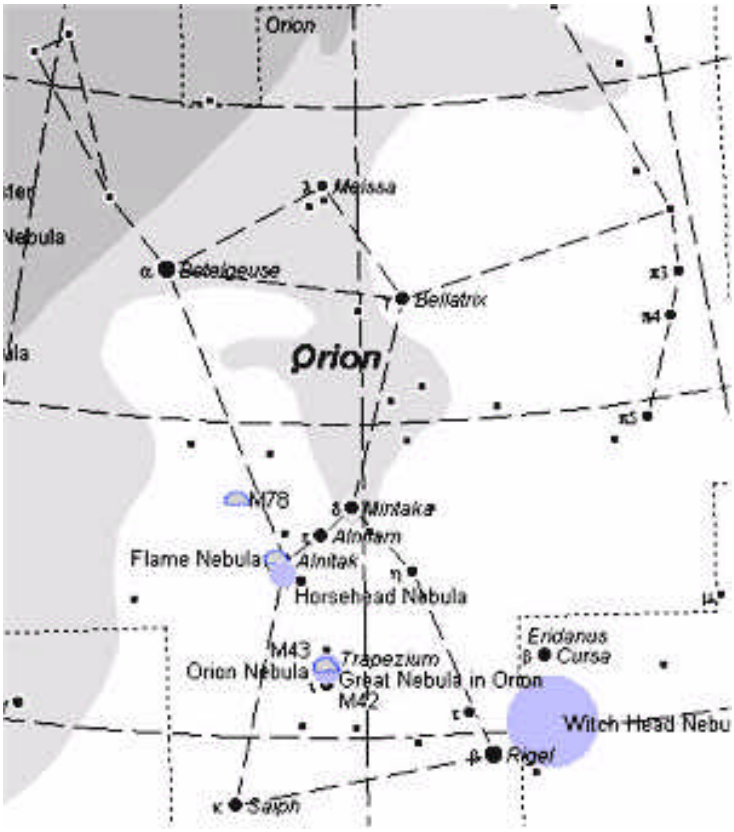
A6. (a) The Crab Nebula (M1), in the constellation of Taurus, is a remnant of the supernova that was seen to explode in 1054 AD (www.seds.org/messier/m/m001.html). OK, you could also have chosen the constellation Cancer ('crab') ...
(b) The Horsehead Nebula (Barnard 33), in Orion, is a dark dust-cloud (http://tinyurl.com/8stnox), much photographed (http://tinyurl.com/8wwmyh).
(c) The Owl Nebula (M97), in Ursa Major, is a planetary nebula, the sloughed-off hot gaseous shell of a red giant star (www.seds.org/messier/m/m097.html). [So the 'nebulae' ('clouds') in (a)--(c) are all quite diffent types of object.]
(d) This is the name that's been given to a set of deep, nearly parallel, linear markings on Enceladus, a moon of Saturn (http://tinyurl.com/9766g4). These too

are much photographed (http://tinyurl.com/7ckg7z), mostly by the Cassini Mission (http://saturn.jpl.nasa.gov).

The Splendour of the Hunter

By Andy Fleming

The constellation of Orion is one of the most magnificent spectacles in our night sky. It is one of the brightest constellations, defying the Tees Valley's worst light pollution. Lying on the celestial equator, it is visible to the unaided eye in northern skies from late autumn to early spring. What's really nice about Orion is that it actually resembles the object it's named after - the hunter in Greek mythology. The whole constellation is full of bright stars and deep sky objects, the former being visible with just the naked eye, many of the latter being visible with a good pair of binoculars or a small telescope.



I often enjoy a speedy tour of the bright objects in Orion, starting in the north east with Betelgeuse, alpha Orionis, a variable red supergiant and one of the largest stars known. At magnitude 0.6, it is a beautiful yellowy-orange colour and looks stunning however you view it. This star is only 600 light years from the Earth,

and has an age of only 8.5 million years. However due to its immense mass (950 times that of the Sun) and size (its diameter if located in our Solar System would be larger than that of the orbit of Mars), astrophysicists predict that it will explode within the next thousand years (indeed, it may have already done so).

Further north west and defining the hunter's head is Meissa, a multiple magnitude 3.4 star, and then it is down to Bellatrix, a 1.6 magnitude multiple star marking Orion's right shoulder. To the west, pi Orionis marks out the centre of the hunter's shield shining at magnitude 3.7. Straddling the centre of the constellation is the asterism known as Orion's belt, three multiple stars easily visible to the naked eye. They are embedded nebulosity, visible through a telescope in dark skies. From south east to north west, they are Alnitak, Alnilam and Mintaka (shining at magnitudes 1.7, 1.8 and 2.3 respectively). Alnitak is surrounded by reflection nebulae, which includes the Horsehead Nebula, very difficult to see, without filters or CCDs.

For me, the most beautiful part of the constellation is the sword, which to the naked eye looks like three stars, the middle of which looks distinctly hazy and cloud-like. This of course is the Orion Nebula, M42 or NGC1976, 1,300 light years away and the closest large region of star formation to the Earth. It is a diffuse nebula, and deep in its centre is a young open cluster called the Trapezium, first discovered by Galileo in 1617. I find it stunning enough through binoculars, but through the telescope with a 20mm Plossl eyepiece it looks absolutely superb – it is incredible to think that you are looking at infant stars. I enjoy looking at M42 with a moderate eyepiece, a trade-off of course – a slightly larger field of view still retains the overall structure of the nebula.

Marking out the hunter's right foot is Rigel, beta Orionis, a blue supergiant that looks beautiful through my binoculars. It is almost always the brightest star in the constellation and in our region of the Milky Way at apparent magnitude 0.2. Rigel is almost 800 light years away and has a mass seventeen times that of our Sun. Finally, Saiph marks out Orion's left ankle, readily visible at magnitude 2.

In addition to being stunningly beautiful, Orion is a useful constellation for star-hopping to locate other celestial objects. To begin, our solar system is located in a minor spiral arm of the Milky Way called the Orion spur, wedged between the major Sagittarius and Perseus arms, and so named for its proximity to the stars in the constellation. Draw a line through Orion's belt, and follow it south east, and you come to the unmissable Sirius, lead star in Canis Major, one of Orion's faithful hounds. Follow the same line north east and you will come to Aldebaran, the brightest star in Taurus.

With so much on offer to view with modest equipment, it is not surprising that Orion is my favourite constellation. Go out and take a look before the hunter takes his summer break!

Astro Talks at Durham University

There is a series of free excellent talks – "Our Universe" - being held in Durham University organised by the Workers Educational Association WEA for those interested in astronomy and cosmology. All are welcome

Session	Lecturer	Date
A Beginners Guide to the Universe	Dr Pete Edwards	Jan 13
Modern Mountain-top Astronomy	Dr Jurgen Schmoll	Jan 20
New Views of the Planets	Dr Pete Edwards	Jan 27
A Users Guide to the Night Sky	Dr John Lucey	Feb 3
The Sun and the Stars	Dr Pete Edwards	Feb 10
Galaxies	Dr Kristen Coppin	Feb 17
The Big Bang	Prof. Carlos Frenk	Feb 24
Black Holes	Dr Tim Roberts	March 3
Dark Matter, the missing universe	Prof Shaun Cole	Mar 10
Astrobiology, the Search for Life in Space	Prof. Chris Done	Mar 17

When and Where :- Tuesday evenings at 6:30pm, Room OC218, Ogden Centre, Durham University.

Star Colours Explained

from the One Minute Astronomer

Here's a short primer on star colours and temperature to help you better appreciate what you see when you look at the stars in the night sky. Although this issue is a little technical, try to stay with it. In just a couple of minutes, you'll understand more about stars than 99% of people who've ever lived.

Basics

• Like most scientists, astronomers love to classify things. In the late 19th century, Harvard astronomers developed a system to classify stars according to the strength by which hydrogen gas absorbed light at particular wavelengths.

The star classes were labeled A to N in order of decreasing hydrogen absorption strength. After a time, the classes were simplified to O, B, A, F, G, K, and M. This is the Harvard spectral classification, which is still used today.

• As astronomers and physicists learned more about atomic structure and the spectra of light from stars, they discovered the Harvard classification system really described the temperature of a star's atmosphere. They discovered the type-O stars are hotter than type-B stars, and type-B stars are hotter than type-A stars, and so on.

• Stars radiate energy according to well-known physical laws, like glowing coals in a campfire. Just as a glowing red-hot coal is cooler than a white-hot coal, for example, so a red star is cooler than a white star, and a white star is cooler than a blue star. This was a major scientific discovery… simply by measuring the colour of light coming from a star, and applying a little physics, it was possible to estimate a star's surface temperature.
•Here's a summary of the dominant colour and temperatures of the main classes of stars, along with examples of stars that belong to each class:

Class	Temperature K	Colour	Example
O	30,000 – 60,000	Blue	Alnitak , Mintaka
B	10,000 – 30,000	Blue-white	Rigel, Spica
A	7,500 – 10,000	White	Vega, Sirius
F	6,000 – 7,500	White	Procyon, Sirius
G	5,000 – 6,000	Yellow-white	Capella, The Sun
K	3,500 – 5,000	Orange	Epsilon Eridanus
M	2,000 – 3,000	Red	Barnard's Star,Gliese 581

Deeper Look

• So the colour of a star is a consequence of its surface temperature. But a blue star doesn't emit only blue light, nor does a red star emit only red light. They emit visible light of all colours to some degree. It's just that their spectrum peaks at a particular colour.
• So why are there blue stars, yellow stars, red stars, but no green stars? As it turns out, there are green stars, that is, stars that radiate much of their light in the green part of the spectrum. But the total combination of the full range of colours of a "green" star appears white to our eyes. If you pass the colour from a whitish star through a prism, you'll see all the colours, including green, spread out in a continuum.
• Astronomers came to understand that bluer stars are intrinsically brighter because they are more massive than white or red stars, and more massive stars burn much faster and hotter than less massive stars. The bluish type-O stars, for example, are only 30-50 times more massive than yellow-white stars like our sun. But O stars burn a million times brighter, so they have far shorter lifetimes. O and B stars only last a few million years before they die in spectacular supernova explosions, while cooler and less massive K and M stars burn steadily for billions of years.
• Some 88% of stars in the universe seem to be the cooler type K and M. Only 1 in 3,000,000 stars are type O. Even middle-weights like our type-G Sun comprise only 8% of all known stars.

Good To Know

This relationship between star mass, luminosity, and colour holds only for stars burning hydrogen in the core during the prime of their lives. For example, young

and middle-aged M-type stars are small, faint and long-lived. But as stars age and start burning heavier elements in the core, bluish O and B stars, for example, evolve briefly into immensely bright M-type red stars known as red supergiants. We'll explain this in later issues. If it sounds complicated, fear not. Even astronomy majors wrestle

Mars Rover Spirit Encounters More Age-related Problems

Five years into a life expected to last 90 days, the rover failed to move after getting driving directions and didn't record a day's activities, NASA says. But it recovered and is back on the job.The long-lived Mars rover Spirit, already suffering from a gimpy wheel, has suffered a new round of aging problems in recent days, including a bout of what one NASA official called "amnesia."

NASA said Spirit reported last Sunday that it had received its driving directions for the day. But it had not moved. This was not a complete surprise, NASA said. There are a number of reasons the rover might not be able to move. It could temporarily be stuck in sand or on a hard-to-negotiate slope. It also might not be properly oriented to the sun, which supplies power to the rover's wing-shaped solar arrays.

In the past, rover drivers have been able to figure out a solution to each of those problems. After the latest difficulty, troubleshooters at JPL guessed the problem was bad positioning, so they ordered Spirit to locate the sun with its camera. The rover reported back that it could not find the sun. That was a surprise to rover scientists because they knew the sun was up. Later, on Tuesday, Spirit reported that it had finally found the sun, but not in its expected location. "We're investigating whether it's the gyros or a camera problem," Callas said.

The other trouble was even more of a surprise. It turned out that Spirit had failed to record last Sunday's activities in its nonvolatile memory, which remains active even when other systems are shut down. Callas referred to the problem as a 90-minute bout with amnesia.

Whatever the cause, Spirit later recovered its memory and was back on the job. "Right now, Spirit is under normal sequence control, reporting good health and responsive to commands from the ground," Callas said.

When Spirit and Opportunity landed on Mars in 2004, scientists were hoping to get 90 days of use from them. Instead, they've lasted five years, challenging the imagination of rover scientists to find new jobs for them.

"Is this an indicator the systems are wearing out?" Callas said, unwilling to speculate. "We can't say."

Contents – February 2009

Articles : Please send contributions for the newsletter to The Editor, Bob Mullen, 18 Chandlers Ridge, Nunthorpe, Middlesbrough, TS7 0JL, 01642 324939 (b2mullen@hotmail.com) Copy deadline date is the 25th of each month).