TRANSIT

The Newsletter of

Cleveland & Darlington Astronomical Society

15th December, 2001. Julian Day 2452259

Editorial

Planetarium Official Opening

The big news of this month, or even of the year, and one of the biggest events in the development of the Society, took place on November 9th, 2001. The superb new Planetarium Building was formally opened. Those of us who were lucky enough to attend the meeting were treated to a wonderful evening. On arriving at the car park, the new building looks modern, neat and well designed. On stepping through the door, it was breathtaking. I met Ray Worthy just inside the auditorium proper and all I could find to say was "Wow, what a place". It exceeded all my expectations, I have to admit. What to pick out? The inflatable dome for display of the planetarium-projected Sky at Night? The elegant seating and furnishings? The frieze of silhouettes of famous North-East landmarks? All these blend together to form a quite stunning interior. This is a resource that will be a great asset to the Society and indeed to the whole Cleveland and Darlington district. We are promised lots of further developments as the Observatory is improved and linked electronically to the planetarium for display of telescope images . Watch this space – and planetarium detailed news from John McCue.

The inaugural lecture in the Planetarium was by that star of astronomical lecturers, Dr Allan Chapman, FRS, who also formally opened the Building and unveiled a commemorative plaque. This man is a phenomenon. He stands before his audience, totally relaxed and without a note or a prompt to be seen. He then proceeds to give a fluent, unbroken discourse for about an hour. Not a hesitation, not an um, not an ah. Not only fluent, but interesting and amusing. I've heard him speak about 4 or 5 times now and always want to hear him again. His expertise is the history of science and medicine – including astronomy, of course. He introduced us to the rich astronomical history we have here in the Northeast and the important contributions made by North-Eastern astronomers. A fascinating evening all round.

Castle Eden Walkway

Don't forget that every Friday night is open night at the Observatory near Thorpe Thewles. Members of the public are welcome and Society members gather there with telescopes and advice. Tell your friends!

December meeting

Our next meeting will be on Saturday, December 15th at the Thorpe Thewles venue, between 2 and 5 pm, when the Society hosts the Thomas Wright Trophy Annual Quiz. This contest is between the local Astronomical Societies – Durham, York, South Shields and CaDAS. We look forward to a good turn-out to support the CaDAS team. Here is the ideal excuse to escape Christmas shopping for a few hours. The lecture following the quiz will be by Dr Paul Money, who is also chairing the quiz, talking on the subject "2Mass, A New View of the Universe".

January Meeting

Friday, January 15th , is Member's Night and Neil Haggath is looking for contributions. Please contact him or John McCue now, if you can give a short talk.

John's observatory

An important item of Society News is to report that John McCue has received the highest level of recognition for his CCD observations of asteroids and comets – currently C/2000wm1(LINEAR). He is now qualified as an accredited observer. The Minor Planet Centre, based at the Smithsonian Astrophysical Institute, USA, designated his Bradbury Observatory as IAU 937. There are only about a thousand observatories, amateur and professional, around the world with this accreditation.

CaDAS Website

Don't forget to visit our very own website and give John McCue your comments (www.stocktonsfc.ac.uk/mccue/caseden.htm).

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New Editor

You will have noticed that Transit has changed to something like its previous incarnation. Planetarium News will be reported in its own publication by John McCue, while I (Alex Menarry) edit Transit, to keep you all informed of Society doings and, of course, to give the usual outlet for members literary efforts. Please keep contributions coming in, sending them to me or John McCue (see the end of the Newsletter). It is my belief that a good newsletter is the agent by which members feel they are in touch with what is going on in the Society and want to contribute to its workings.. The intention is to fulfill that ambition with a regular, monthly, edition. This time Transit has been sent through the post. Please let me know if you would prefer a copy by email, which would save the Society some costs.

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Tuesday 8 November 2001

Auroral rays sighted at 21h 45m UT to north west. Rays were linear in appearance and short lived, only a minute or so but extended in altitude past Vega. Strong glow along the northern horizon thought to be auroral as opposed to sodium street lighting which normally dominate that aspect seen from this site.

from David Graham, Ripon.

The Great Asteroid Hunt

The Great Asteroid Hunt was a competition run by the Cleveland and Darlington Astronomical Society over the summer of 2001. It was devised and organised by Darran Summerfield to raise funds to contribute to the building of the public Planetarium near the Society's Observatory at Castle Eden Walkway, Teesside. Contestants were asked to find "more than 100" names of asteroids hidden in the word square included with the Newsletter.

The competition closed on 30th September, with only two people managing to find all 108 asteroids. They were our very own Neil Haggath and Peter Strugnell from Wiltshire. Unfortunately for Neil, Peter won the first prize of £20. Mrs Brigden, from Newtonmore in Scotland, won the runner up prize of £10. The competition raised £75 for the Planetarium Fund. A heartfelt thanks to all who contributed.
(Editor's Note: After many hours searching the square, I found about 80. I might have known that asrtomind Neil would find the lot.). Many thanks to Darran for the huge effort required to run this nation-wide competition. The asteroid names in the square are

Aase C14C17
Ada I16K14
Aegle A8 E4
Agathe S6 N1
Aglaja A8 A13
Aida D11A11
Aline A11E15
Alma O11R14
Angelina H8 A15
Ani Q6 S8
Anna P11A11
Anneliese L1 D1
Ara G16I16
Armor G5 C1
Asia H5 H8
Astrea A8 G8
Atala A13A17
Atalante A13A20
Ate R17R15
Bali P8 S5
Campania M2 T9
Cantabia A1 A8
Ceres A1 E1
Circe J2 N2
Claudia M2 G8
Danae D15N11
DesideraJ15A15
Dora F15C18
Echo E15h18
Edna J9 M12
Elektra H19N19
Elsa H3 K3
Eos R15P13
Eunomia H19B19
Euphrosyne A20J20
Europa D6 D11
Eurynome H13O13
Eva O13O11
Glauke O7 T2
Hansa N15J11
Hebe C5 F8
Hel F7 F5
Hermione I2 B2
Hersilia D4 K4
Holda S1 M5
Ida C11A11
Ino P2 R2
Io E2 D2
Iris F9 I12
Iva K6 M8
Jenny S13O9
Jokaste S13S19
Juno S4 P1
Leona K15O11
Li I4 J4
Lina D12A15
Lola Q19N19
Loreley Q19K13
Mandeville N13E4
May N9 N7
Meliboea O1 H8
Melopmene Q18Q10
Mnemosyne N13N5
Mocia M10Q6
Nemausa I20O20
Nephthys I20P13
Nestor I20D15
Nike E10H13
Oenone L15L10
Ohio L18L15
Olga H14K14
Pallas O3 J3
Parthenope O3 F12
PerseverantiT1 T13
Pia M4 K4
Philomela T1 L1
Pippa J7 N3
Psyche L5 Q10
Renate R20R15
Rhoda C12G16
Roma C3 F3
Rosa P15S12
Rosalia G2 G8
Sara J16G16
Senta P13T9
Siri F14I17
Sophrosyne M18D18
Sorga E1 A5
Svea N8 K11
Sylvania H15A8
Tea B15B17
Thalia E6 J11
Themis E6 E1
Thetis P16K16
Thyra L8 H12
Tokio S10O6
Toni S2 P2
Una I13K11
Urania B13G8
Ute D7 B7
Vala T6 Q6
Venetia T20N14
Vera T6 T9
Veritas T20N20
Vesta I8 M8
Victoria T20T13
Vienna T6 O11

Two contrasting reports on this year's Leonids, as observed (or not!) in Australia. I must admit I needed to consult an atlas to appreciate who was where.

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The Leonids in Australia

From Darran Summerfield

Just got back from Australia this morning. The storm was amazing. Over a 3 hour period I saw over 1250 meteors, 28 of which I would class as fireballs (by my definition brighter than Jupiter), I saw a fantastic Storm, and two dozen sky spanning atmosphere grazers at the start of the show. All in all a miraculous and surprisingly moving experience. If the photo's turn out I'll have something to show at the January meeting. I've included a table showing my observations...
Here are the entries from my journal relating to the Leonid meteor storm.....

Friday, 16th November, 2001
At 6 O'clock in the evening, departed for Australia. A 1 hour flight to London, then a 2 hour wait. A 12 hour flight to Kuala Lumpur and a 4 hour wait. Then a 5 hour flight to Perth and a 10 hour wait, and finally a 3 hour flight to Alice Springs.

Sunday, 18th November, 2001.
After my epic 36 hour journey to Alice Springs I collected my hire car and drove about 10 miles out of town to a local tourist spot called Simpsons Gap. For a few hours I enjoyed gazing at the stars of the Southern Hemisphere before fatigue force me to take a short sleep in the car. But I realised that I had forgotten something vital – insect repellent.

Monday, 19th November , 2001 (Australia Time)
Resumed my watch at midnight, set up my camp bed (which I had brought packed in my suitcase) and my camera. Thankfully the insects had decided to call it a night. Nothing happened for an hour and a half or so, I took a few practice photographs and noted a dozen or so sporadic meteors. I had forgot to find out time when the Leonid radiant would rise, so I wasn't sure when the show would start. By 1:20 I was getting a little Nervous that nothing was happening.
Then at 1:24 I saw my first Leonid. Having seen many Leonids on other occasions, usually they are bright and fast, this first one was a real surprise. It slowly, almost gracefully, traversed the entire sky, A bright, magnitude zero, yellow orange teardrop leading a blue smoke-like trail. It was going so slowly that it lasted more than six or seven seconds from start to finish. A few seconds later there was another, and then more, and at one point 3 of these wonderful meteors were fanning across the sky at the same time. It was an almost magical sight that reminded me of how I'd imagined the arrival of the Martians the first time I'd read 'The War of the Worlds'. These were earth skimming meteors, their tangential paths just brushing the tenuous outer atmosphere, allowing them To burn more slowly and last longer.
After 40 minutes or so, the Leonids started taking on a more normal appearance as the radiant climbed higher above the horizon. As well as making notes I also tried taking

photographs with exposures ranging from one to ten minutes. Will they work? From 2:00 to about 3:30 the rate of meteors gradually increased. Between 3:30 and 4:00 the meteors came in a torrent. During one 2 minute period I counted at least 50 meteors. Brief moments when the sky was quiet were few and far between. Often there was more than one meteor in the sky at the same time and at one point I counted 7 meteors appearing simultaneously. My favourite was a magnitude -4 fireball that sliced through The Southern Cross.
After 4:00 twilight began to interfere, at 4:45 I stopped recording. In just over three hours I had seen well over 1250 meteors, 28 of which I classed as fireballs (i.e. brighter than Jupiter). Until this evening I had only ever seen 2 fireballs in over 25 years of being an amateur astronomer.
I would guess that the maximum Zenith hourly rate was about 4000 just before 4:00. It was a magnificent and moving spectacle I will never forget.

Wednesday, 19th November, 2001.
At ten O'clock in the morning I arrived back at home. After a 4 hour flight from Alice Springs and a 4 hour wait, a 5 hour flight to Kuala Lumpur and a 3 hour wait. A 13.5 hour flight got me back to the UK, then I waited an hour before an hour flight back home.

Saturday, 24th November, 2001.
Sadly my photographs did not turn out. I suspect a malfunction of the camera.

I know the data below has no real scientific value, but it does illustrate the general rate trend as seen from Alice Springs. My adjusted column is simply 60 minutes divided by the period in minutes multiplied by the number of meteors seen in that period. It roughly equates to an hourly rate and shows up the general trend.

Local Time	Mins	Obs	Adjusted Hourly Rate
1:20-2:00	40	10	15
2:01-2:12	11	15	82
2:12-2:22	10	19	114
2:30-2:31	1	8	480
2:31-2:33	2	25	750
2:34-2:44	10	43	258
2:45-2:50	5	44	528
2:51-2:54	3	23	460
2:55-3:01	6	68	680
3:02-3:07	5	31	372
3:08-3:18	10	100	600
3:19-3:31	12	133	665
3:31-3:38	7	163	1397
3:40-3:45	5	88	1056
3:46-3:48	2	46	1380
3:50-3:52	2	50?	1500? At least 50 observed
3:59-4:06	7	108	926
4:06-4:12	6	71	710

4:13-4:17	4	43	645	
4:18-4:23	5	57	684	
4:24-4:27	3	42	840	Twilight Interfered
4:28-4:33	5	19	228	Twilight Interfered
4:34-4:39	5	29	348	Twilight Interfered
4:40-4:45	5	23	276	Twilight Interfered

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But another story from someone working in Australia

The Leonids 2001
from Dave Weldrake

Hi everyone. Hope things are OK. Well, have I got a story to tell you about the Leonids. What a complete disaster. We got SNOWED on, didn't see a single one and it was the worst night for weather in months.

Well, here's the story. We went up to Mount Clear (note the name! ed.) at about 2pm, beautiful day, 25 degrees. As we were eating our lunch, a huge anvil shaped thunderhead came over, and it absolutely poured down for about 2 hours. The temperature totally bottomed out, and by 5pm it was snowing. Yes, you heard right, it snowed like mad! We had to get out of there or risk being snowed in We sat there in the car in shorts and t-shirt getting snowed on, it was unbelievable. I haven't seen the weather change so quickly in all my life; a real 4-seasons in one day. So we were listening to the weather forecast on the radio, which said it'll be clear and 25 degrees in the city, so we decided to drive to Stromlo and see the Leonids there.

We arrived at Stromlo about 6pm. It was raining there and totally overcast, but we were convinced it would clear up later. So we cooked our steaks etc in the tearoom, and waited for dark. It actually stopped raining and started to clear up about 10pm, so now were getting all excited. We go off to check the weather forecast on the internet. The forecast is for the cloud to clear off later that evening - good stuff. So we stand around at midnight, partially clear skies, but of course its still too early to see any Leonids. We wait ill 1:30 and then walk over to the Oddey Dome to see them.
Five minutes after getting there, the wind changed direction and blew the cloud back over onto us, and it started to throw it down again. We noticed it was clear to the north, and sure enough on the satellite images it was indeed clear there, only an hour away. So we all pile in the car and drive to Boorowa, on the road to Siding Spring, maybe 2 hours north. When we get there, its now 3am by the way, its still pouring down with rain. We waited in the car for maybe an hour for any hope of it clearing up, but no chance.

So we decided to call it quits and go home. I got home at about 6am, slept for 2 hours and then went to the PN conference. So as you can see, it was a complete disaster. We didn't see one, nor did most of the population, because as luck would have it, there was cloud over Canberra, Sydney, Brisbane, Perth and Darwin. Only Melbourne and

Adelaide got anywhere near a clear sky. Unbelievably, it was clear for a month before then too (and every night since). Well, better go, lots to do…

Dave.
D.T.F Weldrake BSc(Hons) FRAS

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And one from the USA

Leonid Meteors Roar In On Schedule

From Sky and Telescope

Skygazers worldwide had a treat on Sunday as the Leonids put on its best display in 35 years. The meteor shower sent bright shooting stars streaking through the sky before dawn Sunday morning for observers throughout the Americas, the Pacific, and the Far East. Preliminary reports paint a picture of the much-anticipated 2001 Leonid shower matching predictions fairly closely. However, the observed rates of a couple of thousand per hour (as seen by a single observer) fell shy of the most optimistic predictions of between 7,000 to 15,000 per hour.

In Eastern North America, sky watchers under dark skies before dawn counted several hundred meteors per hour — an average of one every 5 or 10 seconds, with occasional spectacular bursts (presumably by chance) of two or three at once. A crowd of Sky & Telescope staffers at a lakeshore in Western Massachusetts (under a 6th-magnitude sky) oohed and aahed at blue, green, and red fireballs radiating from the cutting edge of the Sickle of Leo, occasionally lighting the ground with flashes like distant heat lightning. The peak for North America was predicted to arrive around 10:00 Universal Time (shortly before dawn in the East), but rates seemed still to be increasing as morning brightened the sky.

In Kentucky, David Phillips, a meteor observer for 15 years, described seeing roughly a meteor per second under an extremely dark sky. Much of the Midwest was cloudy, but Westerners apparently had the best of it. The peak probably came around 11:00 UT, according to Joe Rao, observing with a crowd of 60 at the Skywatcher's Inn in Arizona. "It was partly cloudy here, with 30 to 70 percent sky obstruction, but you couldn't look up for more than a second or two without seeing a meteor, sometimes four at once," said Rao. "These were 1st and 2nd magnitude. It was the most amazing shower I've seen in over 35 years of watching the sky."

Observing from Fremont Peak, California, Landon Curt Noll observed several bursts of activity including a count of more than 1,500 meteors during a 1-hour interval beginning at 10:45 UT, with more than 600 of those appeared in the 15 minutes beginning at 11:00.

Rates seemed to decline somewhat after about 11:15 UT, but farther west in Hawaii, Stephen J. O'Meara and P. K. Chen were more than satisfied as the radiant rose high in the sky from about 12:00 to 16:00 UT. "We had an absolutely stunning, remarkable, brilliant and continuous display of Leonids," writes O'Meara. "The best

activity I have ever seen. Though there was no 'storm' — meaning the sky was not filled with meteors falling down - the shower did rain meteors and fireballs for four hours."

The biggest peak was supposed to come around 18:00 UT, when Australia and the Far East would be turned into view. Rates did surge again around this time, but judging from early reports, this second peak was only comparable to the first. Bradley Schaefer reported from Alice Springs, Australia, a personal meteor count that peaked with 660 meteors seen during a 15-minute interval. "They were fast," he writes, "and the bright ones were visible in various colors, primarily red, green, and yellow."

The Asteroid Threat, Is It Over-rated?

By Michael Roe

We hear a lot about the asteroid threat these days, those sinister worldlets just waiting to destroy the World, or at least life and civilisation as we know it. Even some respectable astronomers join in the scare stories, whipping up hysteria! But is this celestial horror real? As bad or imminent as the numerous articles and books suggest? I would like to calm these fears and prove that asteroids are not as dangerous as many people think.

First the actual facts. We all know that the asteroid belt whirling between Mars and Jupiter - the asteroids that concern the doom-mongers - are a sparse inner extension of this belt. These asteroids are small, under 7 miles across. Perhaps a thousand exceed a mile in diameter and it usually takes a large telescope to see these “near earth asteroids”, except at closest approach.

The actual impact rate and damage to the Earth is the information needed. Very small asteroids are meteorites when they land on Earth, about 10,000 a year an inch or more across fall to our Earth. That’s 4 or 5 every year on Britain and most are never discovered. So how often do true asteroids collide with Earth? Well, if it happened you would notice believe me; a large crater on land or a gigantic splash in the oceans, creating monster waves. We do have craters like the Barringer crater in Arizona, USA . 4,200 feet across, it is either 25,000 or 50,000 years old. Books differ on the actual age. Most craters on Earth have been eroded away many millions of years ago.

The Moon gives a better idea on asteroid bombardment. Most of its craters are impacts from asteroids or comets. It looks battered by craters, many of them dating from the early history of the Moon over 4,000,000,000 years ago. Some of the largest craters, called seas or maria, were later coated in dark flat lava flows upwelling from deep under the surface. Look at the Mare Crisium or Mare Serenitis. The dark lava cooled about 2,000,000,000 years ago. Only a few craters, all small, show up on Mare Crisium. Craters below 5 miles in diameter are almost absent, even through a good telescope.

I have used information from The Geologic History of the Moon to estimate the crater forming rates for Earth as a whole, increasing the rate by 20 per cent to allow for our planet’s increased gravity attracting passing comets and asteroids.

4,000 years - 1 mile diameter crater
100,000 years - 5 mile crater

400,000 years - 10 mile crater
1,600,000 years - 20 mile crater

It is important to remember that the huge explosion created by an asteroid colliding at many miles per second excavates a crater 20 times its own diameter. The most publicised asteroid collision was the one generally supposed to have killed off the dinosaurs and ammonites about 65,000,000 years ago. It has recently been identified as a deeply buried crater over 100 miles across at Chicxululub on the Yucatan peninsula Mexico. Yes, it did cause an unimaginable catastrophe but geologists have also discovered a gigantic volcanic eruption, the Deccan Traps, in India. For millions of years the Deccan Traps spewed dust and gas into the atmosphere, just like the temporary asteroid collision at around the same time. So perhaps the Chicxululub asteroid collision was just part of the dinosaur extinction.

As you can see from my figures, small craters are more frequent. Anything producing a crater less than half a mile across usually explodes in the atmosphere. A 1 mile crater is formed on average about every 4,000 years on our Earth, and three quarters of these impacts are in the sea. The damage from a 250 foot asteroid, causing a 1 mile crater, would actually be mostly local. That is, severe damage for a 20 mile radius but no worse than a large volcanic eruption. The really terrifying collisions, 10 mile craters or larger only occur every 400,000 years average, hardly something to panic about. These explosions drive enough dust into the atmosphere to cause real damage on Earth including world-sweeping giant waves.

Despite these facts we read such ridiculous statements as “a person is more likely to be killed by an asteroid collision than an aircraft crash”. Yet many people die in aircraft crashes every year. No-one has ever been killed by an asteroid and no-one will for many thousands of years, if ever!

The images of cities devastated by asteroid collisions looks frightening in popular books and science fiction, yet the chance of it happening is almost zero. The next asteroid to strike a city will encounter deeply buried remains long forgotten and deserted. Probably the nearest any large town or city got to being hit by an asteroid was the 3 lb meteorite that fell on 14th March, 1881 on the outer fringes of Middlesbrough near the future site of St Luke’s Hospital! Of course every few centuries the Earth gets hit by something like the famous Tunguska meteorite, which exploded several miles above the forest flattening it. But this kind of catastrophe is local.

I have heard reports of a huge disaster in 537-540AD, explained in the popular media as a giant asteroid collision. As I have said, this type of world ecological disaster happens about every 400,000 years, odds of 1 in 270. Possible, of course, but unlikely. And anyway the Dark Age in Britain began a century earlier with other civilisations, in China for instance, continuing for centuries afterwards with no break. I expect a combination of human social breakdowns, severe weather perhaps made worse by solar output changes, and a few unrecorded large volcanic eruptions caused this. Remember how bad last Winter’s weather was. That could almost wipe out Dark Age communities!

Lastly, the doom mongers themselves. To me they seem a little hysterical, sometimes almost willing an asteroid to drop in with a nice big explosion! The Generals love all this. Another evil enemy to aim their deadly nuclear missiles at. And there is Space Guard, an organisation begging Governments to spend millions of pounds on large

telescopes to discover and track the near Earth approaching asteroids so they can be stopped. They say they need to complete their dedicated mission and find 80% of these nearby asteroids within 10 years. Why? As I've proved we have centuries, millennia in fact, to find them, so what's the rush?

Believe me there are far more imminent threats to civilisation and humanity - in a word, Us! Yes, our rapidly growing population, destruction of our planet's eco-system and warlike habits will end our civilised way of life long before an asteroid or comet impacts our planet. Perhaps the mighty impact will be witnessed by astonished remnants of humanity, a few savage descendants of our species. Maybe that's where Space Guard's fortune should be spent! Perhaps all this asteroid impact hysteria is simply an excuse to divert worries and fear away from our own species self destructive ways leading to the end of civilisation, blaming some poor asteroid instead. Perhaps we should worry about the next Ice Age, which will destroy life on a large scale before an asteroid collision will!

Finally, please study asteroids. Learn to love these little minor planets, not fear them. We could learn a lot about our Solar System's origin from them.

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Sundials – Some Final Words

From John Crowther

First an apology. My last article said that the triangle on which the disc is mounted should be 36 degrees. For the dial to point at the North Star the angle should be 54 degrees. We deal this month with the conventional flat dial. One of these may be made from cement, metal or wood. The base may be of wood or stone or a bird bath may be converted into a sundial. I have seen an impressive sundial made from small slabs built up to look like a spiral staircase.

The gnomon, made as thin as possible, may be just a rod or dowel resting on a triangle set at our latitude angle. The instructions for painting the dial were included last time. The sun dial should be placed on a flat surface with the 12 o'clock mark to the North. The sticking up bit which makes the shadow, the gnomon, is then pointing up to the North Pole in the sky. This is a point near the Polar Star and all the sky seems to turn around it. The shadow cast by the gnomon on to the base of the sundial then tells what we call Local Solar Time (LST). To get the clock time from this we need to do a little bit of arithmetic.

The apparent motion of the Sun in the sky is not 100% uniform, for a number of complicated reasons – including the fact that the Earth moves faster when it is near the Sun in the (Northern) winter. This means that the time we get from the real Sun is not exactly regular – hours measured by the sundial in the winter are not the same length as those in the summer.

In order to get round this oddity astronomers came up with the idea of an imaginary Sun that moves round the sky at a constant rate. Sometimes the real Sun is a little ahead of this imaginary Sun and other times a little behind it, but the difference averages out over the year. Another word for this average is "mean" and what we would get if the

imaginary (or mean) Sun made a shadow, is called "mean time". A trick question is "What is the nearest star called?". Answer: "The Sun".
So we may use as a motto those lines from a hymn, now absent from our hymn book, "Out beyond the shining of the farthest star, Thou art ever stretching infinitely far".

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Black hole monster in a spin releases energy

From an ESA press release via Ray Worthy

Black holes may be worse monsters than we thought. Not only do they inexorably devour matter around them, but they may also be able to steadily belch out energy. This is the conclusion of a European-led team of astronomers whose work with ESA's XMM-Newton X-ray observatory has produced surprising new results. Black holes can contain the mass of a billion Suns. Their gravitational fields are so intense that nothing - not even light - can escape their attraction. Before being swallowed, the gas and dust takes the form of a fast rotating accretion disc accumulated around the black hole, where friction causes it to glow strongly in X-rays.

The spiral galaxy MCG-6-30-15, situated 100 million light-years away, was targeted by XMM-Newton in June 2000 for a team of astronomers led by Dr. Jrn Wilms, from Eberhard-Karls University, Tuebingen, Germany. The data obtained has led them to conclude that energy is not only going in to the galaxy's black hole, but is also escaping. "With XMM-Newton's great collecting power we have discovered something never observed before in a black hole," explains Jrn Wilms. "The observatory's EPIC cameras have obtained a spectrum, which displays an unusually broad 'line' for the X-ray emission corresponding to iron in the accretion disc. This broad line had first been detected in 1995 with the ASCA satellite but we had never seen it so clearly. It is full of surprising features."

Analysis of this iron line has led the team to deduce that it arises from X-ray emission from the innermost areas of the accretion disc, just before matter disappears into the black hole. But the number of photons and their energies measured by XMM-Newton far exceed what could be expected from the established models. It was clear that something else was "powering up" the iron atoms. The hunt for a suitable explanation involved intensive spectral modelling and theoretical mathematics. According to the team, one model fits the XMM-Newton data well. It suggested that rotational energy could escape from a black hole when it is in a strong magnetic field which exerts a braking effect. Never before have we seen energy extracted from black holes. We always see energy going in, not out," said Reynolds, of the University of Colorado. Other scientists involved in this work are James Reeves of Leicester University, United Kingdom, and Silvano Molendi of the Instituto di Fisica Cosmica "G. Occhialini", Milan, Italy.

The team's conclusion that a magnetodynamic process is involved is already provoking intense debate. "We recognise that more observations are required to confirm our work," says Jrn Wilms. " It is extremely puzzling and an explanation must be found."

Only a couple of years ago, before operations with the European X-ray observatory began, no one would have dared propose such interpretations. Sufficiently detailed spectra of the kind today provided by XMM-Newton were just not available.

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A History Lesson With a Difference

By Neil Haggath

An article in the newsletter of Harrogate Astronomical Society points out a bizarre connection between the Space Shuttle and the earliest forms of transport.

The solid rocket boosters used on the Shuttle are transported by rail from the Morton Thiokol factory, where they are made, to Cape Canaveral. The rail route includes a number of tunnels through mountains, and this fact influenced the design of the boosters; they had to be limited to a certain maximum diameter, so that they could go through the tunnels. The tunnels, of course, are just wide enough to accommodate a train, so their width is determined by the width of the railway tracks. The standard gauge of American railways if 4 feet 8.5 inches, simply because that's also the standard gauge of British railways, and the people who built their first ones had also built some of ours.

So why do our railways use such a strange width? Because the people who built the first ones had previously built horse-drawn tramways, and the wooden rails used for hauling wagons of coal out of mines. Those in turn had used the same standard width, because the people who built them had used the same tools and jigs which they had used to build horse-drawn wagons and coaches, which in turn had used a standard width of wheelbase for centuries. The reason for that was simple. On the very poor roads of the stagecoach era, all coaches had to keep their wheels within the deep ruts which had been worn in the roads over many centuries, or else they would have shaken themselves to bits.

Britain's oldest roads dated back to the Roman occupation, and the original ruts had been made by the wheels of Roman war chariots. Those in turn had always been built with a certain standard width, because they were always drawn by two horses side by side; the distance between the shafts had to accommodate the rear ends of two horses.

So, as daft as it may seem, a factor in the design of the world's most advanced space transportation system is intimately linked to the width of a horse's bum!

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Please send contributions for the Newsletter to Alex Menarry , 01325 482597 (a.menarry@virgin.net) or to John McCue, 01642 892446 (john.mccue@ntlworld.com).