TRANSIT

The Newsletter of

Cleveland & Darlington Astronomical Society

14th January, 2005. Julian Day 2453385

In the December issue the front page galaxy was, of course(!), our near neighbour in the local group, Andromeda; M31, NGC 224, a spiral type Sb. Here's another well known spiral, in false colour. The "false" part comes about by superimposing images taken in different wavelengths in colours chosen by the artist – often David Malin. Is this permissible, I wonder? Our society image experts are usually very careful to preserve the visual appearance of their images at all costs, as a matter of principle.

Editorial

December meeting. I was told I had missed a very interesting and absorbing lecture on Dark Matter by Dr Pete Edwards of Durham University last month. This subject is at the forefront of research and controversy at the moment. 'Astronomy Now' and 'New Scientist' have regular features on the latest observations and theories. Yet another example of the fascination of our subject and how rapidly it changes.

January meeting. January 14th, 2005, will be Members' Night at Thorpe Thewles. If you haven't given Neil your subject for the evening, please contact him as soon as possible. Anything goes – a quick one on an interesting observation, a long one on a subject you have found interesting, pictures you have taken, news from other Societies. The important thing is for members to be heard.

Front and Back Page Pictures. This month the front page gives you another well-known galaxy to recognise. The back page has the first in the "what's this Moon feature" series. There is a superb, new edition, Moon map in print at the present from Phillips – more than 500 features names and indexed is the blurb. I got one and a dark skies map for Christmas.

Cassini and Huygens. Huygens was released as planned on Christmas day and is now on its complex path to descend to the surface of Titan. It enters the atmosphere on the day of our next meeting – January 14th. The project began in June 1982.

Article on Titan. Rob Peeling's article is being published at just the right, topical moment, when we need all the information we can get as backgrond to the exciting times ahead. Surely this probe won't suffer the fate of Beagle 2?

Radio Astronomy. Bob Mullen is the only radio astronomer (and radio control enthusiast) I know in the Society. He may be looking for kindred spirits with his article published this month.

Light Pollution Issues. I can recommend the Phillip's "Dark Skies Map" for Britain and Ireland. With lots of campaigning, and a bit of luck, the dark areas will be protected from now on and the bad areas improved.

Comet Machholtz. In January the comet will be crossing Taurus and Perseus at about magnitude 4 – the brightest it will achieve. It has been seen by a few members and probably imaged by some. Please send in your reports.

NASA Spitzer Infra-red Telescope. As always when a new instrument comes into use, lots of exciting results are being reported from Spitzer. See Rod Cuff's Astronomy and the Internet articles for the best web sites.

NASA Swift Gamma Ray Observatory. Another new NASA project was successfully launched recently. This time an orbiting observatory dedicated to gamma ray bursts, ready to swing into action as soon as a new one is detected.

Astrofest 2005. The two-day European Astrofest conference and exhibition is on Friday, February 4th and Saturday, Febraury 5th. Exhibition only is £5 at the door. Lectures are £12.50 a session. Ticket phone number is 01732 367542.

Neil Haggath's new website. Have a look at www.spaceandsanity.com for reasons to shun all the idiocies promulgated about space. This includes a rebuttal of all the reasons which have been put forward to cast doubt on whether men really went to the Moon.

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Space Elevators

By Darran Summerfield

With the world on the verge of private space travel, and NASA undergoing a major overhaul the future of the space industry hasn't looked this dynamic in a long time. Now, what was once an idea on the fringe of science fiction is creeping into mainstream science. If Space Elevators can work, then they will change space flight forever.

What is a Space Elevator?

Anchored in space a ribbon 62,000 miles (100,000 kilometers) long would be made of carbon nanotubes. A "climber" would haul cargo, as well as passenger modules up and down the length of ribbon. What's needed, advocates explain, is a super-tough ribbon that does an about face in thinking. It hangs from the ground and falls into the sky -- thanks to the Earth's spin and centripetal force. Of course, money is a key lubricant in this high-wire balancing act of technology. At the third annual international conference on the space elevator being held in Washington, D.C., scientists and engineers are tackling hurdles that must be overcome for the concept to, quite literally, get off the ground.

Challenges ahead

"It's a mega project…things are moving about as quickly and as well as could be expected," said Bradley Edwards, Director of Research for the Institute for Scientific Research (ISR), based in Fairmont, West Virginia. He is a leading authority on the space elevator concept, and is moderator for this week's event. Edwards is quick to run down what's up on the space elevator challenges, from carbon nanotube technology, power beaming, climber hardware to space debris impacts on the ribbon, health and safety issues, as well as cost, politics and regulations.

At the latest gathering, leading scientists delving into carbon nanotubes are detailing the fast-paced nature of their work in this arena. Different methods of producing carbon nanotubes are moving forward, even to the point of a new process that spins the material in similar fashion to how rope is made.

The discovery of carbon nanotubes and the ongoing development to form them into a composite material is central to space elevator viability being achieved in the coming years. Recently Chinese scientists claimed to have successfully fused nanotubes together.

Major advancements are underway in carbon nanotubes, Edwards said. That goes for competitive production ideas, as well as churning them out in ever-stronger batches and at costs far cheaper than before. Purchasing grams of the material in the past has turned into buying kilograms today, and for a greatly reduced price tag, he said.

Space elevator basics

Blue-sky thinkers like Edwards envision the space elevator as a revolutionary way of getting from Earth into space. The primary system is a ribbon attached at one end to Earth on a floating platform located in the equatorial Pacific Ocean. The other end of the ribbon is in space, beyond geosynchronous orbit. Believe it or not, the ribbon would be a meter wide and thinner than a sheet of paper. Once operational a space elevator could ferry satellites, spaceships, and various structures into space using electric lifts clamped

to the ribbon. Research points to a space elevator capable of lifting five-ton payloads every day to all Earth orbits in 15 years after formal go-ahead.
The first space elevator would reduce lift costs immediately and drastically, as compared to current launch costs. Additional and larger elevators, built utilising the initial design, would allow large-scale activities in space and reduce lift costs even more. Admittedly, years of research are required to turn this pipe dream into actual space hardware. Nevertheless, major organisations are taking the notion seriously. That is clear from the list of sponsors for this week's meeting: Los Alamos National Laboratory, NASA's Marshall Space Flight Center, NASA Institute for Advanced Concepts, as well as the National Space Society. "There's a broad range of issues…but we're trying to hit the biggest issues we can," Edwards said.

Straightforward exploration
Being on top of the space elevator has its downside, Edwards noted. "I get a lot of 'this is crazy' kind of comment," he said. But remember the early mariners who dared to build ships that sailed around the globe. Recall how going to the Moon was thought impossible, expressed by well-known experts at the time, Edwards countered. "People have to take the time to look at the engineering that's been done," Edwards explained, "then make an informed decision. That's what we've been pushing."
Edwards said NASA's new reach back to the Moon, onward to Mars and beyond would become a very clear-cut undertaking – given high-strength material to fabricate a space elevator.
"The risk of a Challenger or Columbia shuttle tragedy is basically removed. You don't have the large energy transfer type events of a rocket launch or re-entry. No need for heavy-lift vehicles. You can eliminate a lot of the other development risks," Edwards concluded. "The whole space exploration program could be very straightforward and become successful pretty quick."

Summary
Arthur C Clarke, who was one of the original thinkers behind the Space Elevator concept famously, said "It will be built about 10 years after people stop laughing." Well, it seems that, scientists at least, are taking this idea seriously.

Current Timescale: 20-25 years
Current Pricetag: 6 Billion dollars

Adapted from an article from SPACE.com

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The Conjunction of Bethlehem?

by Neil Haggath

The December meeting of Derby Astronomical Society was their equivalent of our Members' Night. It included a discussion on the possible astronomical explanations of the "Star of Bethlehem", which has inspired me to write this piece – albeit too late for the December *Transit*!

Firstly, cards on the table. I'm an atheist and a rationalist; I don't believe in the existence of God, anything "supernatural", "miracles" or anything which violates the laws of physics. Full stop. Sorry if I offend any Christians; they are not obliged to read on! So I'm writing this from a purely astronomical point of view – the view that if the "Star" existed at all, then it has a rational explanation, in terms of some kind of natural astronomical phenomenon.

I don't deny of course, that a man named Jesus probably existed; that's pretty much an established historical fact. (It's also a historical fact that a man named Mohammed existed, and that a man named Gautama, later known as Buddha, existed!) I accept that he existed *as a human being*. I'm also assuming that someone must have had a reason to write the bible stories, i.e. they must have *some* origin in real historical events.

The traditional image of the "Star", reinforced by today's Christmas card pictures, is that it was something incredibly bright and spectacular – but was it? Only one of the four Gospels – that of St. Matthew – mentions it at all, and then only in four brief sentences. It may well be a pure fabrication on the part of that author, to "spice up" his story. But if the account *was* based on a real phenomenon, then the lack of any mention in the other three versions of the story suggests that it wasn't so spectacular after all. Perhaps, whatever it was, it wasn't even noticed by the man in the street – but had some deep *astrological* significance.

Now I hate to mention the dreaded subject of astrology – but it's impossible to discuss this topic *without* it! The people of that era firmly believed in it, and the predictions of astrologers influenced affairs of state and political and military campaigns. The "Wise Men" - if they existed at all – were almost certainly astrologers. Matthew says that when they visited King Herod, and told him that they had "seen his star in the east", Herod himself had not seen it; this supports the above idea, that the "Star" was something of great significance to astrologers, but was not noticed by those not accustomed to studying the sky.

Furthermore, the Jewish prophets had been predicting for centuries that God would send a "saviour", or some such thing. So it's quite feasible that if the astrologers of the time saw some unusual celestial phenomenon, which they perceived as being a sign of some exceptionally momentous event, they might have interpreted it as meaning that that long-predicted event had finally happened.

Before we consider what that celestial phenomenon could have been, we need to consider *when* Jesus was actually born. It's a well-known fact that our calendar is in error, and that he certainly *wasn't* born in either 1 BC or AD 1! The Christian calendar was not established until around AD 400, by a monk named Dionysus Exiguus – and he got it wrong. Until that time, no numerical system of dates had been used; historians dated events by descriptions such as "in the fifth year of the reign of King … ". This makes it very difficult to date events in that era precisely. Dionysus calculated the time which had elapsed since Jesus' birth, by considering the lengths of the reigns of various kings and emperors – but, as was established by later historians, he accidentally omitted one Roman emperor, who had reigned for only a few years. So we know that Jesus was actually born several years before 1 BC.

Now, one event which *can* be precisely dated is the death of Herod. A historian of the time recorded that a lunar eclipse occurred a few days before Herod's death. Astronomers

have calculated that a lunar eclipse occurred on the night of 12-13 March 4 BC; there wasn't another for several years before or after, which would have fitted the description.

So we can say with confidence that Jesus was born sometime before that date. And if the story of the "Slaughter of the Innocents" has any basis in reality, then it must have been at least two years earlier, since Herod is said to have ordered the killing of all boys up to two years old. Therefore, it seems likely that the date of Jesus' birth was about 6 or 7 BC. So we need to find an astronomical event which occurred around that time.

So what could the "Star" have been? Firstly, let's just ignore the Biblical descriptions of it "going before them" and "standing over" Bethlehem. This is obviously a physical impossibility, and probably nothing more than poetic licence on the part of the author. Let's face it; *any* object high in the sky appears to move with a traveller, as he continues to see it in the same position relative to himself.

Some people have suggested that the "Star" was in fact a comet. The artist Giotto di Bondone depicted it as such, in his famous painting *The Adoration of the Magi*, in 1306. It's likely that he was inspired by seeing the comet which we now know as Halley, at its apparition of 1301 – hence the naming of the ESA space probe to Halley's Comet in his honour. Some have even suggested that Halley itself was the "Star", as it passed perihelion at around the right time – but this actually occurred in 11 BC, which was almost certainly a few years too early.

I don't give any credence to the comet idea. It's true that comets were frequently interpreted as portents in the ancient world – but they were usually regarded as *bad* omens, rather than good ones, and associated with the deaths of kings, or various disasters. (Let's face it; think of any comet you like, and you could *find* some disaster to associate with it, if you tried!) Moreover, since comets were fairly frequent phenomena, and usually associated with relatively mundane earthly events, it's unlikely that one could have been interpreted as a sign of something so momentous as the birth of the Son of God – unless it was an exceptionally spectacular one, say one of "Great Comet of 1843" standard. And if *that* was the case, then how come the Chinese missed it? The Chinese of that era were also obsessed with astrology; their emperors employed "Court Astronomers", who kept meticulous records of celestial phenomena. They recorded almost every apparition of Halley for many centuries – but there is no record of any really bright comet around 7 or 6 BC.

Other people, sticking to the idea that the "Star" was some kind of brilliant beacon, have suggested that it was a supernova. Sir Arthur C. Clarke is fond of this theory, and expanded on it in his famous 1950s short story, *The Star*. Certainly, a supernova – one within our own Galaxy, like those seen by Tycho and Kepler - would have been an awesome sight to the ancients. It would also have been completely outside the experience of the astrologers, who probably *would* have interpreted it as a sign of something exceptionally important.

But there are obvious problems with this theory. Firstly, how come Herod didn't notice it, and how come the other three Gospels omit to mention it? Secondly; once again, how come the Chinese didn't record it? They frequently *did* record what they called "guest stars" – most of which were merely "ordinary" novae, and vastly less bright and noticeable than a Tycho-class supernova. And finally, where is the remnant? Any supernova within a few thousand light years would have left an obvious remnant, which

astronomers would surely have identified by now – as they have identified the Crab Nebula with the supernova of AD 1054, and Cassiopeia A with Tycho's supernova.

Actually, Chinese records do show that two "ordinary" novae occurred, in March 5 BC and February 4 BC. These would obviously have been noticed by astrologers, but were probably not bright enough to be noticed by the man in the street. It has been suggested that the combination of these two events accounts for the "Star of Bethlehem" – especially as the latter occurred in Aquila, and it has been shown that to a person standing at the South Gate of Jerusalem in the evening, it would indeed have appeared more or less above Bethlehem. But these events were almost certainly a couple of years too late; the latter was just a few weeks before Herod died.

The most likely explanation, in my opinion, is that of Prof. David Hughes of the University of Sheffield. He believes that the "Star" was nothing more spectacular than a series of conjunctions of Jupiter and Saturn.

"Wait a minute!" I hear you say, "Planetary conjunctions occur all the time, and astrologers would have been thoroughly familiar with them. How could they have thought that something so mundane signified the birth of the Son of God?"

Well, yes – planetary conjunctions *were* thoroughly familiar to the astrologers, and were normally taken to signify far more mundane events. But very occasionally – only once in every 805 years – we get a rather unusual kind of conjunction. This is a triple conjunction, in which Jupiter and Saturn undergo three consecutive "close encounters" within a period of a few months. That the "Star" was a triple conjunction was first proposed as long ago as the 17th Century, by Johannes Kepler, who observed just such a series of events in 1603-4, and calculated that another had occurred in 7 BC, with the three conjunctions on 27 May, 6 October and 1 December. He knew that the timing would have been just about right, as the error in the calendar was already known by that time.

Many astronomers have dismissed this idea, because the two planets never passed closer together than about one degree; therefore, they never came anywhere near merging together to give the appearance of a single "star". But according to Hughes, who has researched the astrology of the era, this doesn't matter. When an astrologer in those days talked of "a star", it didn't necessarily mean a star at all; the word was used to describe *any* celestial phenomenon of supposed astrological significance. It's perfectly feasible that the phrase "We have seen his star" could have referred to a planetary conjunction. (Even today, the horoscope columns in newspapers are often headed "Your Stars", when they are in fact mainly concerned with the positions of the planets.)

Also consider the following; Hughes believes that the astrologers of the era associated Jupiter with royalty, and Saturn with Judea (i.e. Israel). Each of the conjunctions occurred in the "sign" of Pisces, which was also associated with Judea. This latter fact also neatly explains the apparent paradox of the Magi "following" the "Star". It's obvious that Matthew didn't mean this literally; the Magi probably came from Persia, as that's where the word "Magi" originated, and would therefore have had to travel *west* to Israel – yet they claimed to have "seen his star in the *east*"! But we can now see that this association of Pisces with Judea would have "directed" them where to go, rather than the actual direction of the "Star" in the sky. They didn't "follow" it literally, but figuratively, as detectives "follow" a lead.

So Hughes speculates that the sequence of events was as follows. The first conjunction, on 27 May 7 BC, alerted the astrologers to the birth of a new "king" in Judea. It's also quite feasible that they were capable of predicting conjunctions, and thus realised that the one they observed was the first in a rare triple sequence, which they interpreted as a "sign" of exceptional importance. Allowing time for preparations, the Magi began their journey – which would have taken several months – sometime in the summer. The 6 October conjunction occurred around the middle of their journey, serving to confirm to them that they were on the right track.

The last conjunction, on 1 December, occurred around the time of their meeting with Herod. In the early evening, it would have appeared in the east, as per Matthew's account; but by midnight, it would have moved around to the south, where it literally indicated the direction from Jerusalem to Bethlehem. So this might even explain the phrase "went before them"!

Finally, it's interesting to note that in a museum in Berlin, there is a 2000-year-old tablet, inscribed with calculations predicting the triple conjunction of 7 BC – which shows us that it certainly *was* an event of considerable importance to the astrologers of the era.

All this, of course, is pure speculation; it's highly unlikely that we will ever be able to identify the "Star of Bethlehem" with any certainty. The triple conjunction is very plausible, but does it really explain the mystery? As dear old Sir Patrick would say: "We just don't know!"

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Why Does Titan Have an Atmosphere?

by Rob Peeling

In July this year the Cassini spacecraft went into orbit about Saturn. During December it released the Huygens probe, which will land on one of Saturn's moons, Titan. Much of the effort in the mission is being put into studying Titan. So what's so interesting about Titan?

Titan is the second largest moon in the solar system, coming just behind Jupiter's Ganymede. This would mean that it would be a key target for the Cassini mission anyway, even if only as a gravitational lever to pull the spacecraft round the Saturnian system. However what is really special about Titan is that it is the only moon in the solar system to have a thick atmosphere. What is more, the atmospheric pressure at Titan's surface is actually rather greater than on Earth. Even better, the main component of the atmosphere is nitrogen just like Earth's. This where the similarity ends though. Titan is very much colder than Earth and instead of there being any oxygen in the atmosphere the next most important chemical present after nitrogen is methane (natural gas). The action of the Sun's ultraviolet light on the methane leads to the bizarre possibility of Titan having lakes or seas of liquefied petroleum gas. Why is Titan unique amongst the planetary moons in having a substantial atmosphere?

A planet or moon can only hold on to an atmosphere for a significant time, say the lifetime of the Solar System, if the molecules in the gas are not moving fast enough to

escape from the gravitational hold of the body concerned. From Newton's Universal Law of Gravitation it is simple to calculate how fast a gas molecule needs to go to be able to escape. The speed of a gas molecule is predicted by the Kinetic Theory and depends on what the chemical composition of the gas and it's temperature. Not all the molecules in a gas move at the same speed, they actually move a range of speeds from very slow to very fast but with a definite preferred value somewhere in the middle. The shape of the distribution of speeds and therefore the average speed can be predicted mathematically from just the weight of individual molecules and their temperature.

If we know the temperature of a planet or moon we can then compare the speed of the gas molecules at the planet's temperature with the escape velocity calculated using the mass and diameter of the planet. If a gas molecule is going faster than the escape velocity then it will be lost into space. However the gas molecules cover a wide range of speeds. If we simply compared the average velocity of the gas molecules to the escape velocity then we know that half of them are going too fast and will be lost. Any gas will only be around for a few days – like the rocket exhaust on the Moon from the Apollo landers. However if we make the comparison at, say, nine times the average molecular velocity, then we are including the high speed gas molecules and can show that any gas will be around for a few billion years. This is shown in figure 1, below. The line is nine times the average molecule velocity for the temperature given and the points are the escape velocities temperatures for the bodies concerned.

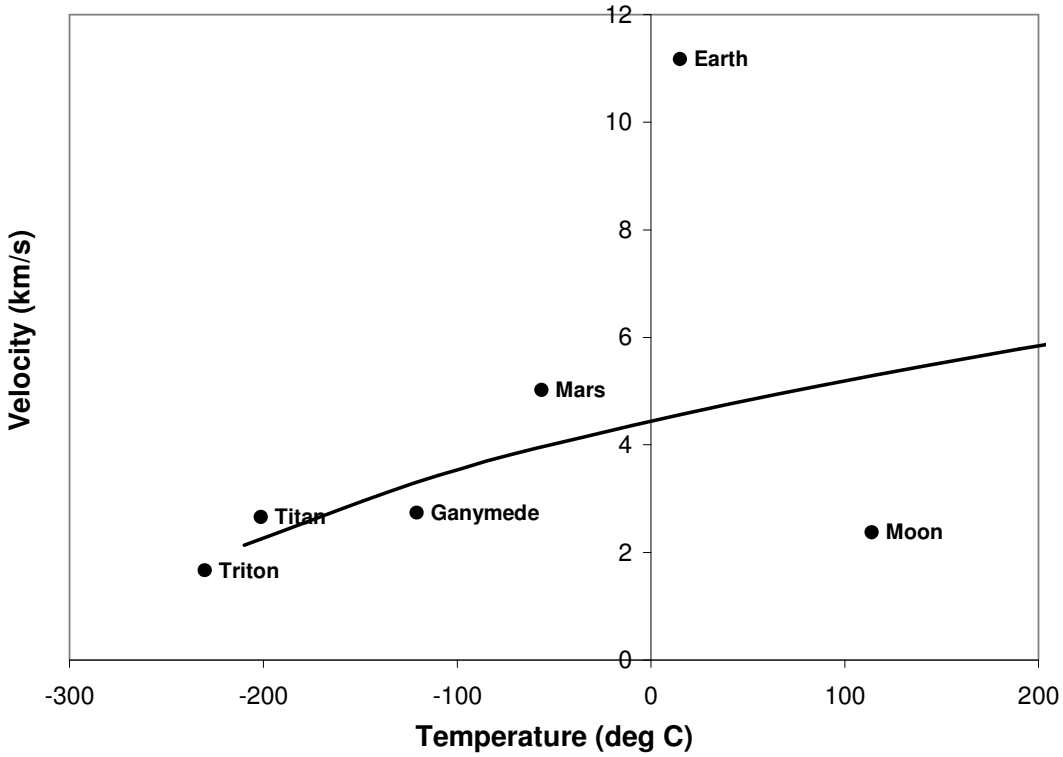

Figure1: Potential for a Nitrogen Atmosphere on Bodies in the Solar System

The line on the graph shows the speed of a gas molecule moving at nine times the average molecular velocity over a range of temperatures. The planets and moons above the line have escape velocities that allow an atmosphere, whilst those below the line cannot hold on to an atmosphere. The Earth and Mars lie well above the line and possess atmospheres as we know. Of the four moons plotted, only Titan lies above the line and is the only one known to have an atmosphere. Looking at the graph we can see that an atmosphere becomes possible because Titan is so cold due to its great distance from the Sun. The Moon and Ganymede are too hot and so no atmosphere exists.

References & Further Reading

1. Beneath Titan's Veil, Cambridge University Press.
Good, readable, detailed book about what is known about Titan and the aims of the Cassini mission. It will be completely out of date after 1st July 2004 when Cassini arrives.
2. Zelik & Gregory: Introductory Astronomy & Astrophysics, 4th Ed. Brooks-Cole 1998
Undergraduate level text book. The source of the numerical treatment behind this article. See Chapter 2
3. Pasachoff: Astronomy: From the Earth to the Universe, 6th Ed. Brooks-Cole 2002
Text book at approximately A level standard. Mostly avoids all but the simplest mathematics.

The Fun of Radio Astronomy

By Bob Mullen

Imagine a dull, wet Sunday afternoon and you fancy doing some realtime skywatching. Radio astronomers *can* do it in the wet and also in daytime!

Thanks to distance learning courses provided by Manchester University, students can book personal realtime observing from their home PC using the Jodrell Bank radio telescopes. As well as following the fascinating course of instruction prepared and mentored by world-leading radio astronomers you can become involved in genuine hands-on observation and interpretation of distant astronomical radio sources.

Manchester University offers two courses, a first year "Introduction to Radio Astronomy" and a second year "Exploring the Radio Universe". The first year course includes attending a resident weekend at the Jodrell Bank Observatory with lots of hands-on practical work and even more intensive brain work. The second year course offers the opportunity to remotely access their telescopes at any time convenient to yourself from home, primarily to conduct observing experiments as part of the course but also allowing you to wander the radio sky and study other phenomena which might interest you.

Observing with a radio telescope is obviously very different from using an optical telescope. With an optical telescope 'what you see is what you get', the brain immediately processes and interprets the eyepiece image, the results being very familiar. With a radio telescope the results are initially unfamiliar and require technology to translate them into a recognisable format. In the early days (1940s – 1960s) the observer used analogue signal strength meters and high speed chart recorders to display the relative intensity of radio signal as the antenna passed across the distant radio source. To make any sense out of the results involved a lot of hands-on calculation and signal contour charting techniques, consuming massive amounts of manpower (the only sane reason for retaining post-graduates).

With the introduction of computers and digital technology this work is now easily handled, producing false colour imaging results comparable to the Hubble glossies seen in the optical world. One benefit of radio astronomy over optical astronomy is that radio waves easily penetrate through the dark nebulae observed in optical astronomy. Imaging distant galaxies by radio provides a fully "visible" picture which would be heavily obscured using optical means.

Astronomical radio signals have a number of causitive origins. A massive thermal heat source such as a star radiates across most of the electromagnetic spectrum but only optical light, radio and parts of the infra-red emissions can penetrate through our atmosphere. As light waves carry relatively more energy than the radio waves we can see stars better visually at a distance than at radio wavelengths. As a result observation of thermal radio sources are limited to very close objects such as the sun. Other lower level thermal radio sources include Jupiter and even the moon.

Another more useful radiation mechanism, regarded as non-thermal, depends on free electrons being ejected from the ionised plasma surrounding a star and being accelerated to higher energies by the magnetic field lines of the star. This process, in effect, corkscrews the resultant radio signal as a concentrated beam towards the observer. These higher strength signals are detectable over massive distances, producing the most important vector for studying distant galaxies, supernovae, quasars and pulsars.

A third useful mechanism depends on the quantum state of a neutral hydrogen atom. The atom can be found in two states, the electron spinning in the same direction as the proton or spinning in the opposite direction of the proton. A typical atom is expected to change between the two states every 10 million years or so - fortunately there is so much neutral hydrogen in interstellar space that the radiation appears to be constant to the observer. As the atom changes its state there is an energy emission at a radio wavelength of 21cm. By tuning the radio receivers to this wavelength the density of neutral hydrogen can be mapped from the received signal strength as the antenna scans across the sky. In this way the denser spiral arms of the Milky Way were mapped out early in the history of radio astronomy. With improved equipment and techniques the more distant galaxies and interstellar clouds are being mapped. Radio astronomers have also discovered similar quantum processes in other elements and compounds, radiating at higher frequencies, which give them the ability to delve deeper into the chemical structure of distant sources.

Another mechanism well used in radio astronomy is the Doppler shift. As in optical spectroscopy the motion of an astronomical object can be detected by a observed shift in spectral wavelength. Radio waves travelling towards the observer shorten in wavelength and those travelling away lengthen in wavelength. This is illustrated when looking at a galactic spiral arm containing neutral hydrogen, if the arm is stationary the wavelength is exactly 21cm, if approaching it would be less than 21cm (= blueshift), if going away it would be longer than 21cm (= redshift). This simple wavelength measurement adds the dynamics of a rotating body into an observation.

Unfortunately, because of the longer wavelengths involved, radio telescopes have a rather poor resolution compared with optical telescopes. For a radio telescope to have the same resolution as the 2.4m diameter Hubble telescope it would have to be 200Km in diameter. This is obviously impractical for a single antenna but using the interferometer method of having a number of suitable individual antennas stretched over an equivalent distance of 200Km and electronically adding their combined signals such a system could match the Hubble resolution. This principle is employed around the world – the UK Merlin system, the New Mexico VLA, the US- straddling VLBA etc. with a number of others on the drawing board including futuristic systems to be employed both in space and on the back side of the moon.

Other interesting applications of radio astronomy include investigating the Cosmic Microwave Background, both from the earth and from space. Jodrell Bank is also involved in the SETI project, listening out for intelligent signals from other parts of the universe.

Manchester University and Jodrell Bank provide an opportunity to practically observe the radio universe at the same time as studying their fascinating courses under the guidance of some really bright guys. It's also a great way to spend a wet and dismal Sunday afternoon - at the end of telescope, I certainly enjoyed it!

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Astronomy and the Internet

from Rod Cuff

If you have any particular areas that you'd like me to tackle for a future issue, please e-mail me (rod@wordandweb.co.uk).

Venus

The previous article in this series was rather dismissive about possible Internet material concerning Venus, but following Dr Mike Lancaster's excellent talk on the Magellan project at our meeting in November, I did a bit of digging, and there's plenty out there.

- The Magellan Project home page at http://www2.jpl.nasa.gov/magellan is no longer maintained, but provides a full coverage of the project's activities and achievements.
- There are plenty of Venus-related images at http://solarviews.com/cap/index/venus1.html.

- General information about the planet, and links to much more, are at www.nineplanets.org/venus.html.

Cassini–Huygens

This will be an exciting month for the Cassini mission to Saturn and its moons. The Huygens probe separated from the parent vessel as planned on Christmas Day, and its descent (controlled, we must hope) to the surface of Titan is scheduled for 14 January. You should be able to follow progress and relate it to current knowledge through these sites:

- Cassini–Huygens Mission HQ (at the Jet Propulsion Lab in Pasadena, California) has its website at http://saturn.jpl.nasa.gov/home/index.cfm.
- The Huygens probe itself is a special project of the European Space Agency (ESA), fully covered at www.esa.int/SPECIALS/Cassini-Huygens.
- You can bone up on what we currently know about Titan at www.solarviews.com/eng/titan.htm.

Further solar system snippets

- The High Resolution Stereo Camera on board ESA's Mars Express spacecraft has produced the highest-resolution pictures so far of Mars's moon Phobos – see http://spaceflightnow.com/news/n0411/12phobos.
- Our ideas on the size of the objects in the Kuiper belt beyond Pluto have taken a big knock recently, and are discussed at http://spaceflightnow.com/news/n0411/10kbo.
- Particularly if you have a computer-controlled telescope, you may find http://cfa-www.harvard.edu/iau/Ephemerides/Comets a very useful site for coverage of all comets visible at any given time…
- … and speaking of comets: by now you'll probably have caught at least a glimpse of Comet Machholz for yourself, but you might like to read Don Machholz's own account of his discovery at www.astronomy.com/asy/default.aspx?c=a&id=2465.

Software and Internet applications

- If you're particularly interested in observing the Moon, then Lunar Phase Pro (www.nightskyobserver.com/LunarPhaseCD) looks like a terrific piece of software to buy, at around $35–40. You can download an evaluation copy free of charge, too.
- A website called '*Your Sky*, the interactive planetarium of the Web' (www.fourmilab.ch/yoursky) can produce maps for any time, date and observing location. From the orbital elements of an asteroid or comet (see above!), it will compute the object's current position and plot it on the map. Each map is accompanied by an ephemeris for the Sun, Moon, planets and any tracked asteroid or comet.
- In the last issue I mentioned a free software download for Adobe Photoshop that would enable amateurs to combine and process HST images into their own personal pictures. To realise just what amazing results this can give, take a look at http://spaceflightnow.com/news/n0412/15tarantula to see what the 23-year-old Danny LaCrue has done with the Tarantula Nebula.

Far away

- ‘What happens when two of the largest gravitationally bound objects in the universe slam together? … astronomers who studied the galaxy cluster Abell 754 with the European Space Agency's XMM-Newton X-ray observatory [say] "Here before our eyes we see the making of one of the biggest objects in the universe"’ – quoted from http://skyandtelescope.com/news/article_1363_1.asp.
- Astronomers are beginning to produce results from studying the Hubble Space Telescope's Ultra Deep Field, the product of an 11.3-day exposure last March. See what is being learnt, at http://skyandtelescope.com/news/article_1356_1.asp.

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Bob Mullen wrote:-

Hi Keith, Who would have thought that plain silly old moon could develop such a fascinating series of images to pursue photographically! I think the astronomical community has become too blase about deep sky images of the Hubble ilk that they forget the moon has its own fascination in phases, libration, surface geography and sheer photogenic pleasure. I think your phase images will bring a fair number of society members back into the fold of good old-fashioned moonwatching. I look forward to your presentation at the society meeting.

Heres wishing you enough clear skies to finish off the series before then.

Best regards, Bob.

PS Patrick Moore's Sky at Night on BB4 has some tremendous amateur-generated images slotted into their programme subject material, have they asked you as a previous prize entrant to supply any of your images for future use??? B.

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Transit Tailpiece

Good Luck, Mr. Gorsky

The story in the November Transit has been de-bunked by two spoilsports in the Society. It’s such a lovely story it deserves to be true.

Neil Haggath writes: - As has been documented in NASA circles, "Mr. Gorsky" was in fact the name of a Canadian rock band, of whom Armstrong was a fan.

Rod Cuff said:- I was sad to see the Armstrong/Gorsky urban myth promulgated yet again as a true story! See www.truthorfiction.com/rumors/a/armstrong-gorsky.htm and numerous other debunking sites ...

European English

From Barry Hetherington

The European Commission has just announced an agreement whereby English will be the official language of the European Union rather than German, which was the other possibility. As part of the negotiations, Her Majesty's Government conceded that English spelling had some room for improvement and has accepted a 5-year phase-in plan that would become known as "Euro-English".

In the first year, "s" will replace the soft "c". Sertainly, this will make sivil servants jump with joy. The hard "c" will be dropped in favour of "k". This should klear up konfusion, and keyboards kan have one less letter.
There will be growing publik enthusiasm in the sekond year when the troublesome "ph" will be replaced with "f". This will make words like fotograf 20% shorter.
In the 3rd year, publik akseptanse of the new spelling kan be expected to reach the stage where more komplikated changes are possible. Governments will enkourage the removal of double letters which have always ben a deterent to akurate speling. Also, al wil agre that the horibl mes of the silent "e" in the languag is disgrasful and it should go away.
By the 4th yer peopl wil be reseptiv to steps such as replasing "th" with "z" and "w" with "v".
During ze fifz yer, ze unesesary "o" kan be dropd from vords containing "ou" and after ziz fifz yer, ve vil hav a reil sensibl riten styl.

Zer vil be no mor trubl or difikultis and evrivun vil find it ezi tu understand ech oza. Ze drem of a united urop vil finali kum tru.

If zis mad you smil, pleas pas on to oza pepl. Zen ve vil rul ze vorld.

Quote/Unquote

Science is systemised, positive knowledge. The acquisition and systemisation of positive knowledge are the only human activities which are truly cumulative and progressive.
The history of science is the only history which can illustrate the progress of mankind. In fact progress has no definite and unquestionable meaning in other fields than the field of science.
George Sarton

The reasonable man adapts himself to the world. The unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man.
George Bernard Shaw

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Articles Wanted! Please send contributions for the newsletter to Alex Menarry, 23, Abbey Road, Darlington, DL3 7RD, 01325 482597 or to John McCue, 01642 892446 (john.mccue@ntlworld.com). Copy deadline date is the 1st of each month

The Back Page Pictures

As threatened, a new quiz to stress your memory and knowledge – or maybe to inspire you to look at the Moon more? Here's your starter for 10. Top picture a well-known Lunar crater. Lower picture a wider view, showing the mountain range running east. Name both. If you are an expert, name the small range to the south-west of the crater. Pillips have published a new Moon Map recently (ISBN 0-540-06378-9, printed in China), if you need some assistance (like me!).