CANOPUS

The Astronomical Society of Southern Africa

Johannesburg Centre

Monthly Newsletter for February 2002

Contents:

The Sir Herbert Baker Library, 18a Gill Street, Observatory, Johannesburg
P.O.Box 93145, Yeoville, 2143

Editorial

Plenty of Summer heat around of late - sometimes quite late into the evening, and unfortunately, still accompanied by enough cloud to cause some minor irritation when setting up to do some viewing. Beautiful sunsets though, so if the telescope can't do its job effectively, take out the old camera and snap some of those sunsets instead. Have you noticed how, when you've just set up to follow some favourite object, it suddenly fades by several magnitudes?…….darn clouds!

In between the cloud, Jupiter is like a searchlight overhead at midnight and Saturn still presents a pretty picture where it is currently situated by the Hyades close to Aldebaran. Interesting difference in colours and brightness. Venus is not doing too much at present, but this should soon be remedied.

Our friend at the Jet Propulsion Laboratory, **Bill Wheaton,** has taken time out of an extremely busy work schedule to submit an article about the investigation of Space at microwave wavelengths and more specifically covering the spacecraft doing these studies at present, while **Wolf Lange** returns to these pages after a break with his informative, sometimes humorous, "A to Zee of Astronomee". *Welcome back to both of you.*

Eben van Zyl moves on to another astronomical discovery in his article covering milestones in Radio Astronomy and we again have our little guide to Internet Astrosites compliments of **Evan Dembskey**.

Brian Fraser has supplied us with the heavenly guide for the next 2 months. Remember, if you need the tables for the Sun, Moon and Planets - just dive into the website where they will shortly be loaded covering the whole year.

LIBRARY BOOKS – *each year at this time we carry out an audit of our Library to check for damaged and/or missing books. We have not received very many returns and lots of our books are still out there, so please, if you are currently in possession of any books/magazines/videos or anything else borrowed from the Library, would you please return it so that it can be checked.*

The Editor

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Notice of Monthly Meeting

The Monthly Meeting of the Johannesburg Centre of the Astronomical Society will be held in the Sir Herbert Baker Library, 18a Gill Street, Observatory, on Wednesday the 13th of February, 2001 at 20:00.

Tektites

By: **Trevor Gould**

Telescope Making Classes

Would you like to make your own telescope?…or finish off a partially finished one? Well your opportunity has arrived (once again). Join the Telescope Making Class being held under the guidance of Brian, Evan and Chris. Contact Brian on (016) 366-0955 if you are interested.

Monthly Meetings

If you have any ideas for topics or subjects that you feel should be presented at future meetings of the Johannesburg Centre, please contact one of the Committee members, or email us with the details thereof.

The Editor.

Public Viewing *(weather permitting)*

Public viewing nights are held *subject to suitable weather conditions* on the Friday nearest First Quarter, and are held at the Old Republic Observatory, 18a Gill Street, Observatory, Johannesburg. Starting time around 19:30. *See the ASSA event calendar for the proposed viewing dates.*

ANNUAL AUDIT of LIBRARY

We are still missing many books and other items borrowed from the Library. If you are in possession of any object borrowed from the Library, PLEASE RETURN IT so that it can be audited and checked for condition.

Some of these answers sound familiar ...

Q: What is a planet?

A: A body of earth surrounded by sky.

Q: What causes the tides in the oceans?

A: The tides are a fight between the Earth and the Moon. All water tends to flow towards the moon, because there is no water on the moon, and nature abhors a vacuum. I forget where the sun joins in this fight.

Submitted by: **Chris Stewart**

ASSA Jo'burg Centre - Calendar of Events

Month	Day/ Date	Event	Details
Feb	Mon 11	Committee Meeting 17:30	
	Wed 13	**Monthly Meeting**	TBA / TAG
	Fri 15	Public Viewing	
Mar	Sat 9	Overnight at Tswaing Crater	Dr Dion Brandt
	Mon 11	Committee Meeting 17:30	
	Wed 13	**Monthly Meeting**	Trevor / Tektites
	Fri 15	Public Viewing	Meteorite Workshop
	Fri 29	Easter Expedition / Kalahari Safari > 7/4	Trevor
Apr	Mon 8	Committee Meeting 17:30	
	Wed 10	**Monthly Meeting**	Basic Quantum Theory / Rob Scott
	Fri 12	Public Viewing	
	Sat 20	Broederstroom visit: Celebration of centenary of Franklin-Adams telescope	With the Pretoria Centre
May	Mon 6	Committee Meeting 17:30	
	Wed 8	**Monthly Meeting**	Fermi's First Reactor/ Mike Smith
	Fri 17	Public Viewing	
	Sat 18	Telescope Extravaganza	Chris S
Jun	Mon 10	Committee Meeting 17:30	
	Wed 12	**Monthly Meeting**	TBA
	Fri 14	Public Viewing	FireWalking
Jul	Mon 8	Committee Meeting 17:30	
	Wed 10	**Annual General Meeting** and Viewing evening	

Reminders

2002	ASSA Symposium / hosted by Pretoria Centre/ poss. At Aloe Ridge **December 4, Solar Eclipse**
2003	Centenary of Flight **August: Mars opposition**
2004	Centenary Sir Herbert Baker Library Building Johannesburg Centre to host 2004 ASSA Symposium **June 8, Venus Transit**

Telescope Making stuff

Some people have contacted me with bits and pieces for telescopes that they want to sell.

50mm secondary diagonal mirror.

12-inch Duran 50 glass mirror blank w/18mm tool.
R1500-00

10-inch Duran 50 glass mirror blank w/18mm tool.
R1000-00

8-inch Duran 50 glass mirror blank w/18mm tool.
R600-00

These are "full thickness" glass blanks (ratio 6:1) imported from the USA.

Anyone interested please contact me and I will pass on your details.

Brian Fraser
Work 011 871-0370.
email *brian.fraser@macsteel.co.za*

US Space and Astronomy News

Bill Wheaton, Caltech

2002 February

MAP at L2:

A little over twelve years ago, in November 1989, NASA launched COBE, the Cosmic Background Explorer. As the first space mission to explore the Cosmic Microwave Background (CMB), COBE was a major contributor to our understanding of the early history of the universe. The June launch of MAP, the Microwave Anisotropy Probe, continues this ongoing revolution in cosmology. Last November, after a journey of 1.5 million km and five months to the outer Earth-Sun Lagrange point L2 (on the extension of the Earth-Sun line beyond Earth), MAP settled into its proper station for the next several years of observing. Cosmology is a big subject in every sense, one that needs continual going over and probably even some due scepticism, given its richness in theoretical elaboration and dearth of observational detail. Yet with the radical improvement in our observational capabilities during the past decades, the observations are rapidly becoming more and more constraining to our theoretical and physical understanding. While it will not be possible to cover the whole vast subject here, still we should make some effort to explore the questions MAP is trying to address, and set the stage for the results that are even now being accumulated by the investigators. Thus we will make a beginning, and hope to work away at the subject in succeeding months, a little at a time.

At the start of our story was Einstein, who pondered the overall structure of the Universe as soon as he had developed his stunning General Theory of Relativity (GTR). GTR is a theory of gravitation, but also a theory of the structure and geometry of space and how that structure changes with time: the stuff of cosmology indeed. In GTR, gravity results from a curvature of space and time (4-dimensional space-time, that is), a curvature induced by the presence of energy and of stress. Just as a two-dimensional surface embedded in our ordinary three-dimensional space may be flat like a tabletop or curved like the side of a race car, so it is with space-time. In a flat space, the ordinary rules of Euclidean geometry hold. For example, the circumference of a circle is pi times its diameter, and the sum of the interior angles of a plane triangle equals 180°. And as small regions of Kansas might appear pretty flat to a human surveyor, so the closely Euclidean behaviour of the relatively small regions of space and time which we normally experience does not guarantee that the larger form is flat.

In his study of the differential equations his theory implied for the structure of space-time, and their possible solutions, Einstein found that in order to get a static homogeneous cosmos, he had to add an ad hoc repulsive term, the cosmological constant, to support everything against the steady attraction of gravity. But then just few years later Hubble discovered the recession of external galaxies and the expansion of the universe. As a result, the need for the cosmological constant seemed to vanish for a long time, since the dynamically expanding solutions appeared to be the appropriate ones. This family of solutions called for an early, dense hot phase in cosmic history, giving rise to the idea of the Big Bang.

Long years after the earliest moments, the remains of the explosion cooled sufficiently that protons could easily capture electrons, and make neutral hydrogen atoms. By sometime around 400,000 years, the free electrons were virtually all gone. Then what had been a white-hot (about 3000 K), opaque mixture of gas, plasma, and light became almost perfectly transparent neutral hydrogen, with some helium and a trace of other light elements mixed in. The light was still there too, left with a nearly perfect "black body" spectrum, characteristic of the temperature when the fog of white-hot plasma cleared, but now "decoupled" from the matter, so that the two components went their separate ways for a long while, intermingled yet hardly interacting. (There would have been neutrinos, too, and probably other cryptic components not yet known to us as well, but they did not much enter into the conception.) For billions of years the expansion continued, the gas cooled, and the light was red-shifted by

gravity so that it appeared still with the nearly-perfect black body spectral form it had had from the start, but at a progressively lower and lower temperature. Today that radiation has cooled to a temperature of 2.725 K, measured by COBE with an uncertainty of only about 0.001 K. >From a blinding white-hot flash, the radiation has become microwaves, the merest whispers of the creation. The existence and properties of the CMB are probably the single strongest confirmation we have that our basic picture of the early universe is substantially correct. Aside from the "dipole effect", due to the special velocity of the Sun and Earth (since individual stars and galaxies are not generally perfectly at rest with respect to it), the temperature is nearly constant in all directions.

The radiation is also very nearly perfectly smooth, with only the subtlest spatial irregularities being detected by COBE. Lately exciting observations, taken from balloons floating above Antarctica, have confirmed and extended the COBE measurements, though only for small regions of the sky. Yet the Cosmic Microwave Background is nothing less than the actual flash of the Big Bang: if you like, the legendary Fiat Lux! declared In the Beginning. (No wonder it inspires awe among us!) So in those tiny ripples observed in the photosphere of the expanding explosion, are still to be seen the marks of the earliest processes at work, the sound waves, shocks, and turbulence of that beginning. To observe it clearly, we must cool our instruments to liquid helium temperatures, seek stability to the micro-kelvin level, escape from all confusing foreground radiations, and find the nearly perfect electronic silence at L2: a million miles beyond the Earth and Moon. >From the point of view of the mission designer, this is what MAP is all about.

We will return to these matters again; until then, further details may be found at:

http://map.gsfc.nasa.gov

Bill Wheaton

ANOTHER DISCOVERY BY RADIO ASTRONOMY

At Cambridge, England a large arrangement of 2048 erect-standing di-poles, more than four acres in area was erected. It was very sensitive to radiation of wavelength 3,7 metres.

In 1967 Miss Jocelyn Bell and Anthony Hewish used this system and became aware of queer, repeating radio signals having a periodicity of just more than one second. For all the orld it appeared as if there was a radio transmitter in space transmitting very regular signals. Could these signals be coming from some intelligent source? Bell and Hewish spoke under their breath about the L G M's (little green men). But no, there was no code in the signals and no Doppler-shift due to the rotation of a planet housing the L G M's which there would be on account of the spin of the planet. They called this source of pulsating signals a "pulsar" and it was designated CP 1919 +21 - Cambridge pulsar, situated at right ascension 19h 19m and declination + 21°.

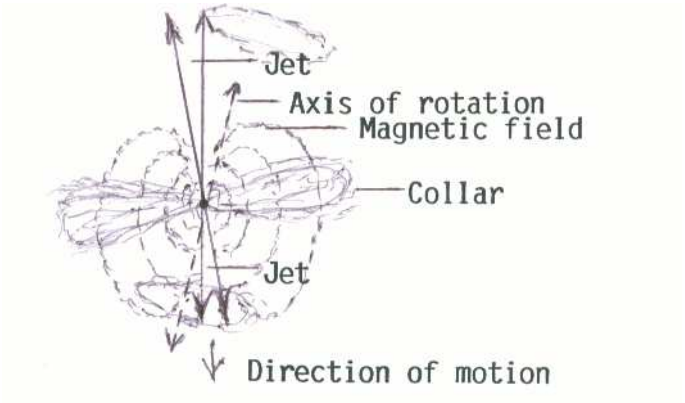
Early in 1968 another three pulsating objects were found and by 1970 another 50 were known. Their periods ranged from 3,74 down to 0,00155 seconds. T Gold suggested that the pulsations were due to the rapid spinning of very small bodies consisting of neutrons, which astrophysical theory had shown to be the possible remnants of supernova explosions. The diameters of these "stars" would be no more than 10 to 20 km. The pulses would be caused by rapidly moving electrons that are constrained by a very strong magnetic field. Every time that the axis of the magnetic field points towards the Earth we receive a pulse of radiation. With a period of 0,00155 seconds, the number of rotations per second must be 1 ÷ 0,00155 = 645 rotations per sec! These neutron stars can only be the residues of supernovae - stars that had exploded and left a tiny residue no more than 20 km in diameter.

When the Crab nebula was examined at X-ray wavelengths by the Einstein satellite HEAO-2, launched in 1978, it was found that 96% of the X-rays of the nebula were due to synchrotron radiation and that the remaining 4% of the X-rays come from the star in the centre of the nebula. These X-rays are caused by synchrotron radiation which is due to electrons moving at speeds close to the speed of light in a

very strong magnetic field. The energy of the X-rays from the pulsar comprise at least 100 milliard electron volts. This proved that the residue of the Chinese "visiting star" of 1054 is a pulsar. Its period of 0,033134 seconds, means that it spins 1 ÷ 0,033134 = 30 times per second. The neutron stars or pulsars were thus found to be the residues of supernovae. The rate of spin of a pulsar gradually decreases with time. Those with the shortest periods are the youngest.

HEAO-2 received X-rays from the remnant of Tycho's star of 1597 from a globular volume but no radiation from a central star. This supernova must therefore have belonged to class la, namely a white dwarf whose mass increased by accretion from a companion star to more than the Chandrasekhar limit of 1,44 solar masses. It then blew itself to smithereens and left no central residue. The area of Tycho's remnant fits closely the area of the radiation from the radio waves which show that the mass of that star must have been 1,5 solar masses so that it exceeded the Chandrasekhar limit.

In the Gum nebula a pulsar has been found in the Vela portion and it is belting it out at 200 km per sec. This shows that the supernova explosion is not spherically symmetrical. A supernova is now pictured as having two diametrically opposite sets of jets from the poles of its magnetic field. This axis is close to the axis of spin so that the jets describe cones in space. Around the equator of the neutron star a “collar" of material expands at hundreds of kilometres per second. Because the speeds of the jets are not equal the neutron star gets a kick which sends it off at great speed.



Jan Eben van Zyl

The “A to Zee” of Astronomee.

By: Wolf Lange

A selective mixture of interesting terminology, objects, people of interest to all that love and are involved in Astronomy. Compiled by Wolf Lange who will deny any wilful exclusions . . . . . .

Sources include: Collins Dictionary of Astronomy 2nd Edition, Burnhams Celestial Handbook Revised and Enlarged Edition, Patterns in the Sky by Julian DW Staal and the Amateur Astronomers Handbook by JB Sedgwick.

Chondrite – a type of stony Meteorite that contains Chondrules. These are the most abundant class of meteorite in the solar system est. @ 86%. Largely composed of iron and magnesium bearing silicate minerals with a wide range of compositions. A few types are: carbonaceous Chondrites have the highest proportions of volatile elements and are most oxidized whilst enstatite Chondrites contain the most refractory elements (withstanding high temperatures) with “ordinary” Chondrites with intermediate in volatile element element abundance and oxidation state. Trevor Gould of ASSA is known as an expert in meteorites and organising meteorite hunting safaris!

Chryse Planitia – a relatively smooth Martian plain – 1600km across and 2,5km below the average planetary surface. It appears to have suffered water erosion in the past and was chosen as the site of Viking I landing in 1976. (NOTE: solar planetary exploration has introduced a new set of geophysical terminology other examples are mons, valles & rilles .

Cluster – a group of stars whose members are sufficiently close to each other to be physically associated. Broadly clusters are grouped into open clusters e.g. the *Pleiades* and globular clusters e.g. *Omega Centaurus.*

Coalsack nebula (Southern Coalsack) – a prominent *Dark Nebula* about 170 *Parsecs*

distant in the southern constellation of *Crux.* Can be seen with the nacked eye near and below the *Jewel box* open cluster. Best seen in winter when the southern cross is well above the horizon in the early evening and away from the city lights.

COBE – Abbreviation for Cosmic Background Explorer. One of the new generation of satellites launched in Nov. 1989, dedicated to the study of cosmic Microwave Background Radiation. Mission life was 4 years. Two cryogenically cooled instruments have observed the sky at infrared wavelength. There are basically three instruments that do whole-sky surveys and are designed to detect fluctuations in brightness of the microwave background. The detailed analysis of fluctuations in temperature will ultimately result in developing cosmological models that determine how the early inhomogeneities collapsed to form the Large-scale structure we see in today's Universe. Wow!

Cold dark matter – See *Dark Matter*.

Columba (Dove) – one of a number of the lesser know small constellations making up the 88 named constellations. Situated in the southern hemisphere near Canis Major. It has two bright stars of 2nd and 3rd magnitude. Approx. position RA 6h, DEC –35 degrees & an area covered of about 270 sq. degrees.

Constellation – any of the 88 areas into which the whole of the northern and southern hemisphere of the sky is now divided. Also referred to as the *Celestia*l *sphere*. Every star, galaxy or other celestial body lies within, or sometimes overlaps, the boundaries of one of the constellations. These boundaries were established unambiguously by the IAU (International Astronomical Union) in 1930 along arcs of Right Ascension and Declination for epoch 1875 Jan. 1.

Coordinate system – a system resembling that of latitude and longitude on the earth by which the direction of a celestial body or a point in the sky can be specified. There are 4 basic coordinate systems: *Equatorial, Ecliptic, Horizontal and Galactic,* each one has a fundamental circle a zero point and coordinates.

Copernicus – Nicolaus Copernicus a Dutch Astronomer proposed and published in 1543 in his book De Revolutionibus a heliocentric solar system using basic ideas of the Ptolemaic system. There was a strong and prolonged reaction – especially by the church – to the Copernican system which effectively displaced (correctly so) the Earth as the Centre of the Universe.

Also a young lunar crater to the south of Mare Imbrium that is 90km in diameter.

Thirdly it's a NASA Orbiting Astronomical Satellite OAO-3 launched in Aug. 1972 and operating until Dec. 1980, carrying a 0,9m telescope. (So Hubble was NOT the first after all!).

Cosmic dust – small particles or grains of matter found in many regions of space. There size ranges from 10um to less than 0.01um. Thought to be composed mainly of carbon and silicate material with, in some cases, mantles of water, amonia or carbon dioxide ice. Associated with Dark Nebulae.

Crab Nebula (M1; NGC 1952) – a turbulant expanding mass of gas and cosmic dust with luminous twisting filaments of ionized gas lying about 2000 parsecs away in the constellation of Taurus. It is the remnant of a Supernova probably type II, that was almost certainly observed by Chinese and Japanese in 1054.

Crux or Crux Australis (Southern Cross) – a conspicuous constellation in the southern hemisphere only recorded as recent as in the 1500s by early seafarers. The area also contains the brilliant Jewel box cluster and the dark Coalsack nebula.

C-type asteroids – as promised with B-types here it is: the most common class of Asteroid in the outer main belt, having surfaces similar in composition to Carbonaceous Chondrite meteorites. The three sub-classes: B-type asteroids have a higher Albedo than the average C-type and G-types have a stronger UV absorption feature.

Wolf Lange

JPL ASTEROID MISSION GETS THUMBS UP FROM NASA

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A mission that will orbit the two largest asteroids in the solar system is one of a pair of missions chosen by NASA for the agency's Discovery program.

The mission, called Dawn, is managed by NASA's Jet Propulsion Laboratory, Pasadena, Calif. Led by principal investigator Dr. Christopher T. Russell of the University of California, Los Angeles, Dawn is scheduled for launch in 2006.

The second new Discovery mission is Kepler, a spaceborne telescope, also scheduled for launch in 2006. It will search for Earth-like planets around stars beyond the solar system. Kepler is managed by NASA's Ames Research Center, Moffett Field, Calif.

"Kepler and Dawn are exactly the kind of missions NASA should be launching, missions that tackle some of the most important questions in science yet do it for a very modest cost," said Dr. Edward Weiler, associate administrator for space science at NASA Headquarters in Washington D.C. "It's an indicator of how far we've come in our capability to explore space when missions with such ambitious goals are proposed for the Discovery program of lower-cost missions rather than as major projects costing ten times as much."

The Dawn mission will make a nine-year journey to orbit the two most massive asteroids known, Vesta and Ceres, two "baby planets" very different from each other yet both containing tantalizing clues about the formation of the solar system. Using the same set of instruments to observe these two bodies, both located in the main asteroid belt between Mars and Jupiter, Dawn will improve our understanding of how planets formed during the earliest epoch of the solar system.

Ceres has quite a primitive surface, water-bearing minerals, and possibly a very weak atmosphere and frost. Vesta is a dry body that has been resurfaced by basaltic lava flows, and may have an early magma ocean like Earth's Moon. Like the Moon, it has been hit many times by smaller space rocks, and these impacts have sent out meteorites at least five times in the last 50 million years.

The mission will determine these pre-planets' physical attributes, such as shape, size, mass, craters and internal structure, and study more complex properties such as composition, density and magnetism.

The Dawn mission builds on the highly successful ion-propulsion technology pioneered by NASA's Deep Space 1 spacecraft. During its nine-year journey through the asteroid belt, Dawn will rendezvous with Vesta and Ceres, orbiting from as high as 800 kilometers (500 miles) to as low as 100 kilometers (about 62 miles) above the surface.

"I'm ecstatic that we'll have such a great opportunity to show what ion propulsion can do," said JPL's Sarah Gavit, Dawn project manager. "Ceres and Vesta are two of the largest unexplored worlds in our solar system. We'll learn about early planet formation in ways that wouldn't have been possible before this mission." She said she looks forward to working with Orbital Sciences, a new industry partner for NASA's interplanetary spacecraft. Orbital Sciences Corporation, Dulles, Va., will develop the Dawn spacecraft.

"With its cutting-edge capability, Kepler may help us answer one of the most enduring questions humans have asked throughout history: are there others like us in the universe?" said principal investigator William Borucki of NASA's Ames research Center, Moffett Field, Calif., leader of the second selected mission.

The Kepler mission differs from previous ways of looking for planets orbiting other stars. Kepler will look for the 'transit' signature of planets that occurs each time a planet crosses

the line-of-sight between the planet's parent star and the observer. When this happens, the planet blocks some of the light from its star, resulting in a periodic dimming. This periodic signature is used to detect the planet and to determine its size and orbit. Kepler will continuously fix its gaze at a region of space containing 100,000 stars and will be able to determine if Earth-sized planets make a transit across any of the stars.

The industrial partner for mission hardware development is Ball Aerospace & Technologies Corp., Boulder, Colo. Kepler's selection involves a delayed start of development of up to one year due to funding constraints in the Discovery program.

NASA selected these missions from 26 proposals made in early 2001. The missions must stay within the Discovery program's development cost cap of about $299 million.

The Discovery program emphasizes lower-cost, highly focused scientific missions. The past Discovery missions are Near Shoemaker, Mars Pathfinder and Lunar Prospector, all of which successfully completed their missions. Stardust and Genesis are in space; both have begun collecting science data, although Stardust has not yet arrived at its target comet. Contour is scheduled to launch next summer, Deep Impact in January 2004 and Messenger in March 2004. Aspera-3 and NetLander are Discovery Missions-of-Opportunity under development.

Information about Dawn and images are available at: *http://www-ssc.igpp.ucla.edu/dawn/* . Details about the Kepler mission are available at: *http://www.kepler.arc.nasa.gov* . Kepler images are available at: *http://www.kepler.arc.nasa.gov/downloading.html* . Information about the Discovery program is available at: *http://discovery.nasa.gov/* .

JPL, a division of the California Institute of Technology in Pasadena, manages Dawn for NASA's Office of Space Science, Washington, D.C.

Questions and Answers

The Speed of Light

It has been asked “why is the speed of light what it is?”, and some answers have been put forward. I would like to suggest another approach to the problem.

If we go back to the famous equation derived from Einstein’s mathematics and start from there, we might find a clue.

E = mc**2 (E equals m times c squared)

The energy in an amount of matter depends only on the mass and the speed of light.

Which says that you can convert matter into energy (and vice versa) **using the speed of light as the conversion factor.**
Changing the formula around and we get that

c = square root of (E / m)

which says that the speed of light **is dependant on the mass of a particle and the energy it contains.**

If we take the mass of the smallest particle of matter, the hydrogen atom and consider the amount of energy it contains we can work out what the speed of light is.

So the question becomes “why is the mass of the hydrogen atom what it is and why does it contain the amount of energy that it does?”. We can add questions as to why the charge on an electron is what it is and why the gravitational constant, g, has a certain value. And why do all the so-called “universal constants” have the values that they do?

And the answer to these questions must lie in the conditions that existed at the time of the Big Bang.

Could they have been different? Well it is very easy to imagine the mass of an atom being different, but could it actually have happened? At the time of the Big Bang everybody was somewhere else doing other things, there are no records of what conditions were actually like at the time and the details have slipped by unrecorded.

There may well be other kinds of universes where the mass of an atom is different or the

charge on an electron is different or the gravitational constant is different, but we may never know the answer to that. Of course in the future some clever physicists may be able to simulate a Big Bang under laboratory conditions.

But until then we shall just have to accept that the speed of light (and the other "universal constants") is what it is because of the conditions that existed when the universe was created at the time of the Big Bang.

Brian Fraser

SPACEWALK TO HELP ASTRONAUTS HAM IT UP IN COMFORT

Fri, 11 Jan 2002 11:20:23 -0500 (EST)
NASANews@hq.nasa.gov
RELEASE: 02-07

As astronauts and cosmonauts have adapted to home life on the International Space Station, they have found amateur radio, often referred to as ham radio, and its electronic connection to life here on Earth to be a constant companion.

During a spacewalk planned for January 14, the crew will install an antenna system that ultimately will enable a key facet of the ham radio station to move into much more comfortable and convenient surroundings inside the station's living quarters.

Since November 2000 amateur radio equipment has been used by Expedition astronauts and cosmonauts to talk to hundreds of kids in schools around the world, as well as to friends, family and others on Earth.

During the spacewalk, Expedition Four Commander Yuri Onufrienko and Flight Engineer Carl Waltz will venture outside the station and install the first of four antennas built by the Amateur Radio on the International Space Station (ARISS) team.

"The installation of this first antenna on the outside of Zvezda will allow the crew to set up ham radio equipment in their living quarters," said Frank Bauer, chief of the Guidance, Navigation and Control Center at NASA's Goddard Space Flight Center in Greenbelt, Md. "The Zarya location worked well, but this new setup is much more comfortable and convenient and should allow for more contact between the crew and amateur radio operators and schools on Earth."

The Russians designed Zvezda with four special ports for installation of antennas that serve two functions: amateur radio and a Russian Extravehicular Activity (EVA) – or spacewalk --television system. The antenna will support Russian video transmission during Russian spacewalks, and during normal operations will support amateur radio activities. The other three antennas will be installed later this year.

Like the space station itself, these new antennas are the result of an international team effort. The Italian partners provided one portion, the Russians designed the system and provided the EVA handling and attachment hardware, and NASA performed the assembly and tests to qualify the units for use in space.

In 1996, delegates from eight nations involved in the space station project, representing major national radio organizations and The Radio Amateur Satellite Corporation (AMSAT), signed an agreement forming ARISS to design, build and operate amateur radio equipment.

In the United States, the American Radio Relay League and AMSAT provide leadership and consultation. They donate and build hardware and make sure safety and qualification tests are successfully completed.

"Astronauts and cosmonauts are ardent supporters of educational outreach contacts with schools," said Bauer, who in addition to his NASA duties serves as vice president for AMSAT's human space flight division. "They have made contacts with hundreds of school children at more than 40 schools around the world."

In the future, ARISS hopes to fly a slow-scan television system on the International Space Station.

More information about amateur radio on the space station is available at:

http://spaceflight.nasa.gov/station/reference/radio/index.html

ESA's new camera will revolutionise the way astronomers observe the Universe

ESA Science News
http://sci.esa.int
15 Jan 2002

Scientists at the European Space Agency have developed a new camera that is poised to revolutionise the way astronomers observe the Universe. Called S-Cam, the new device's capabilities read like an astronomer's wish list. From now on, astronomers will know almost everything about starlight from one simple observation.

S-Cam, which stands for superconducting camera, is the latest result of a decade-old project by ESA to develop the next generation of detectors for space missions. At the heart of S-Cam is a superconductor, a

Material that loses its natural resistance to electricity at low temperatures.

"By 1992/93 we understood theoretically that superconductors would be sensitive in the optical and near infrared region of the spectrum," says Tone Peacock, Head of Science Payloads Technology Division, about the genesis of the new camera. "In the case of a superconducting camera, each individual piece of light (known as a photon) is detected. Not only that, its time of arrival and its colour is measured."

During 1992, working with ESA astronomer Michael Perryman, they predicted this unique capability of superconductors and the impact such a revolutionary light sensor would have on the field of astrophysics.

The ability to 'tag' each photon with its arrival time and colour, coupled with the speed of the superconductor, is what makes S-Cam so attractive. Today, astronomers use Charge Coupled Devices, known as CCD cameras, to make their observations. CCDs are also used in digital cameras and video cameras. Essentially, a CCD catches light in the electronic equivalent of a bucket, known as a pixel. The drawback is that this method can only measure the brightness of a mass of photons. Neither can a CCD measure colour.

With the new device, as each photon arrives, S-Cam records when and where it hits the detector and its colour, then passes the information to a computer where it forms a comprehensive database about the celestial object being studied. With this goldmine of information, astronomers can look for simultaneous variability in the brightness and colour of celestial objects on time scales of well below a millisecond (one-thousandth of a second).

This would allow them to study the large number of rapidly varying celestial objects whose details have so far eluded astronomers. Among them are the cataclysmic variable stars, the optical explosions associated with gamma-ray bursts and the visible light emitted by pulsars, the dead hearts of stars.

Scientists at ESA's research laboratories (ESTEC) in the Netherlands have tested their S-Cam prototype instrument successfully at the William Herschel Telescope (WHT), a large telescope on La Palma, in the Canary Islands. The ESA team lead by the S-Cam instrument manager, Nicola Rando, conducted a series of week-long campaigns at the telescope from late 1999 through 2000 demonstrating all aspects of this powerful instrument.

One result shows a binary star system in which a white dwarf passes behind a red star. As the image dims, so the colour changes from blue to red indicating that the light is being absorbed by material streaming from the red star down onto a spot on the white dwarf. The precise time of this dimming allows the astronomers to determine the size and location of the spot on the white dwarf even though the star is many light-years from Earth. Another observation has easily determined the distance to ten far-off celestial beacons known as quasars.

This is only the beginning. At present, S-Cam works with just 36 pixels but the team are fabricating S-Cams with hundreds and thousands of pixels. Eventually, they will rival the millions of pixels that CCDs now possess. Their use will then extend to all branches of astronomy and beyond. Peacock envisages that

they will eventually be taken up by the microchip industry. "I think the use of these chips to probe contaminants in silicon will become a major industrial application," he says.

Beyond that, who knows? One day, S-Cams may even find their way into household camcorders.

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Several Internet links were included with this story but removed for space problems. They will however, be inserted in the article when loaded up to our website. Ed.

Web between the Worlds

The idea behind the "Wayback Machine" is simple, to archive the Internet. The entire Internet. Every page. Point your browser at:

http://www.archive.org/

and take a look for yourself.

FITS stands for `Flexible Image Transport System' and is the standard astronomical data format endorsed by both NASA and the IAU. FITS is much more than an image format (such as JPG or GIF) and is primarily designed to store scientific data sets consisting of multi-dimensional arrays (1-D spectra, 2-D images or 3-D data cubes) and 2-dimensional tables containing rows and columns of data. Take a look at it at

http://heasarc.gsfc.nasa.gov/docs/heasarc/fits.html

Virtual reality maps of the sky are nothing new. Here is another one.

http://www.honeylocust.com/Stars/

Tatsuro Matsumoto's site at http://www.page.sannet.ne.jp/mazmoto/index-e.htm explains his invention, the Erecting Mirror System, and is also a useful launching point for the Telescope Making Ring. A ring, as you may now, is a chain of thematically related websites, linked so that you can travel from one to the next, eventually returning to your point of origin. Here is another ATM, also on the Telescope Making Ring.

http://users.uniserve.com/~victorp/

Clear skies!

Evan Dembskey

CHANDRA FINDS GHOSTS OF ERUPTION IN GALAXY CLUSTER

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RELEASE: 02-02

"Ghostly" relics of an ancient eruption that tore through a cluster of galaxies were recently uncovered by NASA's Chandra X-ray Observatory. The discovery implies that galaxy clusters are the sites of enormously energetic and recurring explosions, and may provide an explanation why galaxy clusters behave like giant cosmic magnets.

"Chandra's image revealed vast regions in the galaxy cluster Abell 2597 that contain almost no X-ray or radio emission. We call them ghost cavities," said Brian McNamara of Ohio University in Athens today during a press conference at the American Astronomical Society meeting in Washington. "They appear to be remnants of an old explosion where the radio emission has faded away over millions of years."

The ghost cavities were likely created by extremely powerful explosions, due to material falling toward a black hole millions of times more massive than the Sun. As the matter swirled around the black hole, located in a galaxy near the center of the cluster, it generated enormous electromagnetic fields that expelled material from the vicinity of the black hole at high speeds.

This explosive activity in Abell 2597 created jets of highly energetic particles that cleared out voids in the hot gas. Because they are lighter than the surrounding material, the cavities will eventually push their way to the edge of the cluster, just as air bubbles in water make their way to the surface.

Researchers also found evidence that this explosion was not a one-time event. "We detected a small, bright radio source near the center of the cluster that indicates a new explosion has occurred recently," said team member Michael Wise of the Massachusetts Institute of Technology in Cambridge, "so the cycle of eruption is apparently continuing."

Though dim, the ghost cavities are not completely empty. They contain a mixture of very hot gas, high-energy particles and magnetic fields -- otherwise the cavities would have collapsed under the pressure of the surrounding hot gas.

"Ghost cavities may be the vessels that transport magnetic fields generated in a disk surrounding a giant black hole to the cluster gas that is spread over a region a billion times larger," said McNamara. If dozens of these cavities were created over the life of the cluster, they could explain the surprisingly strong magnetic field of the multimillion-degree gas that pervades the cluster.

Galaxy clusters are the largest known gravitationally bound structures in the universe. Hundreds of galaxies swarm in giant reservoirs of multimillion-degree gas that radiates most of its energy in X-rays. Over the course of billions of years some of the gas should cool and sink toward a galaxy in the center of the cluster where it could trigger an outburst in the vicinity of the central massive black hole.

Chandra observed Abell 2597 on July 28, 2000,for 40,000 seconds with the Advanced CCD Imaging Spectrometer (ACIS) instrument. Pennsylvania State University, University Park, and MIT developed the instrument for NASA. In addition to a group of astronomers from the Space Telescope Science Institute, Baltimore, and the University of Virginia, Charlottesville, the team included: Paul Nulsen, University of Wollagong, Australia; Larry David, Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.; Chris Carilli, National Radio Astronomy Observatory, Socorro, N.M.; and Craig Sarazin, University of Virginia.

NASA's Marshall Space Flight Center in Huntsville, Ala., manages the Chandra program, and TRW, Inc., Redondo Beach, Calif., is the prime contractor for the spacecraft. The Smithsonian's Chandra X-ray Center controls science and flight operations from Cambridge, Mass.

Images associated with this release are available at:

http://chandra.harvard.edu

and

http://chandra.nasa.gov

DIVERSE SPACE SHUTTLE FLIGHTS TO SET RECORDS, CONTINUE CHALLENGES IN 2002

NASANews@hq.nasa.gov

RELEASE: 01-256

On the heels of making space history in 2001 by completing the first phase of the International Space Station (ISS) assembly in orbit, the Space Shuttle will continue a string of space firsts during six missions planned for 2002.

"In the past 12 months, we've completed some of the most challenging space flights in history," said Space Shuttle Program Manager Ron Dittemore. "In the next year those challenges will continue with missions just as complex. The team continues to excel safely and successfully, and 2002 promises to be just as rewarding as the past year."

The coming year will be marked by the shuttle fleet matriarch Columbia's return to space on the first non-ISS Shuttle flight in more than two years. In addition, flights by Atlantis and Endeavour will haul more than 50 tons of additional components to the ISS and more than three dozen new experiments and two new laboratory racks. Discovery will remain on the ground in 2002 for standard maintenance and inspections.

In 2002, NASA plans to break a record set only last year for the most space walks ever conducted in a single year. From Space Shuttles alone, 15 space walks are planned coupled with seven space walks that are

planned by crews from the International Space Station. In 2001, 18 total space walks were conducted -- 12 from the shuttle and six from the station.

"Space walks will never become routine, but we have entered an era of space exploration now where they will continue to become more common," said Milt Heflin, Chief Flight Director. "But no matter how many or how often crews leave their spacecraft, each EVA remains just as exciting to prepare and conduct and just as rewarding to complete."

Columbia will begin the new year with a flight to the Hubble Space Telescope on mission STS-109, the fourth mission to service the space telescope since its launch in 1990. Five space walks will be conducted during the flight to install an advanced new camera system, attempt to reactivate an existing infrared instrument system, install new solar arrays and install a new power controller. The mission will extend the lifetime and capabilities of the now-famous orbiting telescope.

When Columbia launches it also will become the second Shuttle ever to fly with a new "glass cockpit," installed as part of maintenance and modifications completed in 2001. The new cockpit has 11 full-color, flat-panel displays that replace 32 gauges and electromechanical instruments and four cathode-ray tube monitors in the old cockpit. The new cockpit is lighter, uses less power and sets the stage for a future "smart cockpit" that will feature new, more intuitive displays to reduce pilots' workloads during critical periods.

In addition, the following flights are planned in 2002:

STS-110, mid spring: Atlantis will deliver to the ISS the first of three giant truss segments to be launched in 2002.

STS-111, late spring: Endeavour will carry to the ISS the fifth resident crew, the Leonardo logistics module filled with experiments and supplies, and a mobile base system -- the second part of the mobile platform for the station's innovative Canadarm2 robotic arm.

STS-107, mid-summer: Columbia will fly an international mission dedicated to microgravity science that will carry a double Spacehab module filled with 32 experiments involving 59 separate

investigations.

STS-112, late summer: Atlantis will make its second visit of the year to the ISS carrying the first starboard side truss segment.

STS-113, early fall: Endeavour will deliver the sixth resident crew and a port side truss segment to the station, completing almost half the length of the final truss.

For more information about upcoming Space Shuttle missions, please see: *http://spaceflight.nasa.gov/shuttle*

Mars Odyssey Ready to Tackle Science Agenda

by Leonard David

space.com

21 January 2002

RENO, NEVADA - NASA's Mars Odyssey is ready to start science duties as it circles the Red Planet. The spacecraft completed a set of aerobraking maneuvers January 11 following weeks of dipping in and out of Mars' thin atmosphere in order to tighten its orbit around the planet.

An upcoming and key event is deployment of Odyssey's high-gain antenna. That equipment is crucial in relaying to Earth quantities of data to be gleaned by the spacecraft's science instruments. The antenna is to be released and deployed with a motor-driven hinge.

If you have access to the Internet, you can view the full story here:

http://www.space.com/missionlaunches/odyssey_update_020121.html

The Sky this Month

February 2002

dd hh		dd hh	
4	14 **LAST QUARTER**	13	17 Uranus in conj. with Sun
7	10 Venus 0.8 S of Uranus	14	21 Moon at apogee
8	09 Saturn stationary	17	00 Mars 5.1 N of Moon
8	16 Mercury stationary	20	12 **FIRST QUARTER**
10	05 Mercury 5.0 N of Moon	21	00 Saturn 0.3 S of Moon…Occn.
11	01 Neptune 3.7 N of Moon	21	18 Mercury greatest elong. W(26)
12	08 **NEW MOON**	23	02 Jupiter 0.9 S of Moon…Occn.
12	08 Uranus 3.8 N of Moon	24	12 Mercury 0.5 S of Neptune
12	20 Venus 3.3 N of Moon	27	09 **FULL MOON**
13	07 Mercury greatest brilliancy	27	19 Moon at perigee

March 2002

dd hh		dd hh	
1	14 Jupiter stationary	18	01 Mars 4.0 N of Moon
6	01 **LAST QUARTER**	20	10 Saturn 0.4 S of Moon…Occn.
9	02 Mercury 1.2 S of Uranus	20	19 Equinox
10	09 Neptune 3.7 N of Moon	21	04 Pluto stationary
11	17 Uranus 3.9 N of Moon	22	02 **FIRST QUARTER**
12	01 Mercury 2.7 N of Moon	22	11 Jupiter 1.1 S of Moon…Occn.
13	22 Moon at apogee	28	06 Moon at perigee
14	02 **NEW MOON**	28	18 **FULL MOON**
15	06 Venus 4.0 N of Moon	31	15 Saturn 4.1 N of Aldebaran

LOCAL TIMES of RISE and SET for the MAJOR PLANETS, 2002

Site Location:- Long. **+28.0** deg. Lat. **-26.0** deg. Local Time:- UT **+2.0** hrs.

Date	Sun		Mercury		Venus		Mars		Jupiter		Saturn	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
Feb 10	05.50	18.54	04.10	17.29	06.19	19.19	09.57	21.37	16.01	02.30	13.53	00.36
Feb 20	05.57	18.46	03.56	17.17	06.36	19.18	09.50	21.19	15.20	01.48	13.14	23.57
Mar 02	6.03	18.37	04.07	17.22	06.53	19.15	09.42	21.01	14.40	01.08	12.36	23.19
Mar 12	6.08	18.27	04.32	17.31	07.09	19.11	09.35	20.43	14.01	00.29	11.59	22.41
Mar 22	6.13	18.16	05.06	17.41	07.25	19.07	09.28	20.27	13.24	23.52	11.23	22.04