MACARTHUR ASTRONOMICAL SOCIETY Inc.

Journal

PRIME FOCUS

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President's Report

Greetings and welcome. The Mars space probes, Spirit and Opportunity have provided some great news stories lately. I know I try to catch all the bulletins just to grab the latest updates. The news about the discovery of water sounds fantastic, I can't wait to see more detailed articles in the forthcoming astronomy magazines.

Last month we were treated to several speakers. Ian Cook quizzed us and Dick Everett gave us the latest news. One very important and overlooked event was the capturing of comet debris by the probe Stardust. I am sure this probe will feature in upcoming news stories. Thanks to everyone who made the night a lot of fun.

Tonight

I am still hopeful of a visit by Ragbir concerning the observing and public nights situation. Ian Cook has previously asked me if he can grab a spot to talk to us and that may be tonight or John will show us the video on the Mars probes. My thanks go to all of our members who put their hand up to act as our speakers. we certainly have an astronomical amount of talent in the club. I still have some contacts to make regarding external speakers and I am hopeful of announcing some dates in the near future.

Important items

Membership renewal fees are due, so please pay as soon as possible. It's only by your prompt payments that we can have some idea as to how we are travelling in the year ahead, e.g. getting our website up and running and insurance payments.

Speaking of insurance I have made some early enquiries and looks like no great drama (except for an increase in paperwork) in renewing for another year. Also I have touched base with the University of Sydney International House over the use of the log

cabin down at the forest, all looks well and we can travel down next week. I have also confirmed the date in March. Future dates depend on successful renewal of our insurance but hopefully I can attend to these matters in due course

Please remember that the field nights we attend are for members only and invited guests. We don't have permission to make these facilities available to the general public. With the cabin hire agreement I had to compile a list of attendees in advance, sign off on that together with my acknowledgement that I will take full responsibility for the conduct of the group and protection of all International House property.

Also a copy of our certificate of currency needed to be forwarded. Our relationship with International House is very important to the society and we have enjoyed some fantastic stargazing whilst down at the forest. I am sure I can count on your support to help me foster and continue the good relationship we currently enjoy.

Our AGM is fast approaching and application forms for management and committee positions are placed near the attendance book. Grab a form or see me as I have some spares. Please be assured that if you feel you can make a worthwhile contribution to assist in running the society then your application would be most welcomed.

Confirmed dates

21/02/04 The Forest; 13/03/04 The Oaks
15/03/04 Gen. Meeting;20/03/04 Forest;
27/03/04 Forest; 19/04/04 AGM.

Remember to contact myself or John Rombi if the weather looks on the foul side, my mobile is 0410 445 041. Well that's about it from me.

Regards
Noel Sharpe

A distant planet is heating its sun

On the Internet I read the German magazine "Der Spiegel" in which is written that in the constellation Sagittarius a planet 270 times larger than the Earth is orbiting its sun. This planet creates a lot of storms and makes extra heat for its sun. This of course is the opposite of what normally happens. This solar system is 90 light years from Earth.
Canadian astronomers discovered it with the 3.6-meter Mauna Kea telescope on Hawaii. Of the 119 extra solar planets discovered, this is the first one with evidence of a magnetic field.
This planet is a gas giant a bit smaller than Jupiter and orbiting its sun in only **3 days.**
Evgenya Shkolnik and the other astronomers from the University of British Columbia discovered that the planet actually travels through sections of the star's outer atmosphere. The strong magnetic field of the planet helps to create massive eruptions on the star's surface.
When astronomers think they've worked out the Universe something new always comes along.

Ursula Braatz.

Light, Motion, Time, and Space

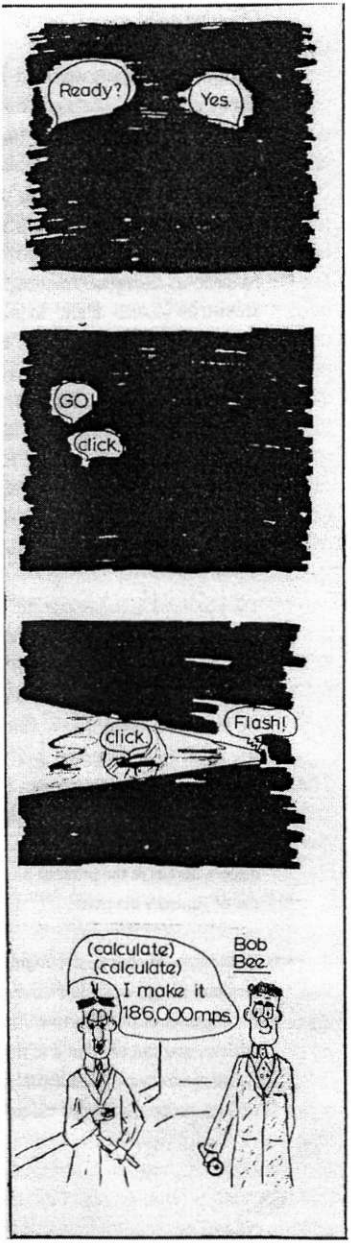
PART 2 - John Casey **18/08/2000**

The Speed of Light: If light travelled at a constant speed in space, in an unmoving aether, it would increase the status of Newton's absolute space as a reference point for measurement.

Measurement of the speed of light began with Galileo, who placed two observers on distant hills. One would unshutter his lantern and the other would respond by doing the same as soon as he saw the light. Thus the observation- " if not instantaneous, it is extraordinarily rapid". In 1675 Roemer in France using astronomical observations measured the speed of light at 200,000 km/sec, whilst Bradley in England in 1729 measured 304,000 km/sec. In 1862 , Foucault of France, using rotating mirrors measured the speed of light at 298,000 km/sec with an uncertainty of 500 km/sec.

Then, in 1887, the famous Michelson-Morley experiment was performed with great accuracy. This was designed to measure the change in the speed of light due to the Earth's motion through the aether over the course of a year. The experiment was based upon interference between light beams moving in the direction of the Earth's motion and at right angles to it. It was performed at such accuracy that it should have detected 1/100th the expected effect from Earth's motion through the aether but no change in the speed of light was found. This was a great surprise. Newton's reference grid, and relativity of all motion to it did not hold for light!

The Dutch physicist Hendrick Anton Lorentz had published an influential study in 1895 that seemed to explain all experimental results [except for the Michelson-Morley experiment] by assumption of a perfectly rigid aether that was devoid of all physical properties except rigidity, but this was necessary to carry the excitations of Maxwell's electromagnetic fields.



To explain this single exception, he proposed that for some physical reason yet unknown, a body moving relative to the aether might contract in the direction of its motion. This was a clue that Einstein would later use for his own theory.

In 1898, Poincare published a paper in which he asked the questions "What does it mean to say that a second today is the same as a second tomorrow?" and "How does one define simultaneity at spatially separated points?" No one had a good answer to these questions until a young Albert Einstein began to work on them in 1905. Einstein took the relativity principle seriously. Basically, the relativity principle says that the laws of nature have identical forms in all [moving] frames of reference, and not, for instance, only in the [stationary] aether. He saw that Lorentz had introduced a "local time" to describe phenomena in a reference frame moving through the aether, and used it himself, and then saw that the key to the entire mystery lay in the concept of simultaneity.

Then Einstein proposed in 1905 that light behaved both as a wave and as a particle...

Einstein took up this idea in his paper on special relativity in 1905. First he proposed that nothing could travel faster than light, and that light travelled the same speed in all frames of reference. He then proposed that all observers moving in different frames of reference and observing a distant frame with a master clock, would in fact see different times and timing, depending upon how fast they are moving. A consequence of this is that two such groups going at different speeds, would each think that the other group's clock was running slow by their own observations of that group, and their measurement of distances in the direction of motion would be shortened.
The key to the simultaneity issue was that no one could, in God like fashion, look in from the outside and see all things in their place in one instant - they had to rely on the fastest messenger, light, to bring the message, and this took time to travel to a distant observer.

But other properties of light and other electromagnetic radiation defied logic at that time. For example the amount of energy within an oven was of scientific concern - the radiation within was electromagnetic radiation with black body emissions – i.e. with a peak intensity at one frequency, but with continuous but decreasing emissions from this peak frequency to the highest known frequencies. If this radiation was truly continuous in character, then the energy available within the oven would be infinite. This would be an impossibility, so something was wrong with their theories.

Then Einstein proposed in 1905, [just before his special relativity paper], that light behaved both as a wave and as a particle, with the energy of a beam of light being not distributed continuously into an ever increasing volume. Instead, he proposed that the energy was made up of a finite number of quanta [or packets] of energy that could only be absorbed or emitted as wholes. These quanta are now called photons, and Einstein showed that their energy must be the radiation frequency multiplied by Plank's constant. It was this paper, not the one on special relativity that won him the 1921 Nobel Prize for Physics. Although Einstein did not like the idea of it, his work opened up the new field of quantum mechanics. Einstein himself published several important papers on the

quantum theory on the specific heats of solids.

The next advance was by the Danish physicist Neils Bohr. In 1913 Bohr showed that the electrons in an atom orbited the nucleus of protons like a miniature solar system, and the electrostatic forces between the protons and electrons would give orbits of definite angular momentum, or energies, and radiation would occur as spectral lines of sharp and specific frequencies when electrons "jumped" from an orbit of higher energy to one of lower energy. Using Newtonian mechanics he calculated the electron orbits for the hydrogen atom and showed that the angular momentum is some exact multiple of Plank's constant. His results were very close to measured values.

All this shows that light and matter are inter-linked. You cannot make light without matter, and you cannot absorb or stop light without matter. The two are bound together, so that light is the messenger of matter, sending out to distance places signals that describe the state that the matter was in as it emitted that light. And now we also know that the straight path of light is only straight when it does not come close to other matter. When it does, its path is bent by the gravity of that matter - or more correctly, space/time warps from this mass. When a mass of matter is large enough, then the light it emitted cannot escape at all - this is a black hole, in which matter on the inside greedily consumes all matter and light that passes its way through the event horizon - the zone where the escape velocity equals the speed of light. Einstein looked at these observations from a different vantage point, and instead said that space-time is bent by matter, and light always travels the shortest course in space-time.

The properties of light, and all other electro magnetic radiation are bound up in the concept of time, and to the movement of charged particles. Coulomb's Law describes the force that develops between two stationary electrical charges, and states that this electrostatic force varies directly with the size of each charge and inversely as the square of the distance between them.
$F = Q_1 x Q_2 / (\text{distance apart})^2$.

Maxwell, engraving by G.J. Stodart.

James Clerk Maxwell

Maxwell had noted that a magnetic field, or magnetism, is simply the result of uniform relative motion between charged particles. The difference between an electric field and a magnetic field is that the electric field produces the same force on one of the charges irrespective of whether this charge was moving or not, whereas the magnetic field only produces a force when there is relative movement between the charged particles. Such relative movement implies both a distance change, and a time change.

Now, if one of these charges not only moves relatively to the other, but accelerates in some direction, then a second magnetic field is generated, but with a component at right angles to the direction of motion and to the other magnetic field. The importance of this is that this force effect from the accelerated motion falls off only as the distance apart, not as the square of the distance as when the charges were static or in constant motion. The difference between uniform movement, and an acceleration is that the dimensions involved have changed from length/time to length/time/time, and the effects of this are that the magnetic effects of the acceleration of the charged particles are now the major effect observable from a distant location.

Maxwell made his contribution to science in realising that the electrical influence of one charge on another was not instantaneous. Maxwell realised that the entire field of magnetism resulted from the fact that a charge could not instantaneously exert its coulomb force on all other charges in the neighbourhood, but that its influence propagated out with the speed of light, and this caused a "magnetic" component due to changing distances between the charges.

Maxwell showed that when charged particles were accelerated energy was being radiated into electro-magnetic fields that carried away a specific amount of energy. Where there was movement, but no acceleration, a standing electrical and magnetic field was produced that did not change after the initial energy required to start the moving charged particle [accelerate it from non moving to moving]. To continue to accelerate the charge, energy had to be supplied continuously sufficient to overcome that being radiated as electro-magnetic radiation.

Electromagnetic radiation may be considered a transverse wave motion, since the electrical and magnetic field at any point are oscillating up and down in a direction at right angles to the direction of propagation of the radiation. By analogy to sound waves, [where only solids are rigid enough to vibrate at right angles to the direction of the sound waves - liquids and gases cannot do this], the aether was considered 100 years ago to be the needed medium for electromagnetic radiation. It would have to exhibit immense rigidity - the property of an extremely strong high tensile solid- so rigid it could vibrate at the extreme frequencies that electro-magnetic radiation such as X Rays possess, and still give sharp spectral lines.

Note that this is a similar effect to the seismic waves passing through the Earth, where only the compressive waves can pass through the liquid and solid regions - the transverse waves pass through solid rock, but not molten rock.

Light photons appear to be immune to aging, so looking out further into the night sky is looking backwards in time, to the period when the photon were emitted by electrons changing energy levels in atoms in some distant location. There is a different kind of aging present, but it is the lowering of the frequency of the photon as the universe expands around it - a red shift. An infinite universe would drain the frequency of vibration of the photon to zero as the red shift continues indefinitely. Lower frequency means less energy present, so all the energy of the universe would also drain away in this expansion. This would be where time stops counting too, as how can there be time without movement?

If there is enough matter in the universe, the expansion might stop and reverse, whilst there was some energy remaining and the universe would then contract. Then the frequency of the photon would start to climb ever upwards until even the photon could not hold together - perhaps in the death/birth of another big bang.

Would an expanding universe then just be what we see from the inside of a black hole?

It is time to ponder this elusive dimension. Is time continuous or granular? Can it flow backwards. Can it stop and start? Is time just an indication of movement? At absolute zero, when all movement of matter has reached a minimum, has time stopped also? Can time be warmed up to make it go faster? What about Light - is it the carrier of time? Or is it the very expansion of the Universe that causes time?

One must wonder what happens to time within the event horizon of black holes. If light still has a frequency inside a black hole and cannot escape, then does this just mean that time has stopped - or has it just lost its meaning? If there are other big bangs, would a second in these new universes be the same as ours.

What if time just changes direction within a black hole? Would an expanding universe then just be what we see from the inside of a black hole, [seemingly for us from a big bang, about 15 billion years ago]? Perhaps time will tell!

John Casey ■

Astronomy near Wallis Lake, Foster

We stayed at our friend's property near Wallis Lake to celebrate the New Year. On the 30th December I got my telescope out that night. Venus was beautiful and a little orange in colour. This could have been caused by the atmospheric conditions. By the time I set up the scope Venus was gone. The Moon and Mars were close together and easy to watch through the binoculars. Then I watched Orion and when I had The Orion Nebula in focus I saw a satellite through my telescope. Then without the telescope my friend and I saw a shooting star.

On New Years Eve we celebrated outside. We greeted the New Year with a beautiful starry sky and the planets Jupiter and Saturn. On the 2nd January my friend and I saw something strange in the sky. It was about 10.30pm and there was a ¾ Moon. We saw two "stars" over the Moon; one was bright and orange like Jupiter and the other smaller. They were moving very fast and disappeared very quickly. I knew that it was not Jupiter because it was rising later. Were they satellites, the space station, or U.F.O.'s?

On the other nights the Moon was bigger and brighter and the stars too dim to observe. There was a full Moon on the 8th January and the atmosphere made it look orange. It looked great.

Ursula Braatz. ■

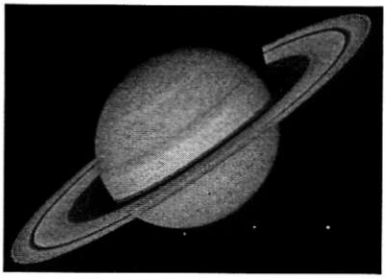
What IC this Month
16 February – March 14, 2004

The Moon Diary
20/02 New Moon; 28/02 First Qtr
07/03 Full Moon; 14/03 Last Qtr

Evening Sky Planets
Venus rises in Pisces during the daylight and sets almost 2 hours after sunset. It will be partnered by a very thin crescent Moon on 23/2 as it moves towards its furthest distance from the Sun later in March. It already has a decidedly crescent image in a telescope and shines at mag. –4.

Appearing in Aries **Mars** sets about 3 hours after the Sun and is still bright enough to attract attention. A First Qtr Moon will be about 5° from the planet on 26/2 as it travels eastward into Taurus in time for our next MAS meeting in March.

Saturn is just past opposition which means it is the brightest and best view for the year. It has been in Gemini for a few months and will stay there for almost all this year. It rises in the daylight and sets between 11.30pm and 9.45pm. At the moment it appears stationary but will resume its eastward travel during March. On 1st March it will be close to an almost full Moon and not far from M35.



The chief of the planets **Jupiter** has a fascination with Leo the Lion and rides on his back all this year. Rising in daylight it will set between 5 am and 2.30 am mid March. It will reach its brightest on 4th March and be close by a full Moon three days later. We are approaching a rare sight when Jupiter will experience a 'triple shadow event' in late March

Morning Sky
Neptune rises at 5.00am in February but too close to the Sun for viewing till late March when it will rise just before 2.00am. It is still stuck in Capricornus and it seems just last month we were seeing it in the mid evening.
Uranus rises and sets with the Sun in February until later in March when it will be visible about 4.30 am.
Mercury rises in Capricornus just one hour before the Sun and sets 30 mins after in February. Then it is hidden behind the Sun till about 5-6 March when it will return in the evening climbing away from the Sun each night for two weeks before plunging earthwards again.

Comets
C2001 Q4 is the only comet brighter than 10th mag. this month and you may find it travelling east through Tucana. It will be about 8-6th mag so get out the binoculars and see how you go.

Meteors
The faint **delta Leonids** will be shooting past until the 10/03. The maximum is a paltry 2 per hour on the 25th Feb from around the hindquarters of Leo. For the real enthusiasts with good eyesight I think.

Good seeing IC