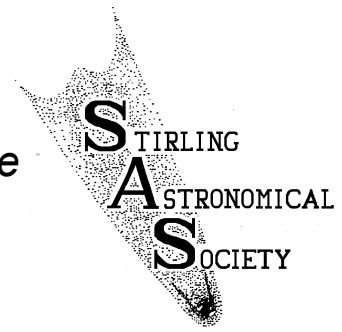


Newsletter of the



Vol. 17 No. 1 January 2002

WORKING BACKWARDS TO THE MOON'S BIRTH

Astronomers have long pondered on the origins of the Solar System as a whole, and of the Earth and Moon in particular. The current picture is of a disc of gas and recycled stardust that wheeled around a new formed Sun, with the dust and gas gradually coalescing under gravity into the major planets and many minor planets and asteroids. How then does the Moon fit into this?

After the Apollo astronauts returned with the first samples of Moon rock in 1969, astronomers became convinced that the Moon was formed from the debris of a collision at least 3 billion years ago. Now, recent research indicates that 4.5 billion years ago the newly formed Earth must have collided with another body about the size of Mars. The colossal impact would have ejected into space a huge shower of molten rocky material from the crusts of Earth and the other body. These rocks orbited the Earth and eventually coalesced by collision and gravity into a single object - the Moon. This would explain why, while the Earth has a massive iron core as well as much lighter crustal rocks near the surface, the Moon contains very little iron at all.

The recent research involved working backwards from the present state of the Earth and Moon using computer simulation, to see how the present angular momentum of the rotating Earth and also the Moon's orbit could have come about. This has led to the conclusion that a single impact with a Mars-sized body is the most likely explanation. When this collision took place, the Earth was more or less fully formed and rotated much more rapidly, with a five-hour day. A collision with a larger or smaller body would not entirely account for the present situation. A collision of the Earth with a larger body would then have required another collision to account for the present Earth's rotation and Moon's orbit, and a collision with a smaller body would not have produced a Moon-sized satellite. An earlier collision, before 4.5 billion years ago, with a then partly-formed Earth would have produced a partly-formed Moon, which would then have accreted iron-rich material at the same rate as the Earth was doing, which has not happened. A later collision is not compatible with other evidence for the Moon's actual age.

The new tidal forces generated by the Earth's new satellite Moon gradually slowed the Earth's rotation and widened the Moon's orbit, and this has continued ever since. In addition, the Moon's influence has stabilised the tilt of the Earth's axis, which in turn has resulted in the Earth having a regular rhythm of seasons and fixed polar, temperate and tropical regions. And of course the Moon is responsible for the tidal seas around all the Earth's coasts. Without these various results of the Moon's influence on the Earth it would have been much more difficult for life to have evolved here in the way it has. So we have a lot to thank that unknown body for, all that time ago, when it crashed into the Earth!

Derek Allen

GHOSTS OF THE PAST

The "Atom Splitters", as the idiom of the day had it, became famous for achieving the first nuclear reaction by "artificial" means. This feat was announced in *Nature* in 1932: "Disintegration of lithium by swift protons", and was recognised by a Joint Nobel Prize for Physics in 1951 for "work on transmutation of atomic nuclei by accelerated particles". The story behind this achievement is worth telling, and gives some insight into how practical physics was done seventy years ago.

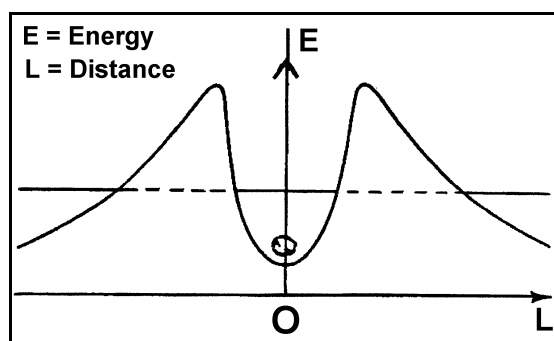
JOHN D. COCKROFT (1897-1967) came from a Yorkshire textile family, and in 1914 he enrolled for an Electrical Engineering course at Manchester University. His studies were interrupted in 1915 by First World War commitments, but on their resumption later he obtained an MSc Tech degree in 1922. He then went to Cambridge to study mathematics and was awarded a first class honours degree in 1924. Then, in 1925, he joined Rutherford as a physics research student. He worked on a variety of projects and, although not regarded as a great experimentalist, was a good organiser and had a deep knowledge of both classical and quantum physics. Like Dirac, he carried his learning lightly. Cockroft was quiet, rather laid back, a good speaker and a good listener. He enjoyed playing hockey, often alongside R Woolley, who later became Astronomer Royal when Greenwich Observatory was moved to Herstmonceux Castle in Sussex (see *Mercury* Vol.15 16? No.1 January 2001).

ERNEST T. S. WALTON (1903-1995) was born in County Wicklow, a son of the manse, and graduated from Trinity College, Dublin with BSc and MSc degrees. He came to Cambridge in 1928 with an Exhibition of 1851 scholarship and joined Rutherford's research group. He was awarded a PhD in 1931 and earned the reputation of being a talented experimenter.

At the time that Rutherford returned to Cambridge as Professor (see *Mercury* *ibid.*) he was experimenting with beams of alpha particles (helium ions of mass 4) directed onto targets of different elements. In 1919 he reported that, when using a nitrogen (mass 14) target and photographing the tracks of the charged particles in a Wilson cloud chamber, some helium ions stopped and two new tracks appeared. One of these was a proton (mass 1) and the other an isotope of oxygen (mass 17). Rutherford's explanation of this was that an atomic nucleus of nitrogen had first absorbed a helium ion producing a nucleus of mass 18. This was unstable and emitted a proton, leaving a nucleus of mass 17. The overall mass was thus conserved, but redistributed.

Other possible transmutations of elements were studied, but it became clear the alpha particles are not a good experimental tool. They have a high energy of a few million electron volts (MeV) which cannot be varied, they are only produced by radioactive material, and they are emitted in a statistically random fashion. What Rutherford now required was a linear accelerator producing beams of particles with energy variable over a wide range, up to at least 1 MeV. This was the problem which finally came home to roost with Cockroft.

In Rutherford's day, practical physics was very much a DIY affair. Any new instruments or equipment required had to be made in the laboratory. Thermionic valves were available, but of course no chips, and the scientific instrument industry was in its infancy. Even with the best available technology, a 1 MeV accelerator seemed an improbable target. But was it really necessary? The situation is as shown in the diagram. The atomic nucleus is pictured as held in a crater, surrounded



by energy barriers. The nucleus is positively charged, and an approaching positive charge will be repelled unless it has sufficient energy to surmount the barrier and fall into the crater. For an alpha particle inside the crater similar energy will be required to get out. For a radioactive nucleus emitting alpha particles, the height of the barrier was calculated to be 7-8 MeV. But the alpha particles emitted have an energy of less than half this value, so by classical physics they could not be emitted.

The removal of this difficulty was first suggested by George Gamow in America in 1928. He speculated that in quantum mechanics an alpha particle could be represented by a wave, and this wave could "tunnel" through the barrier, as shown by the dotted lines. If a particle could tunnel to get out, could a particle outside also tunnel to get in? Moreover as a proton has a smaller mass than an alpha particle and is singly instead of doubly charged, the repulsive force between a positive nucleus and a proton will be less than between the nucleus and an alpha particle, and so the barrier will be reduced in height.

It was decided, therefore, to build a linear accelerator which could produce a beam of protons of variable energy up to about 0.75 MeV. The required equipment was to be designed and operated by Cockroft and Walton. There were two parts to the design: the first was to produce the necessary high voltage and the second was to apply the voltage to an accelerator in which protons could be energised as required and focused into a narrow beam.

The high voltage was obtained from a small alternating voltage which, by a suitable arrangement of thermionic rectifiers and capacitances, was rectified and multiplied fourfold. A maximum voltage of 700 kilovolts was obtained. Further details may be seen in the Science Museum, London. This voltage multiplier circuit is still used in the early stages of large particle accelerators, as at CERN. The voltage was applied to an accelerator in the form of a glass tower containing focusing electrodes, and topped by a hydrogen discharge tube to supply the protons.

Construction was well advanced by 1931, and then Ernest Lawrence in the USA announced his invention of the cyclotron and the construction of the first working one, for which Lawrence later received a Nobel Prize. It was a circular accelerator and seemed capable of producing energies of several MeVs. Was America going to pip the UK at the post? Rutherford thought not, and construction at Cambridge continued. This resulted in the successful use of the accelerator in 1932, some three months after Chadwick's discovery of the neutron.

The first transmutation to be effected was lithium (mass 7) to helium (mass 4). A lithium nucleus contains three protons and four neutrons. When the proton beam was focused on a lithium target, in some collisions a proton was absorbed. But a nucleus of four protons and four neutrons is unstable and an immediate release of energy occurred with formation of two helium nuclei. The mass of each nucleus is slightly less than that of the separate components, and it is the energy equivalent of the mass difference which is released.

It was found that an accelerating voltage of only 125 kV was needed to produce the transmutation, instead of the original 1 MeV first thought necessary by Rutherford. Clearly, tunnelling had taken place. Also, the two helium nuclei were emitted simultaneously in opposite directions, thereby conserving momentum. Measurements of their kinetic energy showed that the energy released per disintegration was about 16 MeV, as expected from Einstein's $E = mc^2$.

Harry Stout

VISITS TO THE WORLD'S LARGEST TELESCOPES

In August and October, my wife and I visited two 1.8 metre telescopes, 5000 miles apart, which were at one time the biggest in the World! One, at Birr in the centre of Ireland, is very well known but I had never heard of the other, seven miles north of Victoria on Vancouver Island, Canada.

Having spent five days in Vancouver, we had taken the ferry 35 miles over to the Island with the Butchart Gardens as our first must visit tourist sight. However, a chance interview on the local TV drew our attention to The Centre of the Universe visitor centre at the Dominion Astrophysical Observatory, Little Saanich Hill, just east of the road to the Gardens. As well as touring the displays, a guided tour of the Plaskett Telescope was included, and on Saturday evenings the public can enjoy free observing from 5 till 11 pm. Unfortunately, we never left the Gardens till well after 10 and although we passed the observatory entrance, I lost the way on the main road back to our hotel in Victoria. (Another story!).

Dr. John S. Plaskett, an astronomer at Dominion Observatory, Ottawa, founded the Victoria observatory around 90 years ago, after surveying five sites across Canada. He chose the 230 m hill on the island for its good seeing and low rainfall - the site is in a small rain shadow area with rainfall doubling within 10 miles. In 1913 tenders for construction of a 72 inch telescope were requested, and in 1914 the main mirror blank was made in France, being shipped out 5 days before the outbreak of war to Pittsburgh, USA. The dome and mountings were cast in the Cleveland area, temporarily erected, then dismantled and transported by rail (and ferry) in the summer of 1916 to Victoria. Hauling of the heavy parts, some of 7 to 9 tons each, was by horse-drawn carts up to the new observatory. It took two weeks. A 14 ton partly-assembled piece was lifted by genuine horse-power over a period of 3 days at one foot a minute. Assembly took six weeks in all - no accidents and no rain!

The mirror's history reads like that of the Hubble. Grinding and polishing took nearly three years and were finished with an unexplained scratch. Reworking removed too much glass from the centre, and only on the third attempt was the mirror completed successfully in April 1918. Then came a nerve-racking six day journey across the continent, followed by lifting it into place and adjusting it. Within a week it was the largest working telescope in the world, and it carried out much valued work studying the spectra of stars. Putting the construction into a local and European scale, you would have to imagine the observatory site as high on the slopes of a tree-covered Dumyat, with the metal work being done in Cairo and the mirror blank being shipped from Afghanistan, ground in Greece, and all the bits transported by rail through the Alps to Leith with a final ferry journey to Kincardine. And all done 85 years ago, while the rest of the world was at war!

Two months on and we stood in the grounds of Birr Castle, looking at the restored six foot telescope constructed in the 1840s by Lord Ross. For over 70 years this was the World's largest telescope and at 50 feet long, it certainly looks it. Encased in wood barrelling, it reminded me of the Stirling twelve inch telescope, but the mounting and manoeuvrability are completely different. No photograph can prepare you for seeing the engineering at close quarters. Slung between two walls 45 feet high, the telescope was hoisted up and down by a winch (now an electric motor) and the counter-balance weights moved along the the wall on chains. A modified universal joint at the base allowed some sideways movement at the top of the instrument, so an object crossing the southern meridian could be followed for almost an hour. There are three viewing platforms built with heavy timber, so access to the eyepiece was possible at whatever angle the telescope was set. Changing observing targets, however, must have been a large man-power operation. The site was often cloudy and the unprotected observers must have had few productive observing sessions. Nevertheless, the spiral nature of the Whirlpool Nebula was established in 1845. Lord Ross repaired a 36 inch instrument (damaged in a gale shortly before the building of the 72 inch) and I suspect that this became his favourite telescope, given that the equatorial mount allowed it to be used all over the sky. We spent almost three hours

visit in poor weather the Museum will provide plenty of interest for the non-astronomer. Given a sunny day, you will enjoy the grounds and marvel at the 19th century engineering.

The internet can provide more information on these telescopes. I am grateful to Scott Mair of The Centre of the Universe for directing me to <http://www.hia.nrc.ca/moffatt/history/begin/begin.html> which also has links to other astronomy sites.

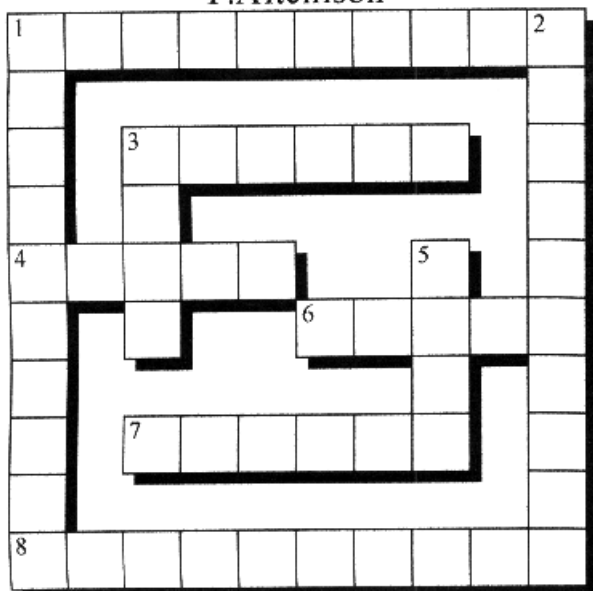
Bert Mackenzie

Editor's Note

In 1922 Plaskett discovered that each component of a sixth magnitude spectroscopic binary star in the constellation Monoceros is of exceptionally high mass, estimated to be 55 times the mass of the Sun. The star is now named after him. Monoceros (The Unicorn) is a faint constellation which straddles the celestial equator next to Orion. It is not one of the ancient constellations, but seems to have gained general acceptance in the mid-seventeenth century. It is rich in stars and nebulae because of its location in the Milky Way. Its brightest two stars are of the third magnitude, and it contains the Rosette Nebula, the Cone Nebula and Hubble's Variable Nebula.

Astropuzzle No.2

T.Aitchison



Across

1. Constellation near the north celestial pole
3. Constellation: the crab.
4. The sense of hearing responds to this.
6. Astronomer who devised classifying stars using Greek letters.
7. Luminous atmospheric phenomenon.
8. Process by which a wave is returned after striking a surface.

Down

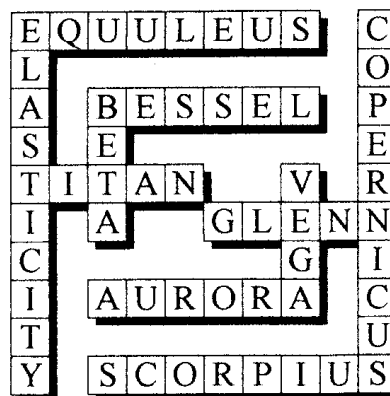
1. Constellation; the greater dog (5,5).
2. Antiparticle of the proton.
3. Constellation: Southern Cross.
5. Constellation: The lyre.

(SOLUTION on page 11)

OOPS!

In the last *Mercury*, by mistake we gave the wrong Solution to Astropuzzle No.1. The correct Solution is shown alongside.

Sorry, Terry!



Solution to Astropuzzle No.1

DIRECTOR OF OBSERVATIONS' REPORT FOR THE YEAR 2000-2001

OBSERVATIONAL HIGHLIGHTS

- Lunar eclipse of 9 January 2001.
- Auroral Display of 11/12 April 2001.
Moon, Mercury, Venus, Mars (best views for two years), Jupiter and its moons, and Saturn and its moons have all featured in records of memorable evening observations.
- Solar activity is high as we reach sun-spot maximum.
- Deep-sky objects on occasional clear dark nights.

EDUCATIONAL ASPECTS

- Astronomy Activity Afternoons for Primary School classes at St Ninians (three classes) and at Allan's School.
- Astronomy Activity Evenings with 1st Stirlingshire Scout Group, and at Camphill School, Blairdrummond.
- Participation in Night Festival at Laighills, Dunblane (organised by Countryside Rangers).
- Series of ten Evening Lectures given in both Autumn and Winter terms, through the hospitality of Stirling Highland Hotel.

VISITS TO THE OBSERVATORY

- Total number of visitors since November 2000 : 438 (compared with 557 in 1999/2000) - a reduced take-up during Stirling Councils Open Doors Days.
- **Log Book records:**
 - Visiting Groups* Hotel guests particularly, members of the Alumni Programmes, Council staff, Hotel staff and families, Press reporters, Former Pupils and Staff of High School of Stirling.
 - Nationalities* Canadian, American, Australian, Irish, Welsh, English . . . (and of course Scottish!)
 - Astronomical Societies* Stirling (regularly!), Glasgow, Falkirk, Edinburgh, Liverpool and Cambridge.

WORK ON THE TELESCOPE (It's now 112 years old, and better than ever!)

- Installation in progress of improved focusing mount, and counterweights.
- Minimisation of interference from light pollution.
- General maintenance - visitors continue to express their delight at seeing the beautifully restored telescope in such impressive working order.

PROJECTED TASKS FOR THE COMING YEAR

- Application for *Awards for All* Lottery Grant to allow the installation of a CCD camera and display.
- Motorising of the equatorial drive.

The Society's thanks are once again due to the Management of Stirling Highland Hotel, and to Stirling Council Education Services.

Ken Mackay

GRAVITATIONAL WAVES AND THEIR DETECTION

The Society has had many interesting lectures at the Smith, but one of the most talked about was delivered by Prof Hough from Glasgow University on the subject of gravitational waves and their detection. He brought with him a quantity of physics hardware which is being developed for detection purposes. Glasgow continues to put much effort into this work, as do many other institutions, and some further comments on the present position may be timely.

A preliminary article on gravitational waves was included in *Mercury* Vol.15 No.1, Jan. 2000, and some questions as yet unanswered will appear in a contribution to a forthcoming issue. These questions formed the basis of an interesting discussion held at the Mayfield Centre, and in the light of that discussion any members wishing to contribute some points should not hesitate to do so.

After Einstein developed his mathematical theory of general relativity in 1916, he realised that his equations implied the existence of several new observable effects, one of which was gravitational radiation resulting from the movement of massive bodies in the Universe. Einstein's mathematics is not for the faint hearted, but fortunately gravitational radiation is a reasonable approximation to *quadrupole* radiation, which is best explained by an electromagnetic analogy.

Two opposite electric charges (+ and -) form a dipole which, by vibrating or rotating around one another, emit dipole radiation. But if there are two such dipoles rotating around one another or otherwise vibrating, they emit quadrupole, rather than dipole, radiation. Two masses cannot form a dipole, as they have the same "sign" but, approximately, two masses rotating around one another behave like two dipoles, and emit gravitational quadrupole radiation. So what then is gravitational radiation? It arises from the excitation of a gravitational field by moving masses. In general relativity a gravitational field is associated with the curvature of four-dimensional space-time. Gravitational radiation travels at the speed of light and carries energy, just as electromagnetic radiation does.

Quadrupole radiation

If two masses are rotating around one another at non-relativistic velocities, the quadrupole radiation emitted goes through a cycle with the frequency of the rotating masses. If the radiation is directed at a circular ring of very low density material, the ring distorts to an ellipse after a quarter of the cycle. After half a cycle the ring returns to a circle, and after three quarters of a cycle it again distorts to an ellipse, but with its major now at 90° to its previous position. The radiation has a second plane of polarisation rotated by 45° to its first phase. This may be compared with electromagnetic radiation in quadrature, which has its electric field rotated by 90°.

If instead of striking a circle of low density material, the radiation strikes at right angles to the long axis of a cylindrical metal bar, the bar is continually stretched and squeezed in two directions at right angles. But because the bar is too solid to follow the variations in the radiative forces, it is set into end-to-end vibrations at its own natural resonant frequency.

Detection of gravitational radiation

The first serious attempt to detect gravitational radiation was made by Joseph Weber at the University of Maryland in the 1960s using a method based on a resonant bar. He set up a bar of aluminium two metres long and 0.5 m diameter and weighing about 1.5 tons. Five strain gauges were fixed to each end of the bar to record any vibrations which might occur. Many other similar detectors have been built since and new technology has been developed, such as cooling the bar to below 10K to increase sensitivity.

Harry Stout

JUST WHAT ARE GRAVITY WAVES?

The existence of gravity waves was predicted by Einstein and much effort is being made to try to detect them. Indeed claims have recently been made that they have actually been detected. However, it is not easy for me as a layman in these matters to envisage just what physical format gravity waves can take. Are they for instance transverse waves, longitudinal waves, or some other form less easy to imagine?

Everyone is familiar with the passage of a transverse wave, for example in two dimensions across the surface of water. The quantity that "makes" these waves is the vertical movement of particles of water that might otherwise be at rest on the surface of the undisturbed water. Another example of a transverse wave is exhibited when one end of a stretched rope is shaken up and down. It is the displacement of particles of the rope from their undisturbed straight line configuration that makes up the wave. (We are not concerned here with such complications of wave motion as interference, diffraction, polarisation, etc.)

To explain the wave motion of light, the concept of an electromagnetic field has been introduced. Electric and magnetic fields ("lines of force") at right angles to each other, and to the direction of travel of the light, are commonly represented by arrows standing on the (straight) line of travel. As the light wave progresses, the tips of these arrows can be regarded as tracing out a transverse wave, analogous to a wave along a rope.

Sound travelling through a gas is an example of a longitudinal wave, where the displacement of particles from their mean position is in the direction of travel of the wave. Again, if the displacement is plotted at right angles to that direction, another "rope" analogy can be drawn.

So just what is the physical nature of a gravity wave sent out to a detector from a distant pulsar or other source? Is it a longitudinal or transverse wave or some other type? Is it a "varying field of attraction" along the direction of propagation, analogous to the compressions and rarefactions of a sound wave in a gas? Does it travel at the speed of light or, as it is not an electromagnetic wave, does it have its own different characteristic speed of propagation? I understand that gravity wave detectors measure minute changes in the gravitational field. Just how are these changes produced by a gravity wave from a particular very distant source?

These may very well be naïve questions to ask, but I would be very interested to know the views and to pick the brains of others on this fascinating topic.

Mike Culpin

FORCES TO BE RECKONED WITH

The October Mayfield meeting hosted a lively discussion of gravity waves inspired by a sheet of very pertinent questions compiled by Mike Culpin and seconded by Harry Stout. Alan Cayless's broad knowledge and expertise at explanations of the complex added to the discussion's enjoyable momentum.

Gravity is a pretty fundamental force in the Universe associated with all mass; it cannot be turned on or off. We observe and describe its properties. Gravity is described as a force and as a distortion in the space-time-continuum. We use the concept of gravitational force to explain the orbits of planets, the formation of stars and the evolving structure of the Universe, but gravity itself is really too fundamental to be explained. The Mayfield discussion was about what might be expected of gravity waves (see Mike's article), but it raised other profound questions in the mind about the nature of forces and matter.

THE NIGHT SKY for January, February and March 2002

SUN	January		February		March	
	13	27	10	24	10	24
(approx) Rises	8.40	8.21	7.53	7.21	6.46	6.09
(approx) Sets	16.12	16.39	17.10	17.40	18.10	18.38

MOON	January				February				March				
	Phase	LQ	NM	FQ	FM	LQ	NM	FQ	FM	LQ	NM	FQ	FM
Date	6	13	21	28	4	12	20	27	6	14	22	28	
Rises	0.00	8.46	11.09	15.31	0.38	8.15	9.59	17.34	2.33	7.03	9.35	18.05	
Sets	11.57	15.32	0.00	8.15	10.33	16.53	1.25	7.36	9.45	18.20	2.56	6.12	

PLANETS

			<i>Magnitude</i>
MERCURY	<i>January</i>	Visible evening twilight low SW sky for first 3 weeks	+0.7 to +1.0
	<i>February</i>	Unsuitable for observation	
	<i>March</i>	Unsuitable for observation.	
VENUS	<i>January</i>	Unsuitable for observation	
	<i>February</i>	Unsuitable for observation first 2 weeks, then low WSW in evening	-3.9
	<i>March</i>	Evening object low W sky	-3.9
MARS	<i>January</i>	Evening SW sky, just south of square of Pegasus	+0.9
	<i>February</i>	SW sky in evening, moving from Pisces to Aries at end of month	+1.2
	<i>March</i>	SW sky early evening in Aries	+1.4
JUPITER	<i>January</i>	Southern sky most of night retrograding in western part of Gemini	-2.7
	<i>February</i>	Southern sky, almost stationary in western Gemini	-2.5
	<i>March</i>	SW sky from sunset until after midnight	-2.3
SATURN	<i>January</i>	SSW sky most of night in Taurus, moving westwards through month	-0.2
	<i>February</i>	SW sky in evening	-0.0
	<i>March</i>	Western sky in evening, not visible after midnight by end of month	+0.1
		Saturn's rings should present a nice spectacle as the ring plane is opening up. Not at maximum until early next year.	

ZODIACAL LIGHT

February The evening cone may be observed stretching up from the western horizon along the ecliptic after the end of twilight from the beginning of the month to the 13th. It is only visible under good conditions and in the absence of both moonlight and artificial lighting.

March Evening cone may be observed stretching up from the western horizon along the ecliptic after the end of twilight from the beginning of month to the 15th.

CONJUNCTIONS (with Moon unless otherwise stated) AND PLANETARY POSITIONS

January

Date	Time	Event
1	06.24	Jupiter at Opposition
2	15.00	Earth at Perihelion, 147 million miles
11	23.36	Mercury at greatest E Elongation, 19° E of Sun
13	13.00	Venus 1°N
14	10.52	Venus in Superior Conjunction
15	05.00	Mercury 4°N
19	03.00	Mars 5°N
24	16.00	Saturn 0.06°S
26	12.00	Venus 4°
26	19.00	Jupiter 0.9°S
27	19.00	Mercury in Inferior Conjunction
28	14.00	Neptune in Conjunction

February

Date	Time	Event
8	02.00	Saturn at stationary point
8	17.00	Mercury at stationary point
10	07.00	Mercury 5°N
12	23.00	Venus 3°N
13	17.00	Uranus in Conjunction
17	04.00	Mars 5°N
21	00.00	Saturn 0.2°S
21	16.00	Mercury at greatest W Elongation, 27° W of Sun
23	02.00	Jupiter 0.9°S

March

Date	Time	Event
1	15.00	Jupiter at stationary point
12	03.00	Mercury 3°N
15	10.00	Venus 4°N
18	03.00	Mars 4°N
20	10.00	Saturn 0.4°N
20	15.00	Pluto at stationary point
22	12.00	Jupiter 1°S

CONSTELLATIONS

Near the meridian at 22.00 on:

1st January

Draco, Ursa Minor (below pole), Camelopardus, Perseus, Auriga, Taurus, Orion, Eridanus, Lepus.

1st February

Draco (below pole), Camelopardus, Orion, Canis Minor, Monoceros, Lepus, Canis Major, Puppis.

1st March

Cepheus (below pole), Camelopardus, Lynx, Gemini, Cancer, Leo, Canis Minor, Hydra, Monoceros, Canis major, Puppis.

METEORS

The Quadrantids are visible from the northern hemisphere, 1-6 January.

Hamish MacPhee

REGULAR ACTIVITIES OF THE SOCIETY

Lectures by visiting speakers take place in the Smith Museum Lecture Room, Dumbarton Road, usually on the second Friday each month. Members' Evenings are held at the Mayfield Centre, St Ninians, usually on the fourth Friday each month. All meetings start at 7.30 pm and are held from September through to May. Further details can be obtained from the Secretary or the Stirling Observer. Other activities, including of course observation sessions, are also arranged.

Solution to Astropuzzle No.2



Stirling Astronomical Society

OFFICERS AND COMMITTEE FOR 2002

President	Dr Harry Stout
Chairman	Douglas Cooper
Secretary	Hamish MacPhee
Treasurer	Dr Iain Smith
Director of Observations	Dr Ken Mackay
Membership Secretary	Albert MacKenzie
Librarian	Maurice Dixon
Committee Members	Terry Aitchison Dr Alan Cayless John Clynes

Subscriptions

The Society subscription rates for 2002 are:

Members	£15
Family	£20
Students	£8

Iain Smith is waiting eagerly to receive your new subscriptions!
Members receive free copies of *Mercury*

EDITORIAL

Thank you very much for all contributions received. There is not enough space to include all of them in this issue, and some have been held over. Nevertheless, please keep them coming! Send your contributions to (or first discuss them with) :

either:-

Dr Derek Allen,
1 Ogilvie Road, Stirling FK8 2HJ
Tel: 01786 472771
E-mail:derek.allen@btinternet.com

or:-

Dr Harry Stout,
17 Anderson Street, Dunblane FK15 9AJ
Tel: 01786 824034

Copy can be in clear handwriting, typescript, e-mail, or on floppy disk (preferably in *.rtf* format), in that ascending order of preference for the work involved in editing. Contributions should be not more than about 750 words in length, or 1000 at the most. Please have material ready by the end of February for the next issue of *Mercury* due out the beginning of April 2002.

Index of back issues - Addition to the Index in the last issue:

Vol.2 No.1	Supernova!	
Apr/May 1987	Chairman's Report 1986	Ken MacKay
	Treasurer's Report 1986	Bernard O'Sullivan
	Crossword	
	Planet No.2: Venus	Stuart Murray
	Night Sky	

Still missing : Vol.4 No.2, 1989 - Does anyone have a copy we could see, please?
