TAILPIECE

Advertisements

This space is available free to members for advertisements (preferably, but not necessarily astronomical).

World Wide Web page

The reappearance of the Section's Internet web page was announced in the last issue, but with an error in the URL. The correct address is shown in the next column.

Daniel is maintaining the page, which has information on the Section, the Observatory, past and future events, etc. We also plan to put images and articles on it from issues of Sagittarius, and create a link to La Société's own web page. ☆

Comet Hale-Bopp

The Comet is now well visible in the morning sky, and makes a beautiful sight, especially in binoculars.

Members have probably noticed Geoff's excellent article on comets, and advice on observing Comet Hale-Bopp, which appeared in the latest issue of *Communiqué*, the newsletter of La Société Guernesiaise.

We have also prepared a leaflet about how to observe it, based on the information in the last issue of Sagittarius. It is available at a cost of 10p. Large scale 14-day plots of the Comet's path at one-day intervals have also been generated using the computer program *Megastar*, and are available. We can produce similar charts for any period at any scale. ☆

Astronomy Section Officers

Section Secretary:	Geoff Falla	724101
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The next newsletter will be published early in May. The deadline for publication copy is the 15th April.

La Société Guernesiaise, Candie Gardens, St. Peter Port, Guernsey. Tel 725093

Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

March/April 1997

Forthcoming events

Planetary Geology
by Mick de Pomerai
Tuesday, 4th March
8.00 pm, Frossard Lecture Theatre, Candie Gardens

Occultation of Aldebaran
Friday, 14th March
6.30 pm at the Observatory

Observe the Comet
Wed-Fri, 2nd-4th April
8.30 pm at the Observatory

The Moon
by Geoff Falla
Tuesday, 22nd April
8.00 pm at the Observatory

Also: ***La Société AGM*** onWednesday, 5th March, 7.30 pm at La Trelade Hotel

and: ***Partial lunar eclipse*** on Monday, 24th March 2.45 am at the Observatory

In this issue

Discovery of Neptune – Pt 2

Observing programme concluded

Fission and fusion

Inside

Major articles are in **bold**

Centre inserts

March/April star chart

Moon phase calendar

Sunset, twilight and sunrise times

Planetary geology

Mick de Pomerai, the joint Secretary of the Geology Section, will be giving a talk on **planetary geology, at 8.00 pm on Tuesday, the 4th March, at Candie.** His talk will be illustrated with colour slides, and will look at some of the recent advances in our understanding of geological activity on the inner planets and Jovian moons, including the possibility of life on Mars.

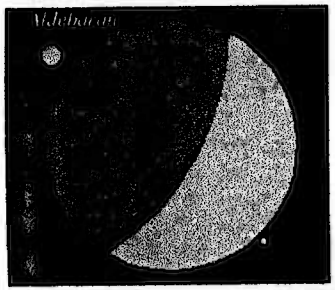
Mick has kindly invited members of the Astronomy Section to this meeting of the Geology Section. ☆

La Société Guernesiaise Annual General Meeting

This will be held at **7.30 pm on Wednesday, the 5th March at La Trelade Hotel.** As usual, in addition to the normal AGM business, there will be brief reports by each Section on its events in the past year, including, of course, the Astronomy Section. ☆

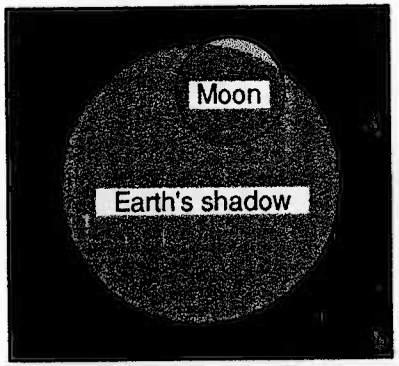
Occultation of Aldebaran

The Moon frequently occults stars, but rarely one as bright as 1st magnitude Aldebaran. The star disappears behind the Moon at about 6.40 pm on Friday, 14th March, and reappears at about 7.50 pm. Come and watch it from the Observatory.



Partial lunar eclipse

The Moon will be partially eclipsed on the morning of Monday, the 24th March. It starts at 2.58 am, and finishes just after the Moon sets, at 6.21 am. Members may wish to observe it from the Observatory. At the maximum eclipse, 92% of the Moon will be within the Earth's shadow.

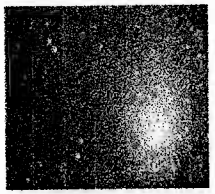


Public to observe Comet

Each evening, from Wednesday the 2nd to Friday the 4th April we will be opening the Observatory to the public, with Comet Hale-Bopp as the main attraction. The public part of the evenings will start at 8.30 pm. At that time the Comet will be at an altitude of 30° in the north-west, and there will be no moonlight to interfere. The Comet should be bright with a good, long tail.

Members' help is needed for this event.

At the date of issue of this issue of Sagittarius Comet Hale-Bopp is easily visible in the pre-dawn sky in the north west, close to Cygnus, and is sporting a tail. It is a good sight in binoculars. Take a look yourself! ☆



Talk on the Moon

Well, about the Moon, actually. **Geoff Falla** will be telling us all about **the Moon on Tuesday, the 22nd April, at 8.00 pm at the Observatory.**

Geoff will be concentrating on observing the Moon at different stages through the lunar cycle, and the features which are visible at each phase. The goal is to make it easy to identify the craters, mare, etc.

Geoff will also be talking generally about the Moon, and the Apollo programme of lunar exploration. His talk will be illustrated with slides. ☆

Additional talks

We have been advised by the Ladies' College that a speaker, Mark Biddiss, is coming to Guernsey in March to give talks to schools about astronomy. He has been booked to give a talk to La Société Guernesiaise **at Candie on Monday, the 17th March.** The time will probably be 8.00 pm, but watch (and listen to) the media for an announcement.

We understand that Mark Biddiss is a "professional lecturer" based in London. The subject of his talk is unknown at the present time. He has several talks in his repertoire, and there is a suggestion that this one may be about the solar system.

An additional Section meeting will be held on Tuesday, the 22nd July. Chris Mahy will talk on the search for molecules in interstellar space, and the accidental discovery of C60 (better known as Buckminster Fullerine). Chris has recently completed a degree in astronomy at the University of Sussex, and his talk will be based on the work of a professor there, Sir Harry Kroto, a Nobel Prize winner. ☆

Into Space with Patrick

400 people packed into Beau Sejour Theatre on the 18th January to hear Patrick Moore review 40 years of space exploration of the solar system. As usual, it was a *tour de force*, with Patrick gripping the audience from the outset with a couple of well-placed anecdotes.

Patrick started with graphic descriptions of astronomical scale, and then gave a synopsis of the Moon, about which he is, of course, an expert. (He conducted much of the basic pre-Apollo research, and was on the Committee which determined the first landing site).

He then conducted us on a rapid tour of the solar system, providing in a short period of time a wealth of facts, embellished with original wit. After an interval there was a question and answer session, and then many people took the opportunity to purchase one of Patrick's new books and visit the Astronomy Section's table. We did good business, and stimulated some interest in membership. Many thanks to Patrick for giving the Section such prominence during his talk. ☆

Tuesday evenings

We continue to meet each Tuesday, from 7.30 pm, with members dropping in at any time during the evening. With the advent of spring, and Easter, we will again be publicising the fact that the public are welcome at the Observatory from 9.30 pm. In the past two years we have had a good response to this initiative, and, with most visitors making a donation, it has been a steady source of income. People seem generally delighted with the experience of looking through a large telescope. ☆

Annual Business Meeting

11 members attended the Annual Business Meeting held on the 21st January. Secretary Geoff Falla summarised the **events** of the last year, emphasising the success the Section had had in continuing to keep astronomy in the public mind. The publicity in the *Guernsey Evening Press* included at least two front-page stories (comet and solar eclipse), two major articles (on light pollution), as well as the monthly star charts which Geoff provides to the Press.

Officers were elected as follows:-

Secretary	Geoff Falla
Honorary Treasurer	Peter Langford
Education Officer	Ken Staples
Editor	David Le Conte
Imaging	Daniel Cave

This last position is a new one; As *Imaging Officer*, Daniel will be responsible for CCD and photographic imaging, and electronic publishing (eg the World Wide Web page).

We are pleased that Ken has agreed to take over as *Education Officer*. This is in addition, of course, to his position as *Light Pollution Officer*, appointed by the BAA.

Unfortunately, Geoff indicated that he would only be serving as *Secretary* for one more year.

There was some discussion about whether the above officers constituted a committee, and if so, what powers such a committee would have, for example in relation to expenditure. It was generally agreed that the present system, whereby expenditure was agreed during normal meetings, by group consultation, was adequate, and that major expenditure would continue to be discussed at Annual Business Meetings.

The **accounts** for 1996 were presented by Peter, and were approved. It was noted that the financial state of the Section continued to be healthy, and that fund-raising had been good, despite the fact that there had been no major fund-raising event.

There was a lot of discussion about the **equipment**, especially the Celestron 14, which needs a thorough overhaul. This will be investigated further. Consideration was also given to its possible replacement, and, if so, what kind of instrument it should be replaced with.

A number of suggestions for **observing** were made. Daniel expressed an interest in concentrating on *Comet Hale-Bopp* and *Schmidt camera photography*, and he also wants to make observations of the *Dwingaloo One* galaxy. Geoff proposed observing the Moon at different phases, emphasising those areas which were best illuminated at each phase. David expressed a wish to see *Pluto*, and suggested *comet searching* as an interesting possibility. Lawrence said he would continue with *sunspot* observations, and it was agreed that we would make contact with the BAA Solar Section. He also advocated observing *meteor showers*, especially the Leonids as well as the Perseids. Debbie suggested completing the observations of *Messier objects*, started a couple of years ago (we are about halfway through it).

It was agreed that the Observatory would continue to be **open to the public** year-round on Tuesdays from 9.30 pm. It was agreed that the Section information leaflet for prospective members should include an application form, and that members of La Société should be offered the opportunity to subscribe to Sky and Telescope.

Geoff said he would explore some ➡

specific ideas for **sponsorship** of the newsletter.

Under Any Other Business, Lawrence raised the subject of a **sundial** (or sundials) for the Observatory. It was agreed that a **survey of members** should be carried out, to find out their interests, equipment, skills, etc. And **magazine subscriptions** were also discussed.

It was a lengthy but most worthwhile meeting, with a good exchange of ideas, providing a firm foundation for the coming year. ☆

Visit postponed

A planned visit to the Observatory by girls from Blanchelande College on 11 February had to be cancelled because of the atrocious weather. Hopefully, it will just be a postponement, and we will be able to rearrange it. ☆

On the Radio . . .

Ken Staples continues to participate monthly in Pat Lihou's radio show on BBC Radio Guernsey.

David Le Conte appeared on Murray Norton's programme on the 18th February, talking about the discovery of Pluto 67 years ago on that day, and about the death of its discoverer, Clyde Tombaugh, in January. ☆

. . . and in the Press

Geoff Falla's monthly star charts continue to get good coverage in the Press. And the Press published a huge article on light pollution on the 18th January, with much input from our own Light Pollution Officer, Ken Staples. ☆

Astronomical images

15 members were present on the 18th February when Daniel Cave spoke about techniques of astronomical imaging. Daniel showed us a large number of examples with a good selection of colour slides, combined with practical demonstrations, and live computer processing.

Daniel started by showing a few examples of simple tripod-mounted pictures, showing star trails and comets. He then turned to the Schmidt camera, and demonstrated its large field of view. He emphasised its speed, and the problems experienced in using it: focus, handling tiny pieces of film, and the ever-present trails of planes and satellites.

Although Daniel illustrated these problems with convincing examples which he had taken with the Section's 8-inch Schmidt camera, he also showed us some excellent pictures, including Comet Hyakutake, the Lagoon and Triffid nebulae, the Swan and Eagle nebulae, Antares and M4, the double cluster in Perseus, and the total lunar eclipse of April 1996.

He then showed a series of beautiful tri-colour pictures taken with the 1.2-metre UK Schmidt, and the 3.9-metre Anglo-Australian telescope.

Daniel showed how photographs could be taken by eyepiece projection with the Section's Celestron telescopes, and discussed piggyback photography with examples of a magnificent lunar corona and an even more magnificent multiple-exposure photograph of the lunar eclipse.

Daniel concluded a fascinating talk by showing pictures taken through the 14-inch Celestron, then digitised and computer processed, as well as CCD images. ☆

The Discovery of Neptune – Part 2

by Frank Dowding

In part 1 of this article, Frank described the social background existing in the first half of the 19th century, and introduced us to John Couch Adams, Urbain Jean Le Verrier, and George Biddel Airy.

In 1826 George Airy became a member of the Board of Longitude. In 1828 he was appointed to be in charge of the Cambridge Observatory, and received a salary of £500 a year. Seven years later, at age 34, due to his thorough and concise records that he had devised at Cambridge, he was given the position of Astronomer Royal at Greenwich, in 1835.

George Airy made a big contribution towards astronomy, by placing great emphasis on accuracy. He never speculated, and had little time for those who did. Consequently, those working for him were not allowed any independent thought, only to do exactly as he instructed.

The Greenwich Observatory was transformed into a highly efficient institution, and was a model for other parts of the world to follow.

So, in 1835, George Bidell Airy became Astronomer Royal, at the age of 34.

We now move to six years later, in 1841. George Airy has become notorious as Astronomer Royal. Urbain Le Verrier has been teaching at Paris University for four years, and John Adams is half-way through university.

In 1841 John Couch Adams was 22 years old, and still an under-graduate at Cambridge. The story goes that he was in Johnson's Bookstore, and in glancing through some old books he found an astronomical report written by George Airy ten years earlier.

"*The movement of the planets can usually be prophesied from Newton's Laws of Gravity*", wrote Airy, "*but we cannot accurately prophecy the movement of Uranus.*"

On reading this, Adams was taken aback, because he had studied Newton's Laws and found them to be an exact science. He felt there must be another reason why Uranus was unpredictable. Adams decided to study this when he had graduated two years later.

So on graduating in 1843 he took some books with him and went to Cornwall to study in quiet. He was helped here by his friend James Challis, who was now in charge of Cambridge Observatory. Challis lent Adams some books.

Over the next two years, mainly during the holidays between his teaching responsibilities, Adams worked on the idea that another planet further out than Uranus was affecting Uranus's orbit.

So Adams used Bode's Law (see box on the next page) to establish an approximate orbit for the other planet, and he used Newton's gravitation equation for each known deviation of Uranus. He had to keep adjusting both the distance and mass to arrive at a consistent result.

In February 1844, about a year later, Adams had an approximate position, but needed more detail of observations to be sure. He asked James Challis to write to ➡

Bode's Law

Start with the series of numbers 0, 3 . . . with succeeding numbers being twice the previous one:

0	3	6	12	24	48	96	192	384

Add 4 to each number

4	7	10	16	28	52	100	196	388

Divide by 10:

0.4	0.7	1	1.6	2.8	5.2	10.0	19.6	38.8

The result is close to the distances of the planets and asteroid belt from the Sun, in astronomical units, up to Uranus:

Mercury	Venus	Earth	Mars	Asteroids	Jupiter	Saturn	Uranus	Neptune
0.4	0.7	1	1.5	2.8	5.2	9.5	19.2	30.1

George Airy to request them. Challis did this, and promptly received the information which he passed on to Adams, who then continued his calcularions.

In September 1844 Adams completed his work, and told James Challis of his results. Challis wrote a letter of introduction for Adams to take to George Airy. After all, Adams was still a Junior Tutor at Cambridge, and Airy had never met him.

Challis suggested that Adams should post his results to Airy, but Adams wanted to deliver them himself, saying that he was going to Cornwall and could call in on the way. But Airy was not at home; he was in France. Adam left the letter of introduction for him. Airy returned from France, found the letter, and wrote to Challis saying that he was interested in Mr Adams's investigations and would be delighted to hear of them by letter.

But Adams wanted to deliver his results personally. On the 21st October 1845, on returning from Cornwall, Adams called again to airy's house. This time the butler said that Airy and his family were at dinner and could not be disturbed. This was at 4.00 pm, and Airy always had dinner punctualy at 3.30 pm. Adams had also called in the morning, but Airy was out.

Now, Adams could have waited, because he was using the train between London and Cambridge, and there was a later train. But he did not wait; he felt that Airy was more interested in dinner than anything else. But he left his calculations at Airy's house, along with a card showing his name and address.

That evening, Airy found the calculations, and immediately wrote to Adams asking for verifications on the radius vector and the use of Bode's Law. Adams received ➡

the letter, but felt that Airy was not taking his work seriously, because it was all explained in the calculations, so he did not reply. This was a mistake.

In June 1845, four months earlier, Le Verrier had started work to calculate the position of a new planet. By early summer 1846 he arrived at an answer. It was one degree of arc different from Adams's position, which of course he did not know.

Le Verrier did something which Adams had not; he published his result in a Scientific Journal, the "*Comptes Renous*", in June 1846. However, it did not impress the Paris Observatory, which did nothing, but when it came to Airy's notice, who read all journals, he was impressed and realised that it was close to Adams's prediction. Airy wrote to Le Verrier, asking the same questions as he had asked Adams. Le Verrier was also irritated by them, but he did reply.

You see, Airy had still considered Adams as a Junior Tutor, who had not replied to his letter, but here was a man in Le Verrier who had published his results in a scientific journal. He instructed James Challis to initiate a search using the powerful 11.7 inch Northumberland refracting telescope at Cambridge. The Greenwich staff and the 6.7 inch Sheepshank refractor could not be used as it would interfere with the routine.

Airy instructed Challis to search an area 30° long and 10° wide that contained 3000 stars. This was hopelessly inefficient, like trying to find a friend in a stadium by looking at each person in every seat.

Meanwhile, Le Verrier, who did not own a telescope, was becoming irritated by no one taking him seriously. But he was a different man to Adams. He remembered an an acquaintance at the Berlin Observatory. On the 8th September 1846 he wrote to Johann Gottfried Galle, asking him to search for the planet. The letter took five days.

Galle pleaded with his boss, Johann Franz Encke, for the use of the telescope. Encke said it seemed like a waste of time, but gave permission.

On the night of the 23rd September 1846 the dome of the observatory slid open, and the 9 inch Fraunhofer refractor was turned towards the area indicated by Le Verrier. Galle sat at the controls, and a student named Heinrich d'Arrest was at the desk with a star atlas, a brand new map not yet published, by Carl Brenicker.

Galle trained the telescope exactly on the spot predicted by Le Verrier:

Right Ascension: *22 hrs 46 mins*
Declination: *- 13° 24'*

There was nothing resembling a planet.

Galle said that they should have to search the area. As he called out the appearance and position of each object, d'Arrest should check to see if it was marked on the star map. The first object was definitely a star, so were the second and third. The fourth seemed to be of 8th magnitude. Galle called out its position:

Right Ascension: 22 hrs 53 mins 25.84 secs

D'Arrest said that it was not on the map; it was not there when this map was made.

The next night they managed to measure its movement, confirming it to be a planet.

Galle immediately wrote to Le Verrier, confirming the discovery of an 8th planet.

Challis was still searching.

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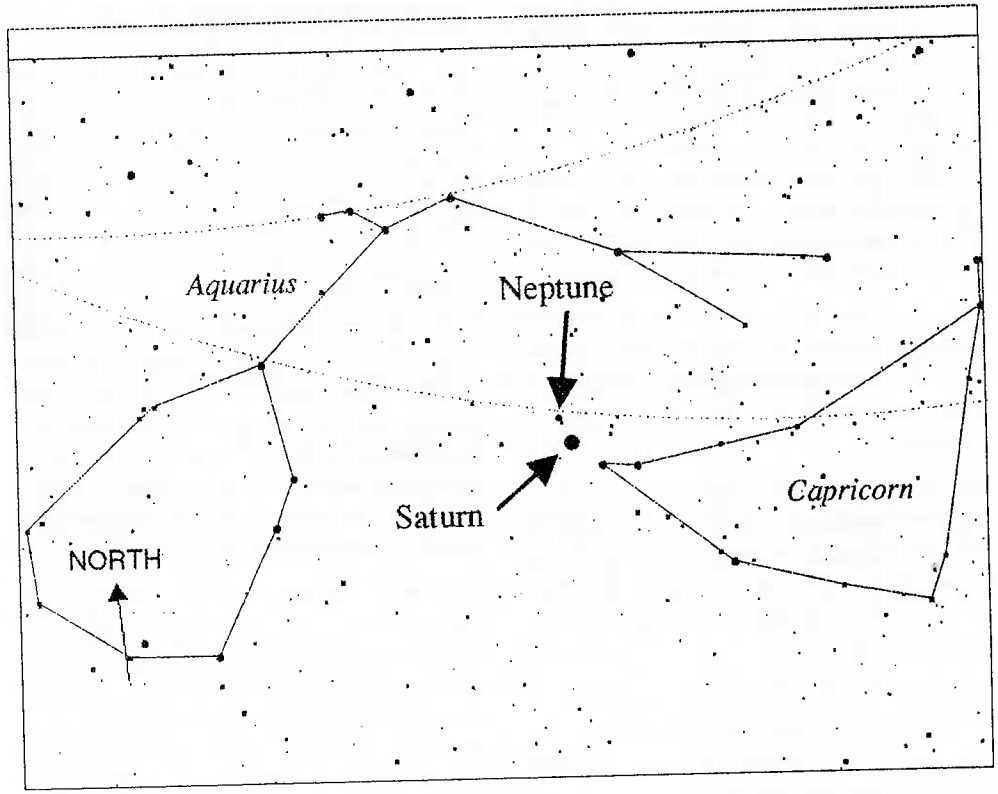


The position of Neptune on the night of the 23rd September 1846

Airy was staying in Gotha in Germany at the time, and heard the news six days later. He wrote two letters about the planet's discovery: one to the Reverend Robert Main, his Chief Assistant at Greenwich, the other to Challis, giving the coordinates but nothing else.

On the 1st October 1846 *The Times* published the news, and it started to spread all over England.

Challis wrote to the *Cambridge Chronicle* noting that in fact Adams had prophesied this a year earlier. John Henhill wrote to the journal *Athenæum*. Airy was blamed for not instigating a search for the planet on receiving Adams's calculations. But Airy was adamant that he was a scientific civil servant, which did not oblige him to instigate searches, and anyway Adams had not replied to his letter.

A row broke out between English astronomers and French astronomers, the English saying that they should receive credit on behalf of Adams, and the French saying that, as Adams had not published his results, where was the proof? This argument went on for about a year, but Adams and Le Verrier took no part in it. ➡

By 1847 it was generally recognised that Adams had in fact calculated it first, but Le Verrier had to take the credit. Adams was offered a knighthood by Queen Victoria, but declined.

I think we have to reflect on a few things. Both Adams and Le Verrier were equally brilliant mathematicians. In fact they met at a later date and became good friends.

Had it been that Adams was a more forthright person and published his results, as Le Verrier had done, then he would have been recognised as the discoverer of Neptune.

But it may not have been that easy to have a theory published. After all, it was not just the English Astronomer Royal that appeared to be not encouraging; the Paris Observatory, or Berlin for that matter, were not interested.

Neptune can be seen with a good pair of binoculars, so why didn't Adams, or for that matter Le Verrier, ask any amateur astronomer to look for it?

From reading several accounts of the episode, I believe that both Adams and Le Verrier were dedicated mathematicians. Neither owned a telescope, and it just did not occur to them that a small telescope would see the planet. In Adams's case I think he had a lot of respect for Airy, and he wanted Airy to recognise him for what he had done. It was only due to misfortune that they did not meet. Had they done so it would have been a different story. ☆

Frank Dowding

In November, Frank will be talking to us about the asteroid belt.

Baker-Nunn cameras

The December issue of *Sky and Telescope* carried an article about a man, Tim Puckett, in America who has purchased several of the massive Baker-Nunn satellite-tracking cameras used from the late 1950s to the 1970s, with the intention of using them for comet and asteroid searches. These cameras are 20-inch f/1 Schmidts – very fast, with a 30° by 5° filed of view, and mounted on a tri-axial mount. They stand 8 feet tall and weigh several tonnes. The article indicated that he planned to set up a network for comet searching, similar to the amateur satellite-tracking network, called Moonwatch, which operated about 30 years ago.

I have registered our interest in participating in a comet searching programme, should one be set up. I have also provided documentation on the cameras, which I still have from my years of working with them in the 1960s. including the "observing techniques" manual which I compiled at that time.

In the meantime, we have purchased a copy of a new handbook by the Comet Section of the British Astronomical Association, entitled *Observ ng Guide to the Comets*. This comprehensive, but compact guide gives a wealth of information for beginners and advanced observers. ☆ ***DLC***

Jersey observatory

We recently had a query from the owner of a six-inch refractor in Jersey about the design of an observatory building similar to the one we built for the 14-inch Celestron. We have provided details of our design. ☆

Observing programme summary – Concluded

The last issue of Sagittarius contained the first part of Geoff Falla's summary by Constellation of all the objects which were contained in his original Observing Programme Charts and Notes published last year. This long series concludes in this issue with a summary of the same objects listed by Object Type. The types are: double and multiple stars, diffuse nebulae, galaxies, open star clusters, planetary nebulae, globular star clusters, and variable stars. Again, there are references to each of the six Chart Sections and stellar coordinates. The list covers the sky down to minus 30° declination.

The full Guide is available for reference at the Observatory.

SUMMARY – LIST OF OBJECTS BY TYPE

DOUBLE AND MULTIPLE STARS

Constellation	Object	Name	Coordinates R A h m Dec degs	Section
		Binocular object: ○○		
ANDROMEDA	Gamma γ	Double star (*Almach*)	02 04 + 42.3	6
	59	Double star	02 11 + 39.0	6
AQUARIUS	Zeta ζ	Double star	22 29 00.0	5
ARIES	Gamma γ	Double star	01 54 + 19.3	6
BOÖTES	Mu μ	Triple star	15 24 + 37.4	3
	Epsilon ε	Double star	14 45 + 27.1	3
CANES VENATICI	Alpha α	Double star (*Cor Caroli*)	12 56 + 38.3	2
CASSIOPEIA	Eta η	Double star (*Achird*)	00 49 + 57.8	5
	Iota ι	Triple star	02 29 + 67.4	6
CEPHEUS	Beta β	Double star	21 29 + 70.6	5
	Delta δ	Double star	22 29 + 58.4	5
COMA BERENICES	24	Double star	12 35 + 18.4	2
CORONA BOREALIS	Zeta ζ	Double star	15 39 + 36.6	3

DOUBLE AND MULTIPLE STARS – CONTINUED

Constellation	Object	Type	Coordinates R A h m / Dec degs	Section
		Binocular object: ○○		
CYGNUS	Beta β	Double star (*Albireo*)	19 31 + 28.0	4
	61	Double star	21 06 + 38.8	5
	Mu μ	Double star	21 44 + 28.8	5
DELPHINUS	Gamma γ	Double star	20 47 + 16.1	4
DRACO	Eta η	Double star	16 24 + 61.5	3
ERIDANUS	32	Double star	03 53 - 03.0	6
	Omicron2 o^2	Triple star	04 15 - 07.7	6
GEMINI	Castor	Double star	07 35 + 31.9	1
HERCULES	Alpha α	Double star (*Rasalgethi*)	17 15 + 14.4	4
LEO	Gamma γ	Double star (*Algieba*)	10 20 + 19.9	2
	Iota ι	Double star	11 24 + 10.5	2
	54	Double star	10 56 + 24.8	2
	90	Double star	11 32 + 17.0	2
LIBRA	Alpha α	Double star	14 51 - 16.0	3
LYRA	Beta β	Double star	18 50 + 33.3	4
	Epsilon ε	Quadruple star (Double-double)	18 44 + 39.7	4
MONOCEROS	Beta β	Triple star	06 29 - 07.0	1
ORION	M 42	With multiple star group (*The Trapezium*)	05 35 - 05.5	1
	Beta β	Double star (*Rigel*)	05 14 - 08.2	1
	Sigma σ	Multiple star group	05 39 - 02.4	1
	Lambda λ	Double star	05 35 + 09.9	1
	Delta δ	Double star (*Mintaka*)	05 32 - 00.3	1
	Zeta ζ	Double star (*Alnitak*)	05 41 - 02.0	1

DOUBLE AND MULTIPLE STARS – CONTINUED

Constellation	Object	Type	Coordinates R A h m / Dec degs	Section
		Binocular object: ○○		
PEGASUS	Xi ξ	Double star	22 47 + 12.3	5
SCORPIUS	Beta β	Double star	16 05 - 19.8	3
SERPENS	Beta β	Double star	15 46 + 15.4	3
	Theta θ	Double star	18 56 + 04.2	4
TAURUS	Chi χ	Double star	04 23 + 25.6	6
URSA MAJOR	Zeta ζ	Visible double ○○	13 23 + 54.9	3

DIFFUSE NEBULAE

Constellation	Object	Name	Coordinates R A h m / Dec degs	Section
		Binocular object: ○○		
CASSIOPEIA	NGC 281		00 53 + 56.6	5
MONOCEROS	NGC 2244	*The Rosette Nebula*	06 03 + 04.9	1
ORION	M 42	*The Orion Nebula* ○○	05 35 - 05.5	1
SAGITTARIUS	M 8	*The Lagoon Nebula* ○○	18 04 - 24.4	4
	M 17	*The Omega or Horseshoe Nebula* ○○	18 21 - 16.2	4
SERPENS	M 16	*The Eagle Nebula*	18 19 - 13.8	4
TAURUS	M 1	*The Crab Nebula*	05 35 + 22.0	1

GALAXIES

Constellation	Object	Type	Coordinates R A h m	Dec degs	Section
		Binocular object: ○○			
ANDROMEDA	M 31	Spiral galaxy ○○	00 43	+ 41.3	5
	M 32	Elliptical galaxy	00 43	+ 40.9	5
	NGC 891	Spiral galaxy	02 23	+ 42.3	6
ARIES	NGC 772	Spiral galaxy	01 59	+ 19.0	6
CANES VENATICI	M 51	Spiral galaxy *(The Whirlpool Galaxy)*	13 28	+ 47.5	3
	M94	Spiral galaxy	12 51	+ 41.0	2
CETUS	M 77	Spiral galaxy	02 43	00.0	6
COMA BERENICES	M 64	Spiral galaxy *(The Black Eye Galaxy)*	12 57	+ 21.7	2
DRACO	NGC 5907	Elliptical galaxy	15 15	+ 56.5	3
LEO	M 65	Spiral galaxy	11 19	+ 13.0	2
	M 66	Spiral galaxy	11 20	+ 13.0	2
	M 95	Barred spiral galaxy	10 44	+ 11.7	2
	M 96	Spiral galaxy	10 47	+ 11.8	2
	NGC 2903	Spiral galaxy	09 32	+ 21.5	2
PEGASUS	NGC 7331	Spiral galaxy	22 37	+ 34.4	5
TRIANGULUM	M 33	Spiral galaxy	01 34	+ 30.7	6
URSA MAJOR	M 81	Spiral galaxy, type Sb	09 56	+ 69.0	2
	M 82	Irregular galaxy (edge-on)	09 56	+ 69.7	2
	M 101	Spiral galaxy *(The Pinwheel Galaxy)*	14 03	+ 54.4	3
	M 108	Spiral galaxy (edge-on)	11 12	+ 55.7	2
	M 109	Barred spiral galaxy	11 58	+ 53.4	2
VIRGO	M 104	Spiral galaxy *(The Sombrero Galaxy)*	12 40	- 11.6	2

OPEN STAR CLUSTERS

Constellation	Object	Type	Coordinates R A h m	Dec degs	Section
		Binocular object: ○○			
ANDROMEDA	NGC 752	Open cluster ○○	01 58	+ 37.7	6
AURIGA	M 36	Open cluster ○○	05 36	+ 34.1	1
	M 37	Open cluster ○○	05 52	+ 32.5	1
	M 38	Open cluster ○○	05 29	+ 35.8	1
CANCER	M 44	Open cluster ○○ *(Præsepe or Beehive)*	08 40	+ 20.0	1
	M 67	Open cluster ○○	08 50	+ 11.8	1
CASSIOPEIA	NGC 7789	Open cluster	23 57	+ 56.5	5
	M 52	Open cluster ○○	23 24	+ 61.6	5
	M 103	Open cluster	01 33	+ 60.7	6
	NGC 457	Open cluster ○○	01 19	+ 58.3	6
CEPHEUS	NGC 188	Open cluster	00 44	+ 85.3	5
CYGNUS	M 29	Open cluster	20 24	+ 38.5	4
	M 39	Open cluster ○○	21 32	+ 48.4	5
GEMINI	M 35	Open cluster ○○	06 09	+ 24.3	1
MONOCEROS	M 50	Open cluster ○○	07 03	- 08.3	1
	NGC 2244	Open cluster and nebula *(Rosette Nebula)*	06 03	+ 04.9	1
PERSEUS	NGC 869	Open cluster ○○	02 19	+ 57.1	6
	NGC 884	Open cluster *(The Sword Handle double cluster)*	02 22	+ 57.1	6
	NGC 1528	Open cluster ○○	04 15	+ 51.2	6
	NGC 1245	Open cluster ○○	03 15	+ 47.2	6
	M 34	Open cluster ○○	02 42	+ 42.8	6
SAGITTARIUS	M 23	Open cluster ○○	17 57	- 19.0	4
	M 24	Open cluster ○○	18 18	- 18.4	4

OPEN STAR CLUSTERS – CONTINUED

Constellation	Object	Name	Coordinates RA h m / Dec degs	Section
		Binocular object: ○○		
SCUTUM	M 11	Open cluster ○○ *(The Wild Duck Cluster)*	18 51 - 06.3	4
TAURUS	M 45	Open cluster ○○ *(The Pleiades)*	03 47 + 24.1	6
	NGC 1647	Open cluster	04 46 + 19.1	6

PLANETARY NEBULAE

ANDROMEDA	NGC 7662		23 26 + 42.6	6
AQUARIUS	NGC 7009	*The Saturn Nebula*	21 04 - 11.4	5
	NGC 7293	*The Helix Nebula*	22 30 - 20.8	5
CYGNUS	NGC 6826	*The Blinking Nebula*	19 45 + 50.5	4
DRACO	NGC 6543		17 59 + 66.6	4
ERIDANUS	NGC 1535		04 14 - 12.7	6
GEMINI	NGC 2392	*The Eskimo Nebula*	07 29 + 20.9	1
HERCULES	NGC 6210		16 45 + 23.8	3
LYRA	M 57	*The Ring nebula*	18 54 + 33.0	4
URSA MAJOR	M 97	*The Owl Nebula*	11 15 + 55.0	2
VULPECULA	M 27	*The Dumbbell nebula*	19 57 + 22.6	4

GLOBULAR STAR CLUSTERS

Constellation	Object	Type	Coordinates RA h m / Dec degs	Section
		Binocular object: ○○		
AQUARIUS	M 2	Globular cluster ○○	21 34 - 00.8	5
	M 72	Globular cluster	20 54 -12 05	4
CANES VENATICI	M 3	Globular cluster ○○	13 40 + 28.6	3
COMA BERENICES	M 53	Globular cluster ○○	13 11 + 18.4	3
HERCULES	M 13	Globular cluster ○○	16 40 + 36.5	3
	M 92	Globular cluster ○○	17 17 + 43.3	4
LEPUS	M 79	Globular cluster	05 25 - 24.5	1
OPHIUCUS	M 10	Globular cluster ○○	16 55 - 04.0	3
	M 12	Globular cluster ○○	16 45 - 01.9	3
PEGASUS	M 15	Globular cluster ○○	21 30 + 12.2	5
SAGITTARIUS	M 22	Globular cluster ○○	18 36 - 23.9	4
SCORPIUS	M 4	Globular cluster ○○	16 21 - 26.4	3
	M 80	Globular cluster ○○	16 14 - 22.9	3
SERPENS	M 5	Globular cluster ○○	15 16 + 02.3	3

VARIABLE STARS

CEPHEUS	Mu μ	Herschel's Garnet Star	22 44 - 58.8	5
CETUS	Omicron o	Mira	02 19 - 03.0	6
PERSEUS	Beta β	Algol ○○	03 08 + 40.9	6

Fission and fusion

So, what is the difference? It's one of those things, so here's a quickie explanation.

Fission is the collision of (shall we say for example) a fast-moving neutron with the nucleus of a heavy element – Uranium 235 (see figure *1a*). In colliding, the neutron causes the nucleus to oscillate and become distorted (*b*). As a result of this the nucleus breaks down and an explosion occurs (*c*), forming two lighter nuclei and three free neutrons (*d*), which can then cause more nuclei to split, and the neutrons formed as a result of these explosions cause others to be formed, and so on . . . Result: a continuous chain reaction called *nuclear fission*.

A great deal of energy is released as a result of nuclear fission, because the nuclei being formed have less mass than the original Uranium nucleus. In other words, mass is made into energy:

$$e = m\,c^2$$

Fusion is the joining of two lighter nuclei to form a heavier nucleus. In this type of reaction there is also a loss of mass and a release of energy.

Nuclear fusion is the type of reaction taking place in the stars, our own Sun included, where hydrogen combines to produce helium. The energy released gives us our light and heat.

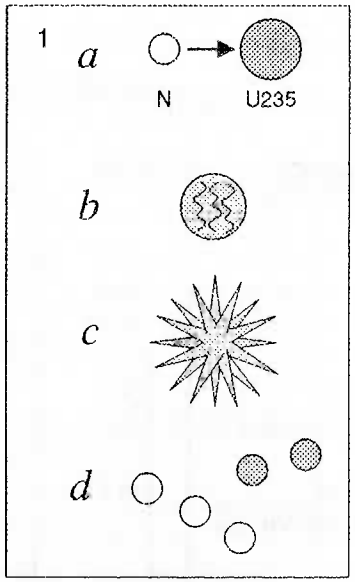
See figure 2:-

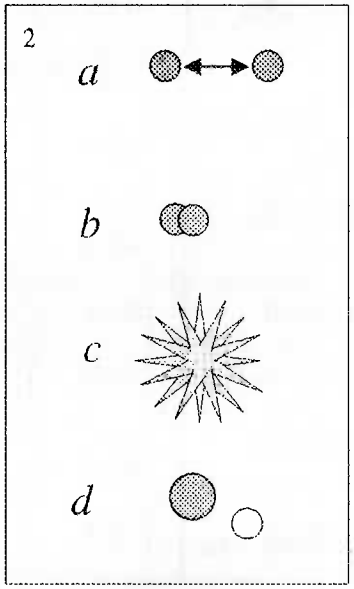
a – two nuclei come together.

b – the nuclei collide.

c – release of energy.

d – Heavier atom formed + 1 free neutron





There it is: **Fission** is the splitting of a large, heavy nucleus into lighter nuclei, while **fusion** is the coming together of lighter nuclei to form a heavier one. Simple, really! ☆

David Williams

Ref: Penguin Book of the Physical World

A step in the right direction

With the recent proposals for legislation to include **light pollution** as a public nuisance, it is considered **a step in the right direction** in the continuing fight against this increasing menace.

There has never been a better opportunity, with the **Channel Islands** being in such high profile in the astronomical world, and the Bailiwick of Guernsey in particular, to show everyone that we respect the importance of this situation. With the international importance of a **total eclipse**, to be observed above us, the eyes of the world will be upon us, and we must not disappoint those that would ensure that we should be seen in the right light (forgive the pun), to do whatever we can, and grasp the nettle to make a continuing commitment to a **dark sky**. Quality of life will be improved, money will be saved, and most important of all, our legacy to our children will be the stars and planets in all their glory.

Ken Staples

Editor's note:

The Board of Health have proposed changes to the environmental health legislation, and a completely new "control of environmental pollution" legislation.

The light nuisance proposals are in the changes to the environmental health legislation. They are not, therefore aimed at light pollution from an environmental aspect. Thus, the fact that the view of the night sky is affected will be irrelevant. For action to be taken, it must be shown that someone's health is being damaged, for example by a bright light preventing them from sleeping. ☆ ***DLC***

Millenium projects

The Millenium Panel has announced its conclusions after considering some 200 suggested millenium projects. It has recommended eight projects for further consideration by the States, as well as a reserve list for further consideration by the people of Guernsey. The Astronomy Section's suggestion for a camera obscura, probably on Castle Cornet, appears on the reserve list. The suggestion for a new telescope does not appear, and neither does the Editor's suggestion for an island-wide solar system model. This does not mean, of course, that these projects need not go ahead, just that they have not been recommended by the panel as millenium projects. ☆

Telescope problems

Just before Christmas we suffered a potentially severe problem with the 14-inch Celestron, when it's electronic drive controller started blowing fuses. First attempts to solve the problem failed, and we therefore tried to find help from sources in the USA and UK, and even investigated the possibility of replacing it. Unfortunately, the drive controller was discontinued some years ago, and we were unable to get any help.

However, John Taylor came to the rescue, did some component checks, and managed to repair it, so the telescope is back in full operation again. The instrument is now about 15 years old, and is showing its age. As discussed at the Annual Business Meeting, we are investigating the possibility of having it completely overhauled. This would necessitate its being shipped back to Celestron in California for a few weeks. ☆