Advertisements

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

Newsletter format

Please note that this newsletter covers a three-month period, January to March. The next newsletter will be issued in early April.

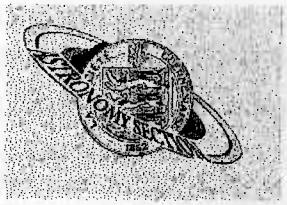
You will also note that the format of the sunset, twilight, and the sunrise times, and the Moon phases, has been changed. A full set for the whole year is on the Observatory notice board. ☆

Bethlehem star

The article by Tom Butler about the Star of Bethlehem, which appeared in the last issue of Sagittarius, was re-published in the Christmas newsletter of the Town Church. ☆

Pleiades plaque

A recent request was for us to provide a chart showing the main stars of the Pleiades – for a boat nameplate! A local craftsman had been asked to carve the boat's name *Pleiades* in wood, showing the main stars. He had found it not easy to pick them out from a photograph, as there were too many stars. We were able, however, to use a computer program to produce a template. ☆



Astronomy Section Officers

Section Secretary:	Geoff Falla	724101
Honorary Treasurer:	Peter Langford	720649
Education Officer:	Ken Staples	65115
Light Pollution Officer:	Ken Staples	65115
Imaging Officer	Daniel Cave	64415
Editor	David Le Conte	64847

Material for, and enquiries about Sagittarius should be sent to the Editor at:

Belle Etoile, Rue du Hamel, Castel
Guernsey GY5 7QJ
Tel 01481 64847 Fax 01481 64871
E-mail: astroguernsey@dial.pipex.com

Observatory: Rue du Lorier, St Peter's, Guernsey. Tel 64252

Web page:
http://ds.dial.pipex.com/nightsky/astro/

E-mail: astroguernsey@dial.pipex.com

Opinions expressed in Sagittarius are those of the authors, and are not necessarily endorsed by the Astronomy Section or La Société Guernesiaise.

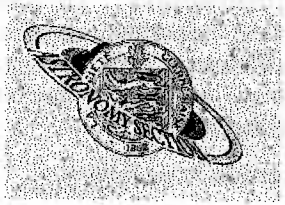
The next newsletter will be published early in April. The deadline for publication copy is the 15th March.

La Société Guernesiaise, Candie Gardens, St Peter Port, Guernsey.
Tel 01481 725093

Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

January – March 1998



Forthcoming events

Annual Business Meeting
Tuesday, 20th January
8.00 pm at the Observatory

Constellations of the Zodiac
Tuesday, 17th February
8.00 pm at the Observatory

La Société AGM
Wednesday, 4th March
7.30 pm at La Trelade Hotel

The February Total Solar Eclipse
Eclipse expedition reports
Tuesday, 24th March
8.00 pm at the Observatory

In this issue

Transient lunar phenomena
The Asteroid Belt

Inside

Centre inserts

Star chart

Sunset, twilight, and sunrise times and Moon phases

Annual Business Meeting

The 1998 Annual Business Meeting will be held at 8.00 pm on Tuesday, the 20th January at the Observatory. This will be an important meeting, as Geoff Falla has announced his resignation as Secretary, so a new Secretary will have to be elected.

The agenda is as follows:-

1. Election of officers
2. Treasurer's report
3. Projects for 1998:-
   (a) Solar projection – sunspots
   (b) Sundial
4. Public visits
5. Newsletter
6. 1999 solar eclipse
7. Any other business

Projects for 1998: It is felt that with the new cycle of sunspot activity beginning, more regular use should be made of our solar mirror system. This will help us to keep track of the rise of activity, expected to reach a peak in 1999/2000. Some preliminary work has also been done with the aim of providing a sundial at the Observatory.

1999 solar eclipse: We will discuss La Société's role in the Royal Astronomical Society's National Astronomy Meeting, the exhibition planned for Candie Museum, and the probability of visits by amateur astronomers from the UK.

Please come along to this important meeting. ☆

Zodiac Constellation objects

Our subject for the meeting **on Tuesday, the 17th February, at 8.00 pm at the Observatory, is *Constellations of the Zodiac*.**

This will help focus our minds on just twelve of the constellations visible from the northern hemisphere, those to be found along the ecliptic – the path traced by the Sun during the year. For those of us not well versed in astrology, the twelve signs of the Zodiac and their respective months, they are as shown in the box.

Aquarius	Jan	20	–	Feb 18
Pisces	Feb	19	–	Mar 20
Aries	Mar	21	–	Apr 20
Taurus	Apr	21	–	May 20
Gemini	May	21	–	Jun 20
Cancer	Jun	21	–	Jul 21
Leo	Jul	22	–	Aug 21
Virgo	Aug	22	–	Sep 21
Libra	Sep	22	–	Oct 22
Scorpio	Oct	23	–	Nov 22
Sagittarius	Nov	22	–	Dec 20
Capricornus	Dec	21	–	Jan 19

Some of the constellations are more easy to recognise than others, but most of them contain objects of particular interest which can be observed with binoculars or telescopes. We will be concentrating our discussion on learning as much as we can about these particular constellations, and noting some of our favourite objects within each of the more observable constellations.☆

La Société AGM

The Annual General Meeting of La Société will be held in early March. The most probable date is Wednesday, the 4th March, at 7.30 pm, at La Trelade Hotel. However, please refer to the next issue of the Société newsletter *Communiqué* for confirmation and details. ☆

Eclipse Expeditions

On the 26th February the shadow of the Moon will sweep across the north of South America and the Caribbean. Several people from Guernsey are going on expeditions to see it, and will be reporting to members of the Astronomy Section **on Tuesday, the 24th March, at 8.00 pm at the Observatory**.

David and Christopher Le Conte, and Maureen Pitman are joining an American group in Venezuela. They will also be spending two nights in the Andes, at 11,000 feet altitude, to view the southern stars. The eclipse will be observed from a site north of Maracaibo, organised by the University of the Andes.

George Le Couteur is going to a different site in Venezuela, after visiting the Galapagos Islands. And Dr Stephen Sweet plans to observe the eclipse from Curaçao.

Hopefully, we will have some pictures to show, but at least experiences to share. This will give members some idea of what to expect during the total eclipse here in 1999, and help members to plan their own eclipse activities. ☆

Asteroid Belt

In November Frank Dowding gave us an excellent talk on the asteroid belt. Over the years Frank has covered just about every solar system object in his talks. The asteroid belt is a subject to which few of us give much thought, so it was good to learn all about it.

Frank's talk is published in full in this issue of Sagittarius, beginning on page 11. ☆

Quiz and supper evening

The annual quiz and supper evening was held on Tuesday, 16th December at the Observatory, and, possibly due to the bad weather conditions, the turnout was disappointing.

Roger Chandler was the quizmaster, and had prepared a wide selection of questions for us. There were varying degrees of difficulty – some we were able to answer easily, whilst others left us scratching our heads.

We all learnt something though, and at the end of the quiz David Le Conte was the winner, with a score of 45 points. Well done to David, and thank you to Roger for his hard work in setting the quiz.

The evening was enjoyed by all those who attended, with the emphasis on fun rather than a serious evening. So even if you feel you are not an expert you can still come along and pit your wits.

Maybe next year? ☆ ***DB***

Transient Lunar Phenomena – by Geoff Falla

It is usually thought that nothing ever happens on the Moon; that with no air and no water, there can be no changes of any kind. However, this does not appear to be entirely correct, as a number of lunar observers have reported seeing changes.

During the Apollo programme of manned lunar landings, seismometers were left on the Moon's surface to detect any Moon-quakes. The result was that around 3,000 Moon-quakes, of fairly weak intensity, were recorded per year.

These are considered to have two possible causes. Firstly, we know that the Moon exerts a gravitational pull on the Earth, distorting the surface by up to a foot. The Earth, likewise, must have a similar effect on the Moon's surface, producing stresses in the crustal layers, particularly at times when the Earth and the Moon are closest to each other. Moon-quakes do appear to be more frequent at times of perigee.

Another cause of Moon-quakes can be as a result of solar heating. All parts of the Moon's surface have two weeks of sunlight, followed by a similar period of total darkness. Temperatures are extreme as a result, and sudden heating or cooling may produce shallow movement in the Moon's surface layers.

Confirmation of changes on the Moon are based on more than just the recorded evidence from instruments on the surface. There have been many visual records of transient events, generally referred to as *transient lunar phenomena* or *TLPs*.

These include occasionally seen glowing appearances, and obscurations of usually clear surface features. In 1976 a catalogue record containing over 700 of these reports was produced by Patrick Moore and B Middlehurst.

Several features on the Moon's surface have been particularly linked with records of transient lunar phenomena – for example, the craters Alphonsus and Aristarchus. In October 1956 a photograph taken from Mount Wilson Observatory showed an area obscured by haze to the east of the central mountain in Alphonsus. Two years later astronomer Nicolai Kozyrev, at the Crimean Observatory, obtained spectrographs set on the same central mountain feature, to confirm the emission of a gas cloud consisting of carbon molecules.

In 1961 Kozyrev also obtained spectrographic confirmation of molecular hydrogen emitted from the centre of the bright crater Aristarchus. It is now accepted that such gas emissions could be caused by sudden solar heating, the events liable to occur a short while after an area emerges from darkness into sunlight, at the lunar terminator. ➠

Over the years a number of anomalies have been recorded by lunar observers from other areas on the Moon's surface. Some of these have been short-lived events, while others in specific areas have been studied over a period of time.

The feature known as Linné, in the eastern part of the Mare Serenitatis, was described in the early 19th century as a well defined, deep crater, with a diameter of about 5 miles. In 1866 astronomer Schmidt announced that the crater had become a conspicuous white spot. Further changes were noted in the report of the British Association, 1867, and now Linné is recorded as a white spot with a small central pit, no longer the crater as previously seen.

On the 9th April 1867, noted lunar observer T G Elger reported a light of magnitude 7 on the dark part of the Moon. The light gradually became fainter, and disappeared after about one and a half hours.

One of the darkest areas on the Moon is the floor of the large crater Plato. This crater is easily identified, in the northern part of the Moon, near the top edge of the Mare Imbrium. The floor of the crater was studied by astronomers Birt, Elger and others. Remarkably, they recorded an apparent pattern of 'lights', which were charted and numbered. The lights seemed to remain fixed in position, but increased or decreased in intensity.

Mysterious dark patches and narrow streaks were recorded in the large crater Eratosthenes, notably by Professor W H Pickering. The markings appeared to spread over the sloping sides of the crater onto the surrounding area on successive nights, not always in the same direction. The existence of the markings was not disputed, but the cause of the apparent movement remained a mystery.

In 1939 Patrick Moore observed a dense mist in the large crater Schikard. The mist covered the entire floor of the crater, an area of around 14,000 square miles, and billowed over the surrounding walls. The cause of this dense lunar fog was thought most likely to be as a result of the release of carbon dioxide.

So the evidence is apparent that the Moon is not quite a dead world, that there are still remnants of activity to be observed – perhaps not by a casual observer, unless extremely lucky, but certainly by those who over the years have made the Moon a subject of careful study. ☆

Geoff Falla

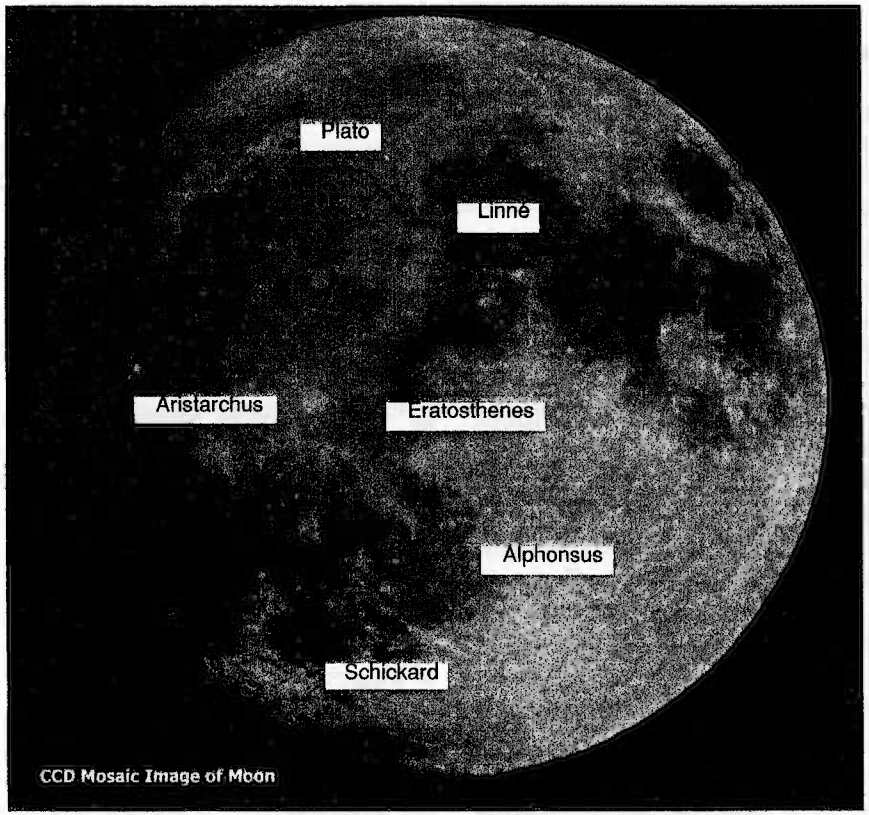
References:

The Amateur Astronomer, by Patrick Moore, Lutterworth Press, 1957

The Moon, by Patrick Moore, Mitchell Beazley, 1981

Mysterious Universe, by William Corliss, Sourcebook Project, 1981

Some of the sites where TLPs have occurred are shown on the Moon photograph on the next page.



Some of the locations on the Moon where changes have been noted.
Lunar mosaic by Daniel Cave. ©

Saturn occulted

In the early hours of the 12th November Saturn was occulted by the Moon. Geoff Falla caught a glimpse of it from his home, using his 90 mm Celestron. Mike Maunder observed it from Alderney. David Le Conte attempted observations with the 14-inch Celestron at the Observatory, but, frustratingly, the sky was largely clear, except for the Moon. The best he could do was watch it being simulated in real time on the computer! ☆

Programme for 1998

This issue of Sagittarius includes in the centre pages a preliminary programme for this year. It is most likely close to the final programme, and we hope to issue a definitive version in the usual card form in the next few weeks.

Please note, however, that the list of officers may well change, depending on the results of the Annual Business Meeting. ☆

LA SOCIÉTÉ GUERNESIAISE

ASTRONOMY

SECTION

Preliminary Programme for 1998

A varied programme of meetings held by and for members of Guernsey's Astronomical Society.

Guests welcome

Meetings are generally held at the Observatory on the Tuesday on or before the full moon. Informal meetings for discussion and observing are also held on all other Tuesdays. Observing is carried out every Friday, and other days, weather permitting.

A map showing the location of the Observatory is on the back of this Programme. There is parking for 15 cars, and overflow parking is usually available at La Houguette School.

For further information, contact the Section Secretary: Geoff Falla, Highcliffe, Avenue Beauvais, Ville au Roi, St. Peter Port, Guernsey
Telephone: 01481 724101
Observatory telephone: 01481 64252
E-mail: astroguernsey@dial.pipex.com
Web page: http://ds.dial.pipex.com/nightsky/astro/

ASTRONOMY SECTION PROGRAMME FOR 1998

All meetings at 7.30 pm for an 8.00 pm start, unless otherwise stated

JANUARY
Tuesday, 20th — ***Annual Business Meeting***

FEBRUARY
Tuesday 17th — ***Constellations of the Zodiac***
7.30 pm — Members' favourite objects

MARCH
Wednesday 4th — ***La Société Guernesiaise AGM***
7.30 pm — At La Trelade Hotel

Tuesday 24th — ***The February Total Solar Eclipse***
Eclipse expedition reports

APRIL
Tuesday 21st — ***Advances in Astrophysics***
Dr David Falla

MAY
Tuesday 12th — ***Mysteries of Time and Space***
Geoff Falla

JUNE
Sunday 21st — ***Summer Solstice***
2.00 pm - 5.00 pm — Solar projection and sundials

JULY
Saturday 11th — ***Observatory Day***
From 9.00 am — All day

THIS PROGRAMME IS SUBJECT TO CHANGE

AUGUST
Tuesday 11th — ***Barbecue (7.30 pm) and Perseid***
(Rain date - 12th) — ***Meteor Shower Count (10.00 pm)***

SEPTEMBER
Tuesday 29th — ***Video Evening and Star Night***
7.30 pm — At La Houguette School

OCTOBER
Tuesday 20th — ***Meteor Preview***
Orionids and Leonids

NOVEMBER
Tuesday 17th — ***Moons of the Solar System***
Frank Dowding
And at 10.00 pm: — ***Leonid Meteor Watch***

DECEMBER
Tuesday 15th — ***Quiz and Supper Evening***
7.30 pm — David Le Conte

Astronomy Section officers

Section Secretary	Geoff Falla	724101
Honorary Treasurer	Peter Langford	720649
Education Officer	Ken Staples	65115
Light Pollution Officer	Ken Staples	65115
Imaging Officer	Daniel Cave	64415
Editor	David Le Conte	64847
Observatory		64252

Membership

Anyone interested in astronomy is welcome to join the Astronomy Section of La Société Guernesiaise - the astronomy society of Guernsey. Membership of La Société is a pre-requisite (single £11.00, double £14.00, students £2.50, but thes may increase during 1998). Membership of the Section costs £5.00 (students and OAPs £3.00). Members receive: the Section's bi-monthly newsletter Sagittarius, an Astrocalendar (see below), and Federation of Astronomical Societies newsletters.

Observing and other facilities

The Section's headquarters is based at its Observatory near La Houguette School at La Pointe, St. Peter's, opened by Heather Couper and Nigel Henbest in 1991 (see map below), with a new building, with roll-off roof, opened by Patrick Moore in 1993. The Observatory is equipped with 14-inch and 11-inch Celestron telescopes, an 8-inch Schmidt camera, and a Starlite Xpress CCD imaging system. We also have a 6-inch Newtonian reflector (which members can borrow), and a solar telescope. The Section's library contains all the major astronomical magazines, about 200 books, and a number of videos, all of which are available for loan to members. There is also a darkroom and a meeting room.

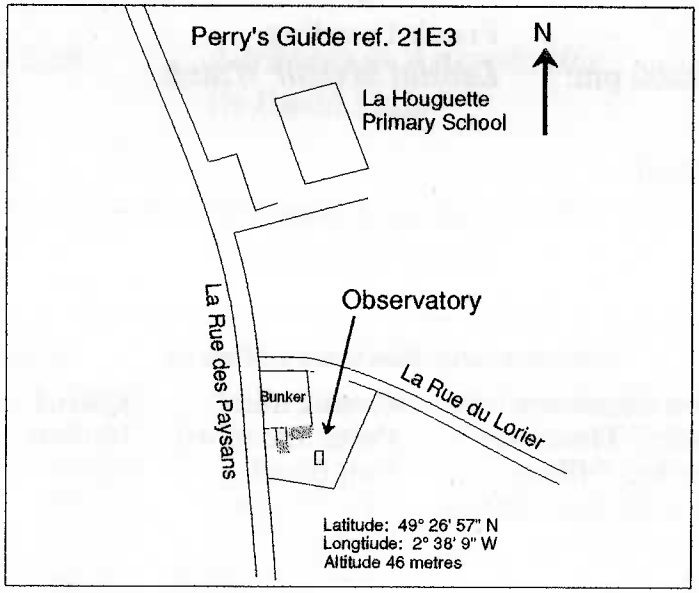
Publications available

Astronomy Guide - A monthly observing guide with a selection of stars and nebulae for the amateur telescope, by Geoff Falla. Members £3.00, non-members £4.50.

Observational Astronomy - A plan for the beginner, by S.J. Lubbock (FAS). Members £2.50, non-members £3.00.

Astrocalendar, 1997 by R.M. Owens (FAS) - Monthly notes and star charts, planets, meteors, eclipses, etc. Free to members, extra copies £1.50, non-members £2.00.

Star Dial A nocturnal for telling the time by the stars. On card for cutting out. 50p.



The Asteroid Belt – by Frank Dowding

Where is the asteroid belt? Well, it is between Mars and Jupiter. To be more exact, it occupies a space between 2 and 3.7 astronomical units (AU) from the Sun (1 AU being the Sun-to-Earth distance). Mars is 1.3 AU and Jupiter 5 AU from the Sun. The centre point between Mars and Venus is 3.2 AU, so the belt is slightly towards Mars rather than Jupiter.

This is all very well, but let us look at the belt from a different perspective.

Because it is between 2 and 3.7 AU across, this makes it 158 million miles from the inside to the outside. It is, in fact, wider than the distance between the Sun and Mars's orbit. Its thickness, ie from bottom to top, is about half its width, approximately 70 million miles. But the majority of the asteroids have inclined orbits, so they cross each other.

When the Pioneer 10 and 11 spacecraft were launched for Jupiter in 1972, they took 7 months to pass through the asteroid belt, even though they were travelling at over 30,000 mph. But the Pioneers and the Voyagers did successfully pass through the belt. At the time of the Pioneers, NASA was very relieved, but it is now considered that for a spacecraft to hit an asteroid would be extremely unlikely.

You see, although there are in excess of 100,000 asteroids, the space they occupy is so large that there are millions of miles between each one.

So, how were they discovered? Well, we come back to Bode's Law again – not strictly a law, because it does not accurately account for the planets further out than Uranus. But by using the formula it does accurately pin-point Mercury, Venus, Earth, Mars, Jupiter, Saturn and Uranus.

But it also predicts a planet 2.8 AUs from the Sun, that is, between Mars and Jupiter, but no-one had seen it. So, in 1800 a group of German astronomers calling themselves the "Celestial Police" began to search for perhaps a faint new planet.

In 1801 Guiseppe Piazzi, a Sicilian Monk, not one of the Police, found a small object, in the right place, which was later named *Ceres*, after the goddess of Sicily. Ceres turned out to be about 600 miles across – in the right place for Bode's Law, but not large enough to be called a planet.

In 1802 Wilhelm Olbers, one of the Celestial Police, found another, which was named *Pallas*. Pallas turned out to be just over 300 miles across.

In 1804 Karl Harding (Celestial Police) found *Juno*, about 200 miles in diameter.

In 1807 Olbers, again, found *Vesta*, about 350 miles across.

At that point the Celestial Police disbanded.

It became apparent that there was not a planet at all where Bode's Law predicted, but perhaps the remains of one.

In 1845 Karl Hencke found *Astra*, a mere 72 miles in diameter, and, between 1845 and 1892, 300 more were visually identified.

Vesta, incidentally, is only 350 miles across and 170 million miles away, but it has been seen with the naked eye, due to its reflective quality.

In 1892 Max Wolfe was the first to take photographs of the night sky in order to compare and identify new asteroids.

Asteroid, by the way means "star-like".

It is currently estimated that the total mass of all the asteroids is about 1/2000 of the mass of the Earth – not even large enough to make a planet the size of our Moon. To gain some perspective, the diameter of the largest asteroid, Ceres, is about the length of Great Britain, from John O'Groats to Southampton. If a man was able to stand on Juno, for example, an asteroid 1 mile across, he could, with one jump, launch himself into space – should he want to, that is!

Asteroids number around 100,000. but only about 300 have been given names. The naming of an asteroid is carried out by the International Astronomical Union Minor Planet Centres in Cambridge, Massachusetts, and in St Petersburg. What happens is that a temporary number is given to a newly found asteroid, and its position is given to astronomers. After about two years, if the predicted position favourably occurs for re-sighting during that time, then it is given a permanent number.

It is then given a name, usually after the discoverer, but it still also retains the number, such as 1 Ceres or 2 Pallas. Initially asteroids were given Greek or Roman names, but now there are so many that that method has been relaxed.

It is estimated that 99% of asteroids over 60 miles in diameter have been identified, and around 50% for diameters of 6 miles across. It is sometimes difficult to distinguish between an asteroid and a comet. In 1989 David Levy examined an asteroid discovered by Carolyn and Eugene Shoemaker, and found a fuzziness around it. It was then decided to be a comet which had come to the end of its days of leaving a tail.

So, why are these asteroids where they are? The answer appears to be Jupiter.

We have to go back in time, before there was a Sun, to a time when the dust cloud began to condense and rotate. Very slowly the dust particles attracted each other to form small, rocky substances. It took thousands of years for objects the size of a football to emerge.

Millions of years later the sun had attracted to itself a large amount of the gas, but left the rocky "planetoids" as they were called, to grow to the size of planets. But in the area that Jupiter was emerging, there were more rocks than anywhere else, and the larger it got, the more it attracted. Jupiter became, and still is, the largest ➡

planet circling the sun – larger than all the other planets put together.

Some believe that Mars is only the small size it is because Jupiter swept up some of what Mars was collecting.

But what of the asteroids that are still there? Well, there are a number of theories.

One piece of evidence is that most of the larger asteroids are broken pieces of a larger unit. This is known because they travel together as what is called a "family".

Some believe that this was either caused by collision of large planetoids, or that Jupiter attracted so much debris onto itself that not enough was left to form a planet.

So, how does Jupiter do this? Well, it is really quite clever.

Because the asteroid belt is so wide, the asteroids are moving at different speeds, depending on their orbital distances from the Sun. Some are travelling close to Jupiter's speed, and therefore seldom feel any of its attraction. But some are what is called "in resonance" – that is, for example, one that is travelling at exactly twice Jupiter's speed. In such a case, it will be close to Jupiter twice in each orbit.

Jupiter circles the Sun in 12 years, so every 6 years it will give a tug on the asteroid, pulling it further out. Over hundreds, sometimes thousands of years it will free the asteroid from the belt, and either gather it onto itself, or sling it, sometimes out of the solar system altogether. Or sometimes set it into a new orbit entirely.

The same fate falls to an asteroid travelling at four times Jupiter's speed, or three times.

It is rather like a game, when if two asteroids collide and one speeds up or slows down, and finds itself being tugged frequently by Jupiter, then it is doomed – unless it hits another asteroid and changes its speed out of harm's way.

That is why there are gaps in the belt, called *Kirkwood gaps*, after their discoverer, also known as *resonance gaps*. One such gap is at 3.3 AU.

Some asteroids are very clever, like the dozens of *Trojan Asteroids*. They are actually right on Jupiter's orbit, and travel at exactly Jupiter's speed – 60° in front and 60° behind. It appears that they have been there ever since Jupiter was formed.

So, why are scientists interested in the asteroid belt?

It is generally accepted that the asteroids are of the same material that went on to form the planets, and indeed the Sun. It is difficult to examine rocks on the Earth and find something which has not changed in some way. Rocks on the surface have been weathered and chemically changed due to interaction between rainfall and wind. Volcanic rock has come from deep inside, and has changed chemically due to immense compression and heat.

But the asteroids, at least some of them, have not. Some have been altered due to high velocity collisions. Some have been able in the past to form quite large bodies, and have ➡

undergone compressional change. Vesta, for example, has even had volcanic activity. This is known from its spectral absorption bands, which indicate igneous rock. It is also most reflective, due to the volcanic lava surface.

In 1992, the use of radar imagery on *Toutatus* revealed it to be a binary asteroid, one 2.5 miles across, and other 1.6 miles, taking four days to orbit each other. In 1993 the *Galileo* spacecraft flew close to *Ida*, an asteroid in the *Koronis* family. It showed that the asteroid is about one mile across, shaped like a large potato, and has a small moon orbiting around it.

Most meteorites found on Earth are thought to have come from the asteroid belt, due to colliding rocks, which push one out of orbit, or large collisions which shatter and send many out of the belt. By studying each meteorite it can be determined what size the parent body was, and seldom is the body more than 600 miles across. In fact, most are much smaller.

By studying the meteorite it can be deduced if it has undergone changes by heating, by being inside another body, for instance.

There are basically two types of asteroid: the *'C'* type and the *'S'* type.

The *C* contains carbon, and it difficult to see as it is darker than coal. The *S* contains carbon with rock, iron and magnesium silicate material. It is a reddish colour. *C* types are mainly in the outer part of the belt, and the *S* type is in the closer part.

Occasionally, a part of an asteroid known as a meteorite will fall to the Earth (not to be confused with a meteoroid, which is a speck of dust). By dating the meteorite the age of the solar system can be calculated.

What scientists are looking for is a meteorite that developed from a cool state, and has not undergone a chemical change due to compression or volcanic effects.

What are the Earth approaching asteroids?

Occasionally, due to a collision or by Jupiter's attraction, an asteroid will move out of the belt and set up an orbit dictated by the Sun and the influence of other planets. This happens once or twice in a million years. It sounds a long time, but over the solar system's 4½ thousand million years it is a regular occurrence. Early on it happened more frequently.

If an asteroid orbits around the Sun, then around Jupiter and back to the Sun, it has to cross the Earth's orbit. It is then called an Earth approaching asteroid. Fortunately, most are not in the same plane, so an impact is not imminent.

One such group of asteroids, 19 to be exact, are collectively known as the *Apollos*. They orbit between the Sun and Mercury, then on around Mars and back.

Icarus has a similar orbit, taking 409 days, and is about a mile across.

Hildalgo has an orbit outside of Mars, then very close to Saturn, the most extreme of known orbits – ➡

more like a comet than an asteroid.

Coming back to the asteroid belt itself:

If Jupiter had not developed as large as it did – after all, it was only by chance that there was more material in the area where it was developing – if it had been a normal size planet, then it is most probable that a 10th planet would have developed, where the asteroids now exist.

Eros orbits around Venus and outside of Mars.

There is also the *Aten* group. These are the most worrying to scientists and astronomers, as they circle the Sun inside the Earth's orbit. In 1937 *Hermes* passed the Earth at about the distance to our Moon. A number of asteroids have been discovered in this area, and are collectively known as the *Aten* group, after *Aten* was first discovered.

To get this into perspective, it has been estimated that an asteroid will come within range of impact during an average range of about a hundred million years – a large one that is. In fact, it is just as likely to impact as to near miss, and to be flung out to a distant orbit.

The moons of Mars, *Phobos and Deimos*, are examples of asteroids which probably got too close to Jupiter, and, from being flung out of the belt, made a close approach to Mars, and stayed there.

Nevertheless, since the 1980s, three groups in the United States have constantly searched for asteroids with a potential impact. One such team, known as *Spacewatch*, is based at the University of Arizona. Using a 36-inch reflector and CCD on Kitt Peak, their slogan is *"Find them before they find us."* This team can identify an object down to 20th magnitude, and recently discovered a 10-metre object passing between the Earth and the Moon.

It is also likely that the Earth, because of its position, may have developed in the way it has, producing life, oceans and a pleasant climate. At first sight it would appear idyllic with no asteroids to worry about. But there is an awful lot of debris out there left over from the initial planet forming, not to mention the comets.

Jupiter plays an important role in the orbit of comets. Without it then comets would roam, with attraction by all planets, and could collide with the Earth or any other planetary body. As it is, Jupiter protects us from that, so I would prefer our chances with an asteroid every hundred million years to a comet colliding with us at random intervals! ☆

Frank Dowding

Frank is programmed to continue his solar system series this year with a talk in November about the moons of the solar system.

Oakvale students visits

In December we had visits from two groups of students, with their teachers, at the Observatory. The weather was not ideal in either case, but nevertheless all the children were able to see something. ☆