This is the 26th annual guide to astronomical phenomena visible from Ireland during the year ahead (naked-eye, binocular and beyond)

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Foreword

We send greetings to all fellow astronomers and welcome you to this, the twenty-sixth edition of our annual almanac for Irish Observers, *Sky-High*.

We are always glad to hear what you liked or what you would like to have included in *Sky-High*. And if you would like to clarify your understanding of anything feel free to contact us at the Society e-mail address: irishastrosoc@gmail.com. Any updates or errata for *Sky-High* will be posted on the *Sky-High* 2018 web page (see page 27). Please acknowledge any use of *Sky-High* 2018.

The times of sunrise, variable star minima etc. are from software by J. O’Neill. The charts were generated using *Guide* 9.1. LPV maxima are by Elizabeth Waagen (Senior Technical Assistant, AAVSO).

We thank the following contributors for their articles or images: Patricia Carroll, John Dolan, James O’Connor and Liam Smyth. All the remaining articles, apart from the Night Sky Primer originally written by Liam Smyth, were written by the Editor. Also thanks to Sara Beck, Patricia Carroll, James O’Connor and Liam Smyth for proof-reading.

Wishing you clear skies for 2018,
Editor, John O’Neill

*Sky-High 2018 © IAS, 2017*

The Irish Astronomical Society

The Irish Astronomical Society was founded in 1937. It caters for those of all ages and interests in astronomy and space.

You don’t have to be an expert to be part of our Society. Many of our members are taking their first steps in the hobby and you are sure to receive friendly advice from some of the more experienced amateur astronomers among us.

Activities include monthly talks, receiving our quarterly magazine *Orbit*, observing groups, e-mail alert notices of transient astronomical phenomena such as aurora, and outings to places of astronomical interest.

Members have joined expeditions to observe several total solar eclipses world wide. Also note, the printed *Sky-High* is a free benefit of IAS membership.

The Society also has a well stocked library of books, journals and videos that members can borrow as well as access to a number of telescopes that can be loaned for a period.

A number of IAS members have made their own telescopes, while others possess telescopes ranging in size to well above 50 cm aperture. Many are now experimenting with the latest technologies to hit the amateur community such as robotic telescopes.

If you are considering purchasing a telescope then we’ll point you in the right direction before you part with your hard-earned cash.

The *Dublin Sidewalk Astronomers* (a group within the IAS) hold public star parties at regular intervals, usually by the seafront at both Sandymount and Clontarf in Dublin (see IAS website for details).
Your Night Sky Primer

As with any hobby, astronomy seems to have its own set of terminology designed to confuse. However, with a little patience you’ll soon pick up the jargon and be well on the way to knowing your way around the sky.

The revolving heavens
We all know the Heavens don’t revolve. It is the other way round, the Earth rotates on its axis. But it looks otherwise and it is easier to describe things as we see them for our immediate purpose. The fact that the Earth turns on its axis about every 24 hours causes the Sun to rise in the east and set in the west, and it is due south at noon. A similar situation applies to all the other heavenly bodies except that since they appear to move relative to the Sun they are not south every day at noon.

The stars appear to drift west in such a way that any particular star is due south four minutes earlier each day or night. If you multiply four minutes by 365 you get something close to 24 hours. So if a star is south at eight o’clock tonight, it will be south four minutes earlier tomorrow, and two hours earlier in a month. In six months it will be south at about eight in the morning. In a year it will again be south at eight in the evening. It follows that we see different constellations in different seasons, but over a year, we see all that portion of the heavens that can be seen from Ireland.

Star maps
You will need at least one star map. This could be a set of monthly charts such as are included in many books on astronomy. A Planisphere is very useful. They come in various sizes at equivalent cost. It allows you to show the constellations visible at any time of the night, any time in the year.

You could get away with using the monthly charts published in newspapers but there are a couple of drawbacks. Each chart is correct for only one time on a given night, say 10 p.m. If you are observing two hours later you would need the following month’s chart. These charts also show the planets visible for a particular month, so they can be confusing unless you tippex them out. When learning the constellations check first from the monthly notes if there is a bright planet in the area.

Once you can find the constellations you will enjoy learning more about them.

A useful guide is the Collins Stars & Planets which has constellation charts as well as all-sky charts, along with sections on the stars and planets. For more detailed studies, especially with binoculars or a small telescope, you will need a more detailed map showing all stars to at least sixth magnitude. A handy atlas is the Pocket Star Atlas published by Sky Publishing, F&W (for about €17). This plots stars to magnitude 7.6 and some 1,500 deep sky objects.

An idea of size or scale
If you have seen a picture of a total eclipse of the Sun you will have noticed that the black disk of the Moon just about covers the bright disk of The Sun. If you were to suspend a one Euro coin about two and a half metres in front of your eye, it would just about cover the Moon’s disk.

The Sun is nearly 1.4 million km in diameter, the Moon is 3476 km and the one Euro coin is just over two centimetres in size. Yet they appear nearly equal. This is because they all seem to take up the same amount of the space in front of our eyes. We may say they have the same angular diameter. In this case it is about half a degree (½°).

Degrees are further divided into 60 arcminutes (60’) with each arcminute made up of 60 arcseconds (60”). The scale allows us to measure angles in the sky or the apparent size of a celestial object. For example, the Full Moon measures an average of ½° or 30’, in diameter.

Your closed fist held at arms length is about ten degrees (10°). Your stretched out hand, i.e. from the tip of your thumb to the tip of your little finger, is about twenty degrees. Between four and five outstretched hands or twice as many closed fists will take you from the horizon to zenith. If you know the Plough you will find that its overall length is rather more than one outstretched hand - it is almost 25°.

Some familiarity with angular measure is necessary to find your way easily about the sky.

Positioning in the sky
Starting at any landmark and going right around the horizon is three hundred and sixty degrees. The azimuth of an object is a measure of its position relative to the horizon as measured from true north which starts at 0° with due east being 90° and so on. Going from a point on the horizon straight up to the point overhead - the zenith - is ninety degrees and a measure of altitude.

Astronomers use a kind of celestial longitude and latitude called right ascension and declination to plot accurately the position of an object in the sky. The basis for this system is the equator and the poles. Right ascension is expressed in hours (h), minutes
(m) and seconds (s) running eastward from 0 to 24 hours around the equator. The zero point of right ascension is taken as the vernal equinox - the point where the Sun crosses the celestial equator, moving from south to north, in its course around the sky.

An object’s declination is written in terms of how many degrees, minutes, and seconds north (+) or south (-) of the celestial equator it is.

The celestial meridian is an imaginary line that starts at the north point of the horizon, rises directly through the North Celestial Pole (NCP) to the zenith and then continues on down to the southern point of the horizon. The NCP is less than one degree from Polaris, the Pole Star.

Planetary data
The Earth is the third planet of the Solar System. Mercury and Venus are closer to the Sun while Mars, Jupiter, Saturn, Uranus, Neptune and Pluto are further out. The major planets are always to be found in the zodiac - a band centred on the ecliptic. The ecliptic is the sun’s path on the celestial sphere. Mercury and Venus seem to swing from one side of the Sun to the other but as viewed from Earth they never get further away than the positions known as greatest elongation. The other planets can be anywhere in the zodiacal band.

The moment when Mercury or Venus are directly between the Earth and the Sun is known as inferior conjunction. They are at superior conjunction when they pass on the far side of the Sun. Obviously, the other planets outside our orbit can only pass through superior conjunction.

When outer planets are in opposition they are opposite the Sun to us and are on the celestial meridian (the southern part - from Ireland) at midnight.

Venus and Mercury show phases like the Moon. Mars can look gibbous, i.e. not quite full. Jupiter can show very slightly less than full at quadrature (i.e. when 90° from the Sun) in amateur telescopes.

The outer planets exhibit a phenomenon known as retrograding. A consequence of their lying further from the Sun than us is that they orbit more slowly than the Earth. Therefore, at opposition, the Earth overtakes an outer planet causing its apparent movement against the stars to come to a halt, move back to the right, halt, and then resume direct motion once again.

A note on time
Times throughout Sky-High are given in Universal Time (UT), unless otherwise noted. This is the 24-hour system starting at mean midnight as measured at Greenwich. It is the same as Greenwich Mean Time GMT. UT is the same as Irish civil time, except when Summer Time is in use. To translate UT into Summer Time just add one hour.

Star magnitudes
The magnitude of a star refers to its brightness, not to its size. The scale of magnitudes is a logarithmic one. A difference of one magnitude is a difference of 2.512 times in brightness. A difference of five magnitudes is a difference of 100 times in brightness. The lower the magnitude number, the greater the brightness.

The stars in the Plough range from about magnitude 2 to magnitude 3½. The faintest stars you can see with the naked eye on a really dark, moonless night, away from city lights, are magnitude 6 or slightly fainter. Binoculars show stars about two magnitudes fainter, while the most powerful telescopes in the world are able to show magnitudes about 20. Modern imaging techniques on such telescopes can reach below 25. The apparent brightness of a star depends on its true brightness and its distance. The term magnitude if not qualified, refers to apparent brightness.

The term absolute magnitude is the magnitude a star would show if it lay at a standard distance of 10 parsecs (the parsec is defined below).

Location
The times for certain events, such as occultations, are given for Dublin. For other locations around the country, you may need to look a few minutes early.

Distance
The Astronomical Unit (au) is a unit of distance of just under 150,000,000 km (the mean distance of the Earth from the Sun). It is convenient for solar system measurements.

For stellar measurement, the light-year is used. It is the distance light travels in a vacuum in one year. It is about 63,000 au.

A parsec is the distance a star must lie at to exhibit a parallax of one arc-second; it is equivalent to about 3.26 light years. Or another way of putting it, is that the parsec is the distance at which the radius of the Earth’s orbit (1 au) would subtend an angle of one second of arc.
### January

1. Mercury at greatest elongation, 23° W in the morning sky.
2. Nearest full moon of the year (356,600 km), just 4 hours after the nearest perigee of the year.
3. 8 Flora at opposition in Gem, mag 8.2.
4. Mars (mag +1.5) lies about 40° N of Alpha Lib (mag 2.7).
3/4. Comet Heinze (2017 T1) passes 1.1° NE of 31 Euphrosyne (mag 10.4) at 0 h.
3/4. Quadrantid meteors at maximum (21 h on the 3rd).
4. Comet Heinze (2017 T1) passes 0.22 au from Earth.
5. Only one moon of Jupiter (Callisto) is visible, from 06:00 to 06:14 UT.
5/6. Comet PanSTARRS (2016 R2) passes 19’ W of 3.6 mag star Gamma Tau at 0 h.
6. Mars (mag +1.4) passes only 14° S of Jupiter (mag -1.8) before dawn.
7. Last quarter Moon lies 0.5° N of Gamma Vir (mag 2.8).
9. Venus at superior conjunction.
11. Waning crescent Moon lies about 3° above Jupiter and Mars.
12. Double shadow transit on Jupiter at 05:44 UT (Ganymede joins Europa).
15. Moon at furthest apogee of the year (406,500 km).
23. Lunar (S edge; waxing crescent Moon) grazing occultation of HIP 6000 (mag 7.3) in Cet at about 17:56 UT. The S limit passes from Kiltrush, Co Clare to Portavogie, Co Down.
28/29. 71 Ori (mag 5.2) occulted by the 12 day old moon; disappearance at 01:18 UT.

### February

1. 1 Ceres at opposition in Cnc, mag 6.9.
1. Mars (mag +1.2) lies less then ½° S of Beta Sco (mag 2.6).
2. Gamma Lib (mag 3.9) occulted by the last quarter Moon, reappearance at 04:08 UT.
5. Waning crescent Moon lies 3° N of Mars (mag +1.1).
12. 12 Massalia (mag 9.8) just 2’ from 5.0 mag star 109 Tau.
17. Mercury at superior conjunction.
21. Comet Heinze (2017 T1) at perihelion, 0.58 au.

### March

1. 20 Massalia (mag 10.2) lies 24’ N of M1.
1. Regulus (mag 1.4) occulted by the full Moon; disappearance at 06:58 UT. Not easy to observe, as only 6° high in the brightening sky.
3. Mercury (mag -1.2) lies 1.0° right of Venus (-3.9) in the dusk.
7. The waning gibbous Moon lies just over 3° N of Jupiter (mag -2.2) this morning.
15. Mercury at greatest elongation, 18° E in the evening sky.
18. 8 Flora (mag 10.3) lies 5’ ESE of 3.0 mag star Epsilon Gem this evening.
18. Mercury (mag +0.3), Venus (-3.9) and the very low, very thin crescent Moon lie in a line. Look 35 min after sunset.
20. Vernal (or Spring) Equinox at 16:15 UT.
22. Waxing crescent Moon in the Hyades.

Sky Diary 2018 (cont.)

22 Aldebaran (mag 0.9) occulted by the 5 day old moon; disappearance at 22:38 UT. The Moon is only 8° high.
23 119 Tau (mag 4.4) occulted by the 6 day old moon, disappearance at 22:38 UT.
24 136472 Makemake at opposition in Com, mag 17.0. It lies 52.5 au from the Sun.
25 Irish Summer Time starts at 1 h civil time (01:00 UT), clocks go forward one hour.
29 Uranus (mag 5.9) is less than 1° WSW of Venus (mag -3.9), as the evening sky darkens.

**April**

1 Easter Sunday.
1 Mercury at inferior conjunction.
2 Mars (mag +0.3) lies 22° NNE of the centre of the globular cluster M22, with Saturn (+0.5) lying 1.3° further on.
5/6 Io lies 18" above Europa at 02:40 UT.
7 The last quarter Moon, Saturn (mag +0.5) and Mars (+0.2) lie in a line before dawn.
12 Mars at quadrature, 88% illuminated.
15 136108 Haumea at opposition in Boo, mag 17.3. It lies 50.5 au from the Sun.
17 Saturn at aphelion, 10.07 au.
17/18 Io lies 20° N of Europa and Ganymede lies 30" NW of Callisto (00:11 UT).
18 Uranus at solar conjunction.
22/23 Lyrid meteors at maximum (18 h on the 22nd).
24 As the sky darkens, spot Regulus (mag 1.4) 20° SW of the limb of the waxing gibbous Moon.
29 Mercury at greatest elongation, 27° W.
29 All five of Saturn’s brighter moons (see page 11 for their names) lie to the E of the planet this morning.

**May**

4 Jupiter (mag -2.5) passes 5° N of 5.2 mag star Nu Lib.
5/6 Eta Aquarid meteors at maximum (8 h on the 6th).
6 Mars (mag -0.5) lies just over 2° SE from the waning gibbous Moon.
9 Jupiter at opposition in Libra, mag -2.5.
9 Comet PanSTARRS (2016 R2) at perihelion, 2.60 au.
17 The thin crescent Moon lies 5° S of Venus (mag -3.9). Look 45 min after sunset.
19 Saturn’s moons Tethys, Dione, Rhea and Titan lie in a straight line, N to S (3 h).
22 The first quarter Moon approaches Regulus (mag 1.4) this evening.

**June**

1/2 Saturn (mag +0.2) lies about ½° S of the Moon, just after midnight.
3 1 Ceres lies 8° WNW of 3.0 mag star Epsilon Leo this evening.
6 Mercury at superior conjunction.
12 Saturn’s moon Iapetus at western elongation (brightest).
14/15 4 Vesta (mag 5.4) passes 0.5° S of the centre of the open cluster M23 (in Sgr).
17 Earliest sunrise of the year (at Dublin), 03:56 UT.
19 4 Vesta at opposition in Sgr, mag 5.3.
21 Summer Solstice at 10:07 UT.
24 Latest sunset of the year, 20:57 UT.
27 Saturn at opposition in Sagittarius, mag 0.0. Full Moon nearby.
28 Mars at east stationary point, begins retrograde motion.

**July**

2 Gamma Cap (mag 3.7) occulted by 18 day old moon; reappearance at 01:45 UT.
3/4 Pluto (mag 14.4) lies 24" NW of the 5.6 mag star 50 Sgr at midnight.
6 Earth at aphelion, 1.02 au.
September

1/2 Comet 21P/Giacobini-Zinner passes 1.2° W of Capella around midnight.
2/3 Aldebaran (mag 1.0) lies just 2° S of the last quarter Moon just after midnight.
7 Neptune at opposition in Aquarius, mag 7.8.
8 Mercury (mag -1.2) lies 8° ESE of the crescent Moon, 40 min before sunrise.
9/10 Piscid meteors at maximum.
10 Comet 21P/Giacobini-Zinner at perihelion, 1.01 au.
10/11 Comet 21P/Giacobini-Zinner lies about ½° S from M37 in the early hours.
14/15 Comet 21P/Giacobini-Zinner lies about ½° from the centre of M35 before dawn.
16 Mars at perihelion, 1.38 au.
17 Saturn (mag +0.4) lies about 4° left of the crescent Moon in the evening dusk.
19 30 Urania at opposition in Psc, mag 9.6.
21 Mercury at greatest elongation, 26° E in the evening sky.
27 Venus at greatest elongation, 46° E in the evening sky.
28/29 Delta Aquarid (south component) meteors at maximum (10 h on the 29th).
30 3 Juno (mag 9.4) lies 10° SW of the 4.3 mag star Mu Cet.
31 Mars nearest to Earth, 0.38 au.

August

4 Favourable lunar libration (10.0° on NW limb).
6/7 Delta Aquarid (north component) meteors at maximum.
9 Mercury at inferior conjunction.
10 Comet PanSTARRS (2016 M1) at perihelion, 2.21 au.
12/13 Perseid meteors at maximum (1 h).
15 Comet PanSTARRS (2017 S3) at perihelion, 0.21 au.
17 Venus at greatest elongation, 46° E in the evening sky.
26 Mercury at greatest elongation, 18° W in the morning sky.
28 Mars at west stationary point, direct motion resumes.
29 Saturn’s moon Iapetus at western elongation (brightest).
31 Favourable lunar libration (9.1° on NW limb).

October

3 56 Gem (mag 5.1) occulted by the 23 day old Moon; reappearance at 02:26 UT. There is also a grazing occultation (north edge) at about 02:14 UT. The north limit passes from Belmullet, Co Mayo to Greencastle, Co Donegal.
8 Draconid meteors at maximum (23 h).
14 Saturn (mag +0.5) lies about 4° E of the crescent Moon in the early evening.
November

2 The waning crescent Moon lies just over 1° N of Regulus (mag 1.4).

3 Comet 64P/Swift-Gehrels at perihelion, 1.39 au.

5 Mars (mag -0.5) passes 0.5° N of 2.9 mag star Delta Cap this evening.

5/6 Taurid (south component) meteors at maximum (18 h on the 5th).

6 Mercury at greatest elongation, 23° E.

10 Comet 38P/Stephan-Oterma at perihelion, 1.59 au. Then in Gemini and perhaps reaching 9th mag.

11 Saturn (mag +0.6) lies less than 1° SW of the crescent Moon in the early evening.

12/13 Taurid (north component) meteors at maximum (17 h on the 12th).

15 Venus lies 1.3° E of 1.1 mag star Spica this morning.

December

7 433 Eros at opposition in Cam, mag 9.7.

7 As darkness falls, Neptune (mag 7.9) lies just 6° SW of Mars (+0.1).

8 40 Harmonia at opposition in Tau, mag 9.4.

12 Comet 46P/Wirtanen at perihelion, 1.06 au.

13 Earliest sunset of the year (at Dublin), 16:06 UT.

13/14 Geminid meteors at maximum (8 h, 14th).

15 Mercury at greatest elongation, 21° W in the morning sky.

15 Lunar (S edge; first quarter Moon) grazing occultation of HIP 118298 in Pisces (mag 6.5) at about 21:40 UT. The S limit passes from Mizen Head, Co Cork to Courtown, Co Wexford.

16 Comet 46P/Wirtanen passes 0.078 au from Earth.

21 Winter Solstice at 22:23 UT.

21 Mercury (mag -0.5) lies 1° above Jupiter (-1.8) in the dawn.

22/23 Ursid meteors at maximum (21 h, 22nd).

28 6 Hebe at opposition in Mon, mag 8.4.

30 Latest sunrise of the year (at Dublin), 08:40 UT.
### Phases of the Moon for 2018

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<th>Date</th>
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<th>Sunset</th>
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<td>17:58</td>
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### Sunrise and Sunset for 2018

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### Nautical Twilight

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The times (UT) in this table are for Dublin. On the west coast add about 12 minutes. North of Dublin, the days are a little longer in summer and shorter in winter and vice versa. The sky is dark enough for most astronomical observing at the end of nautical twilight (when the Sun is 12° below the horizon). The end of civil twilight (when the Sun is 6° below the horizon) occurs about midway between sunset and the end of nautical twilight.
The Planets in 2018

Mercury, the elusive innermost planet, can be seen (given a clear horizon) without too much difficulty if you look at the right date and time.

In March, the planet has its best evening apparition. The graph, below, shows Mercury’s position in the sky relative to the horizon at the end of civil twilight (when the Sun is 6° below the horizon) for this apparition. This occurs at about 35 minutes after sunset at this time of year. In early March, near-by Venus is an excellent guide-post. Best visibility occurs about the 13th March. At that time the magnitude is -0.5. Towards the end of the apparition, Mercury fades rapidly, already to mag +2.1 on March 24th.

The best morning apparition of the year occurs in late August and early September. Best visibility occurs around the 1st September, when the planet’s magnitude will be -0.8. Look 8° up just N of E about 35 minutes before sunrise. Greatest elongation occurs on 26th August.

Venus, does not appear until March. The planet then appears low down in the twilit evening sky. Maximum height (15° at the end of civil twilight) is reached in early May, but by the time of greatest elongation on the 17th August the planet will be already sinking into the bright dusk glow.

To compensate for the mediocre evening apparition, the planet vaults into the morning sky in mid-November. During December it is a glorious morning ‘star’ (mag -4.6), in time for Christmas. In a telescope the gibbous phase is visible.

Mars, as the year starts, is a morning object in Libra. It is then only 4.8” in diameter and mag +1.5. During the spring, the planet steadily approaches the Earth, gaining in apparent size and brightness.

By 27th July, the planet reaches opposition at just 0.39 au from the Earth. It is then a brilliant object of mag -2.8 (surpassing Jupiter) and the diameter will be 24.2” (closest approach to Earth actually occurs on 31st July when the planet is 24.3” across). Although this is the nearest in the current cycle, the planet will be low in the southern sky in Capricornus. We will need a night of steady seeing to make out fine detail on the disc. The planet’s south pole is then tilted 11° towards the Earth. As southern spring advances, the South Polar Cap should be visible. For the rest of the year the red planet continues to linger in the evening sky as it recedes from us.

Jupiter comes to opposition on 9th May. It is then in Libra, well below the equator. Jupiter’s magnitude is then -2.5 and the apparent equatorial diameter is 45”. Solar conjunction occurs on 26th November.

A good quality small telescope should show the dusky belts, the Great Red Spot (GRS) and Jupiter’s four large (known as the Galilean) moons. The intensity of the dark belts varies over months or years and there have been occasions when an entire belt has faded away, as hap-
pened to the South Equatorial Belt in 2010 (see photo on back page). In 2017 both the North and South Equatorial Belts were plainly visible, Favourable transits of the GRS are given in the table on the next column. In recent years the spot has been a pale salmon colour.

On nights of good seeing, a small to moderate telescope may show considerable detail on the disc of Jupiter.

This year the Galilean moons (apart from Callisto) periodically pass in front of and behind Jupiter, but their shadows on the disc of Jupiter itself are actually easier to see. Particularly well placed double shadow transits are given in the Diary. Also the moons fade as they pass into the shadow of the planet.

Saturn comes to opposition on 27th June in Sagittarius. It is then at 22° S declination, the southernmost opposition in the current cycle, allowing only a few brief hours through a lot of atmosphere to view the planet. At opposition the magnitude is 0.0. The apparent (equatorial) diameter of the disc is then 18.4", the smallest in its 29½ year cycle. As Saturn is noticeably flattened, the polar diameter is 2" less.

The northern side of the rings are very wide this year, with the edgewise tilt of 26° around opposition. Most prominent is the ‘B’ ring. Separating this from the outer ‘A’ ring is Cassini’s division. This year, where the inner faint ‘C’ ring crosses the planet, it is difficult to see, as the shadow of the bright rings coincides with it.

Saturn’s largest satellite Titan (mag 8.5) is readily seen in a small telescope. Some of the other main satellites may be seen in a moderate telescope: Rhea (9.9), Tethys (10.4), Iapetus (10.9) and Dione (10.6). The opposition magnitudes are quoted. Enceladus (11.9) and Mimas (13.1) are faint and elusive, even more difficult than their magnitude values would suggest as they are close in under the glare of the planet and its rings. Iapetus is unusual in that it fades to 12th magnitude around eastern elongation. See the Diary for dates of visible western (brighter) elongations when the moon reaches 10th magnitude.

After the summer, Saturn is too low for any effective observation.

Uranus comes to opposition on 24th October (at magnitude 5.7) in Aries. The planet is then 2.7° NE of the mag 4.3 star Omicron Piscium. As the declination is 11° north, might some reader, given dark skies, glimpse it with the naked-eye?

On nights of good seeing, a small telescope will give a view of its small disc, only 3.7" in diameter. See chart on the next page.

Neptune comes to opposition on 7th September at magnitude 7.8. It is then in Aquarius at declination 7° south. It then lies about 2.3° WSW of the 3.7 magnitude star Phi Aquarii.

The tiny disc is 2.4" in diameter. So, for most purposes, it looks just like a star. See chart on the next page for the path of the planet. Binoculars in a dark sky should be all that’s needed.

Pluto appears as a faint stellar object of magnitude 14.4 when it comes to opposition on 12th July. It now lies 22° south of the equator, in the rather dense star fields of Sagittarius. At opposition it is 13° east and a little south of the 5.6 magnitude star 50 Sagittarii. Since perihelion in 1989, the opposition magnitude has declined from 13.8.

Syrtis Major dark feature on Mars

The Syrtis Major on the Central Meridian on Mars at 0 h on the following dates: 3 July, 12 Aug and 20 September.

Jupiter’s Great Red Spot
Transit times in 2018

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 Mar</td>
<td>4:18</td>
<td>24 Mar</td>
<td>3:25</td>
</tr>
<tr>
<td>5 Apr</td>
<td>3:17</td>
<td>10 Apr</td>
<td>2:24</td>
</tr>
<tr>
<td>15 Apr</td>
<td>1:31</td>
<td>22 Apr</td>
<td>2:16</td>
</tr>
<tr>
<td>27 Apr</td>
<td>1:23</td>
<td>2 May</td>
<td>0:30</td>
</tr>
<tr>
<td>6 May</td>
<td>23:37</td>
<td>9 May</td>
<td>1:15</td>
</tr>
<tr>
<td>14 May</td>
<td>0:22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tabulated are GRS transit times, when Jupiter is reasonably high (at least 19°) in the night sky. The Spot is assumed to lie at longitude 278° (Jovian System II), as it was in September 2017. The GRS may drift in longitude as the year goes on. Any update to its position will be posted on the Sky-High web page (see page 27 for the address).
Charts generated using Guide 9.1
Eclipses in 2018

The highlight of the eclipse year is the Total Lunar Eclipse in July.

Total Lunar Eclipse 31st January

A total eclipse of the Moon is visible across the Pacific Ocean and adjoining countries. The total phase lasts from 12:52 to 14:08 UT. From the west coast of US, the Moon sets about the time of the end of the partial phase. From eastern Europe, the Moon rises about the end of the partial phase. The Moon is overhead in the western Pacific Ocean.

Nothing of the event is visible from Ireland.

Partial Solar Eclipse 15th February

A partial eclipse of the Sun is visible across the Southern Ocean, the south of South America and most of Antarctica. Maximum eclipse occurs in Antarctica at 20:51 UT, the magnitude is then 60%.

Nothing of the event is visible from Ireland.

Partial Solar Eclipse 13th July

A partial eclipse of the Sun is visible across the Southern Ocean, the extreme south of Australia and small parts of Antarctica. Maximum eclipse occurs in Antarctica at 03:01 UT, the magnitude is then 34%.

Nothing of the event is visible from Ireland.

Total Lunar Eclipse 27th July

A total lunar eclipse will be in progress as the moon rises (20:21 UT) on the evening of 27th July. When totality ends, it will still be twilight. For the next hour the partial phase will be seen. Times in the table are given in UT (hh:mm). The altitude is for Dublin, the moon will be a little lower in the west of the country.

The diagram, below, shows the passage of the moon through the earth’s shadow. It also shows the meaning of the various eclipse contacts, as given in the table. Over eastern Africa and western Asia all of the eclipse will be seen.

Try some photography. Place the camera on a tripod, focus on infinity and zoom in. Range through different exposures, especially as the moon will be low on the horizon. You can either expose for the umbra or the penumbra.

Partial Solar Eclipse 11th August

A partial eclipse of the Sun is visible across the north Atlantic, northern Europe and parts of central and eastern Asia. Maximum eclipse occurs on the Arctic coast of eastern Siberia at 09:46 UT, the magnitude is then 73%.

Nothing of the event is visible from Ireland.

<table>
<thead>
<tr>
<th>Total Lunar Eclipse</th>
<th>27 July</th>
</tr>
</thead>
<tbody>
<tr>
<td>contact</td>
<td>time</td>
</tr>
<tr>
<td>Mid Eclipse</td>
<td>Greatest</td>
</tr>
<tr>
<td>Total phase Ends</td>
<td>U3</td>
</tr>
<tr>
<td>Partial Phase Ends</td>
<td>U4</td>
</tr>
<tr>
<td>Penumbral Phase Ends</td>
<td>P4</td>
</tr>
</tbody>
</table>

Diagram courtesy of P. Espenshade, NASA.
Comets in 2018

Heinze (2017 T1)

During January this comet is well displayed as it moves rapidly westwards from Lynx to Pegasus. It might be 9th magnitude. On 8th-9th January it lies 1° N of Kappa Cassiopeiae just after midnight. When the comet reaches perihelion on 21st February it will be declining in altitude. Thereafter it fades.

The comet was discovered by Ari Heinze, as part of the ATLAS project in Hawaii, in October 2017. The acronym stands for “Asteroid Terrestrial-impact Last Alert System”.

PanSTARRS (2016 R2)

This long-periodic comet is well displayed, at perhaps 9th mag, as the year opens. It then lies in Taurus 1.8° SE of Gamma Tauri and is moving north. Perihelion is on 9th May, but due to its increasing distance from the Earth it should be only slightly brighter. By June the comet gets lower into the bright summer evenings and fades for the rest of the year. On the evening of 23rd May it lies 1.0° N of 3.8 mag star Zeta Aurigae.

The comet was discovered by the PanSTARRS survey in 2016.

PanSTARRS (2017 S3)

Despite being only on view for a few weeks in July, we may get a reasonable telescopic view of this object. It then passes east from southern Camelopardalis into northern Auriga. In August and beyond, the comet is lost from view. It is possible it might not survive its rather close perihelion passage (0.21 au) on the 15th August.

This comet is yet another discovery by the PanSTARRS survey.

21P/Giacobini-Zinner

There should be a good display of this periodic comet in the autumn sky. Perihelion occurs on 10th September and the comet also swings by the Earth about this time.
Meteor Showers in 2018

The highlights of the year are the Perseids and the Geminids, under moonless skies when highest.

The year opens with an display of the Quadrantids. Unfortunately, the bright gibbous Moon interferes. The radiant is best placed before dawn. Still some bright meteors should be seen, so wrap up well - don't let the (usually) cold weather at this time of year put you off.

The Lyrids, in April, also have favourable (moon-free) conditions after midnight. The radiant is high up in the SE before dawn.

Given clear skies, this should be an excellent year for the Perseids. The Moon poses no interference. Maximum is predicted to occur at 1 h on 12th-13th August. These meteors are bright and fast with a number leaving brief trains.

A few Draconids may be observed on the night of 8th-9th October.

In October the Orionids are a moderately good shower. The radiant lies 4° W of Gamma Geminorum. This year, the full Moon seriously interferes.

The Taurids have a double radiant, peaking on the 5th November (S) and the 12th (N). They are slow meteors. The Moon is favourable for both components.

No outburst is predicted for the famous Leonids this year. Still, after the Moon sets in the early morning hours, a number of these meteors should be observed. The radiant is on the meridian as the morning sky begins to brighten.

The Geminids (maximum on 13th-14th December) are favourable, with the first quarter Moon setting before midnight. They are slow meteors. A meteor watch should be rewarded with a number of bright meteors.

Also in December are the poorly observed Ursids which peak on the 22nd. The Ursid radiant is close to Beta Ursae Minoris (proper name Kochab) and so is circumpolar. This year the full Moon interferes.

Meteor Showers of 2018

<table>
<thead>
<tr>
<th>Shower</th>
<th>Activity Period</th>
<th>Date of Max</th>
<th>Moon’s Age at max</th>
<th>ZHR</th>
<th>Parent Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadrantids</td>
<td>1 – 6 Jan</td>
<td>3 Jan</td>
<td>21h</td>
<td>17</td>
<td>120</td>
</tr>
<tr>
<td>Lyrids</td>
<td>18 – 25 Apr</td>
<td>22 Apr</td>
<td>18h</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>η Aquarids</td>
<td>24 Apr – 20 May</td>
<td>6 May</td>
<td>8h</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>S δ Aquarids</td>
<td>15 Jul – 20 Aug</td>
<td>29 Jul</td>
<td>10h</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Perseids</td>
<td>23 Jul – 20 Aug</td>
<td>13 Aug</td>
<td>1h</td>
<td>2</td>
<td>90</td>
</tr>
<tr>
<td>Draconids</td>
<td>7 – 10 Oct</td>
<td>8 Oct</td>
<td>23h</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Orionids</td>
<td>16 Oct – 30 Oct</td>
<td>21 Oct</td>
<td>17h</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>N Taurids</td>
<td>1 Oct – 25 Nov</td>
<td>12 Nov</td>
<td>17h</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Leonids</td>
<td>15 – 20 Nov</td>
<td>18 Nov</td>
<td>1h</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Geminids</td>
<td>7 – 17 Dec</td>
<td>14 Dec</td>
<td>8h</td>
<td>7</td>
<td>120</td>
</tr>
<tr>
<td>Ursids</td>
<td>17 – 25 Dec</td>
<td>22 Dec</td>
<td>21h</td>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>

The Zenithal Hourly Rate (ZHR) is the theoretical rate seen by an alert observer, in a cloud-free sky, with the radiant at the zenith, in a sky with naked-eye zenith limiting mag of 6.5 (i.e. no moon light, haze or light pollution). It is very rare such conditions are met.
Asteroids in 2018

20 Massalia came to opposition in December 2017, but as the year opens it is still an easy mag 8.8 object. It then lies 14° WNW of the mag 4.9 star 114 Tauri.

7 Iris is also fairly bright (mag 8.5) as the year opens, despite opposition having occurred on 30th October 2017.

8 Flora (mag 8.2) is well displayed in Gemini at the beginning of the year, coming to opposition on 2nd January. See chart below.

1 Ceres is already a mag 7.4 object in western Leo at the start of the year. It peaks at mag 6.9 at opposition on 1st February.

4 Vesta is at opposition on 19th June, in Sagittarius. It reaches mag 5.3. Despite its brightness, binoculars will probably still be needed, due to its southern declination in the bright summer nights.

3 Juno comes to opposition on 17th November. Its high inclination (13°) means it can wander from the Zodiac. Indeed, at opposition this year, it lies 23° S of the ecliptic in Eridanus. At mag 7.4 it should be readily visible in binoculars.

6 Hebe is at opposition on 28th December. The 8.4 mag asteroid then lies ¾° N of Epsilon Monocerotis.

Hebe was discovered in 1847 by Karl L. Hencke in Driesen, Germany (now Drezdenko, Poland).

433 Eros is well on view towards the end of the year, as it loops through Camelopardalis. By New Years Eve, it 1.6° NE of Lambda Persei. Its brightness is then mag 9.1 and it lies 0.22 au from the Earth. It is nearest the Earth in mid-January 2019.

Eros was discovered by Gustav Witt in Berlin in 1898. It was the first Near-Earth Asteroid to be discovered. Its perihelion distance of 1.13 au makes it an Amor type - asteroids that come near the orbit of the Earth but do not actually cross it.
Variable Stars in 2018

Algol

Algol or β Persei is the most famous Eclipsing Binary star. The two components revolve around each other in 2.867 days. The separation is too small to be resolved visually. However, as the orbital plane is very near to our line of sight, eclipses occur. This happens when the large, cool and fainter star in the system partially eclipses the small, hotter and brighter star.

During the primary minimum, the magnitude drops from 2.1 to 3.4. The eclipse lasts 9 h 38 min. From being almost as bright as Mirphak or α Persei (mag 1.8), Algol becomes fainter than δ Persei (mag 2.9) or υ Persei (mag 3.0). The dates and times of well-placed minima of Algol are given in the table below.

<table>
<thead>
<tr>
<th>Star</th>
<th>Date</th>
<th>Mean Magnitude Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ο Cet</td>
<td>14 Jan</td>
<td>3.4-9.3</td>
</tr>
<tr>
<td>R Leo</td>
<td>27 Mar</td>
<td>5.8-10.0</td>
</tr>
<tr>
<td>S Vir</td>
<td>29 Apr</td>
<td>7.0-12.7</td>
</tr>
<tr>
<td>R Vir</td>
<td>16 May</td>
<td>6.9-11.5</td>
</tr>
<tr>
<td>T Cep</td>
<td>11 Jun</td>
<td>6.0-10.3</td>
</tr>
<tr>
<td>R Ser</td>
<td>13 Jun</td>
<td>6.9-13.4</td>
</tr>
<tr>
<td>V Boo</td>
<td>8 Jul</td>
<td>7.0-11.3</td>
</tr>
<tr>
<td>R Cas</td>
<td>14 Jul</td>
<td>7.0-12.6</td>
</tr>
<tr>
<td>R And</td>
<td>25 Jul</td>
<td>6.9-14.3</td>
</tr>
<tr>
<td>R Aql</td>
<td>2 Aug</td>
<td>6.1-11.5</td>
</tr>
<tr>
<td>χ Cyg</td>
<td>14 Dec</td>
<td>5.2-13.4</td>
</tr>
</tbody>
</table>

Khi Cygni reached mag 4.6 in October 2017. At minimum it approaches magnitude 14, so it is then a difficult object, almost lost among the myriads of stars in the dense Milky Way star clouds. When near maximum brightness this autumn, it will be excellently placed in the evening sky.

Of the others, the maximum of R Leonis will be very well displayed in the spring (see article on page 18). R Serpentis and R Aquilae are well on view during the summer months.

LPV Maxima in 2018

<table>
<thead>
<tr>
<th>Star</th>
<th>Date</th>
<th>Mean Magnitude Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>ο Cet</td>
<td>14 Jan</td>
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<tr>
<td>R Leo</td>
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<td>R Cas</td>
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</tr>
<tr>
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<td>25 Jul</td>
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</tr>
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<td>R Aql</td>
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</tr>
<tr>
<td>χ Cyg</td>
<td>14 Dec</td>
<td>5.2-13.4</td>
</tr>
</tbody>
</table>

The Date of Max. is the predicted date of maximum based on AAVSO data as of October 2017. The actual date of maximum of any particular cycle may be a little earlier or later than predicted.

The Mean Magnitude Range gives the brightness range using the average maxima and minima values calculated over many individual cycles.

These predictions are kindly computed and provided by Elizabeth Waagen of the AAVSO.

Long Period Variables (LPVs)

LPVs are pulsating Red Giant stars. Their variation in brightness is caused by their changing size and temperature. They are fun to observe because of their extreme brightness variation and their redness. The table (at right) gives predicted dates of maxima for the brighter LPVs that are well displayed this year.

The brightest LPV, Omicron Ceti (proper name Mira) is still in the evening sky in January when at its predicted maximum. In February 2017 it reached magnitude 3.5 at maximum.

Novae and Supernovae in 2017

The brightest nova of the year occurred in Scutum in June 2017. It reached mag 8.5. It was discovered (at 9th magnitude) by the ASAS automated survey and given a provisional designation ASASSN-17hx.

As of late 2017, the brightest supernova that occurred during 2017 was SN 2017cbv. It reached magnitude 11.5. The host galaxy was NGC 5643 in Lupus.
Leslie Peltier: Variables, Comets and Starlight Nights
by John O’Neill

On our road trip out west last year to see the total eclipse of the Sun, we diverted to a town in north-western Ohio. Delphos is like many small towns in the mid-west of the USA in the middle of flat farm country. In the grounds of the library, there is a monument (image below) to an amateur astronomer! It is to Leslie Peltier, who was born and lived all his life on his farm and in Delphos itself.

Peltier had a wide range of astronomical and non-astronomical interests such as geology and botany.

Variables

“A variable star was a completely new experience; it was not just THERE, it was something that was HAPPENING!”

One hundred years ago (1917-18), there was a record breaking cold winter. Leslie had applied to join the AAVSO. One evening, he trudged into town to collect his package of variable star charts at the post office. When a clear night arrived he set up his 2 inch telescope and searched for his variables. Two hours later, he returned indoors, half frozen. He had failed to find a single one! He could not match the field of view of his telescope to the those of his charts. He later devised a simple solution; make a wire ring to cover the same area on the chart as the telescopic field.

At last Leslie made his first variable star estimate on 1st March 1918. His target was the famous Long Period Variable R Leonis. An extract of his first report (to the AAVSO) is shown at the top of the page. R Leonis has a mean period of 310 days and it varies from magnitude 4.4 to 11.3.

Throughout his career Peltier amassed over 132,000 variable star estimates. The star he observed most was the cataclysmic variable SS Cygni, with 6712 observations. Other stars he liked to observe were R CrB (the “nova in reverse”), T CrB (the old nova of 1866 - despite missing the 1946 outburst), Z Cam (has standstills), Gamma Cas (naked-eye which flared up in 1937), V Sge (peculiar cataclysmic) and DQ Her (the bright nova of 1934).

“I feel it my duty to warn any others ... that they approach the observing of variable stars with the utmost caution. It is easy to become an addict ...“

Comets

Leslie’s small 2 inch spyglass had its limitations. At the end of 1918, he upgraded to a 4 inch refractor. He could now follow any potential comet. But how do we know where in the sky these moving objects are located? Long before the internet and modern communications, Popular Astronomy came to the rescue. In December 1918 he pointed his telescope to a position to the north of the twins, Castor and Pollux. (A little detective works reveals this must have been Comet 19P/Borrelly). A small blob was visible there. He was delighted to...
follow his first observed comet, tracking the eerie glow for many nights.

In 1922 Peltier received a 6 inch (15 cm) f/8 refractor (the Comet Seeker) from Princeton. Now he could pursue more seriously his passion for comet observing and even comet hunting (i.e. discovery). An observatory was soon added to the his cow pasture.

In those early days the skies at the farm, and even in town, were mostly wonderfully free of light pollution. From there he estimated many variable stars and also followed known comets.

Before midnight on Friday 13th, November 1925 Peltier found a fuzzy speck that was out of place, a new comet at last! He was credited as a co-discovered of Comet Wilk-Peltier. He would go onto to discover or co-discover 12 comets in all (from 1925 to 1954). By 1960s, bright lights started emanating from the rural farms, even outshining the town’s glow. Comet hunting was getting more difficult.

Since Peltier’s days, things have changed even more. From about the start of the present century, the vast majority of comets are swept up by automatic surveys.

Starlight Nights

In the mid 1960s Leslie published his autobiography Starlight Nights. I find it perhaps the most inspirational book about astronomy. It answers the question of not how to do astronomy, but why we do astronomy.

“There is a chill in the Autumn air ... Already, in the gathering dusk, a few of the stars are turning on their lights. Vega, the brightest one, now is dropping toward the west. Can it be half a year has gone since I watched her April rising in the east? Low down in the southwest Antares blinks a red-eyed sad farewell to fall while just above the horizon in the far northeast Capella sends flickering beacon flashes ... Instinctively I turn and look back toward the southeast for Capella’s co-riser. Yes, there it is, Fomalhaut, the Autumn Star, aloof from all the others, ...”

Today amateur astronomers have an undreamt of range of resources and equipment to choose from. There is a plethora of CCD and CMOS cameras, types of telescopes, all kinds of accessories and a large range of astronomy software. Some amateurs have even built robotic observatories.

Yet, have we lost something? We spend hours processing images and tinkering with equipment. Few city dwellers have seen the glorious arc of the Milky Way. Many amateur astronomers have no more than a superficial knowledge of the night sky.

In a quiet moment at night, sometimes I put aside the GOTO hand control or shut off the CCD camera. I raise the binoculars to the Pleiades or the Sword of Orion. Memories come flooding back: as a child in the 1960s, I spotted the autumn twinkling of steely Vega; in the early winter, bold Orion the hunter marching above the fields south of Dundrum, Co Dublin.

Today the fields are long gone to the march of apartment developments.

As Leslie Peltier peered through his dome:

“Even as I watch, the dome above me fades away and now its opened shutter is a darkened kitchen window through which I gaze in childish wonder at seven little stars in a long gone autumn sky.”

Leslie died in May 1980 aged 80 years.

(Quotes in italics are taken from Starlight Nights, published by Sky Publishing in 1999. The images and Leslie’s AAVSO report are from the AAVSO archives.)
When the Irish Astronomical Society celebrated its 80th anniversary in 2017 it gave an impetus to us longer-standing members to think about our development as amateur astronomers. First and foremost I am an observer although I have been doing less observing in recent years primarily due to the increasing scourge of light pollution in Dublin where I live. You can just look at the sky with awe, but observing is more than that. Information about where to look and what you are looking at is essential and until recently most of that information came in the form of the printed word, including books. I do not sell, throw out or give away astronomy books: I am an astronomy book hoarder. At this stage I own about a hundred astronomy books and have read many more. But some of them have had a bigger effect on me, particularly the ones I read in the early days. I am sure this is the case for many people. So here I will look back at my gestation as an observational amateur astronomer using my assortment of astronomy books.

The oldest astronomy book in my collection is *Star and Planet Spotting* by Peter Lancaster Browne. It is also the first astronomy book I ever bought and is the one I used to learn my way around the sky. Having found it first in my local library, I realised I could not renew the loan indefinitely and eventually bought a copy. Patrick Moore describes learning the constellations at the age of 6 and avidly waiting for new constellations to appear in the eastern evening sky as the year progressed. I repeated the same experience with this book but not at quite such an early age, starting with the winter constellations and ending with the autumn ones. The annotations I made in the planet section are dated 1984 which is presumably the year in which I bought it.

After some time and a few visits to the bookshop I realised that the maps and text in Lancaster Browne were inadequate and I picked up a copy of the 1984 edition of *Collins Guide to the Stars and Planets* by Ian Ridpath and Wil Tirion. This is by far my most battered and dog-eared book. I have not replaced it with a more modern edition (and it is now in its 5th edition). It has travelled with me to star parties up and down the country and trips abroad. The easy to use format has a double-page spread with a constellation map on one page with stars down to 5th magnitude and an annotated list of interesting objects on the opposite page. I also had the privilege of meeting Wil Tirion at the Whirlpool Star Party in 2005 and he signed the book for me.

However, I craved for fainter stars, which is why I then bought *Norton's Star Atlas 2000.0 18th edition*. This had stars down to 6th magnitude. I had yet to acquire a telescope and was observing with the naked eye and binoculars. Over the years I marked the paths of comets on it: Swift-Tuttle, Kopff, Hyakutake and Hale-Bopp. The charts were on a two page spread but a design fault meant that some objects were buried in the fold between the pages. The paper was not too robust either for observing on damp Irish nights. It has since gone through two more editions with the 20th appearing in 2003.

The oldest astronomy book in my collection is *Star and Planet Spotting* by Peter Lancaster Browne. It is also the first astronomy book I ever bought and is the one I used to learn my way around the sky. Having found it first in my local library, I realised I could not renew the loan indefinitely and eventually bought a copy. Patrick Moore describes learning the constellations at the age of 6 and avidly waiting for new constellations to appear in the eastern evening sky as the year progressed. I repeated the same experience with this book but not at quite such an early age, starting with the winter constellations and ending with the autumn ones. The annotations I made in the planet section are dated 1984 which is presumably the year in which I bought it.

After some time and a few visits to the bookshop I realised that the maps and text in Lancaster Browne were inadequate and I picked up a copy of the 1984 edition of *Collins Guide to the Stars and Planets* by Ian Ridpath and Wil Tirion. This is by far my most battered and dog-eared book. I have not replaced it with a more modern edition (and it is now in its 5th edition). It has travelled with me to star parties up and down the country and trips abroad. The easy to use format has a double-page spread with a constellation map on one page with stars down to 5th magnitude and an annotated list of interesting objects on the opposite page. I also had the privilege of meeting Wil Tirion at the Whirlpool Star Party in 2005 and he signed the book for me.

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Norton’s Star Atlas was titled *Norton’s 2000.0* in its 18th edition.
A trip to the European Astrofest in London in 1994 ended with me struggling home with *Sky Atlas 2000.0 Deluxe edition* by Wil Tirion which is still my star atlas of choice while out observing at the telescope over 20 years later. Its large format charts are a bit unwieldy to use but the paper is robust and has survived unscathed. The beauty of a printed atlas as opposed to a computer chart or app is two-fold at least: you can see the larger picture at a glance and there is no danger of losing your dark adaption should you fail to use the red-light mode.

Back in the early 1990s I was a member of the Lunar Observers Group of the Irish Astronomical Society. The guide of choice was *Observing the Moon Through Binoculars and Small Telescopes* by Ernest H. Cherrington and we met monthly in the Phoenix Park, Dublin. This was a reprint of a book originally published at the time of the Apollo lunar programme. Cherrington describes the features of the Moon through one lunation from day 1 until day 29/30. I found I did most of my observing between day 5 and day 12. Cherrington provides a gentle lesson in observing as he guides you from one feature to another. The main illustrations consist of a double spread of full disc photographs taken with the Lick 36 inch (91 cm) telescope, with one of them being annotated with the names of the craters and mountains.

The photographs in Cherrington were sufficient for me to find the features but then someone brought their copy of Rukl’s *Atlas of the Moon* along to the meeting. I was blown away by the illustrations. However the price tag of £19.99 (€25.38) was a little steep for me at the time. I thought about it for several months before taking the plunge and never regretted it. To me the illustrations have the magical quality of really resembling the lunar surface when seen outside in the dark illuminated by torchlight, but less so in daylight. After a few years it went out of print and copies went on sale for several hundred dollars before a second edition appeared. I was never tempted to sell and still use it as my main lunar atlas.

It was now time to buy a telescope. In 2018 we can all look up telescope reviews on the World Wide Web and even order equipment online. Clearly this was not the case in 1996. There were lots of advertisements in the astronomy magazines and fellow astronomers could give advice. But it would help a complete novice if they could get this information in a compact package. This is where *Star Ware* by Philip Harrington came to the rescue. I could peruse it at leisure and eventually bought my 20 cm Meade Dobsonian telescope mostly on the basis of information I got from that book. The book went through several editions with the most recent (4th) being published in 2007. The nature of the topic means that much of the content dates quickly and we are unlikely to see another edition.

Each of us probably has a similar story to tell, though in the 21st century information is more likely to be accessed online than through the printed word. However, if you don’t want to go the expense of buying all your books, public libraries can come to your aid, as they did to mine back in the 1980s. You can always purchase a book later if you feel you cannot do without it. Ireland now has a national library service which means that members of a public library can request books from any public library in the country. So you have a huge stock at your disposal. In addition all the libraries subscribe to an e-magazine service which currently provides *Astronomy*, *Sky at Night* and *New Scientist* among others.
When Planets Disappear
by James O’Connor

The watching of lunar occultations differs quite a bit from the other activities of the amateur astronomer; indeed it could be said to be almost the opposite of the norm. Normal activities lie in the areas of finding and observing celestial objects. But, where occultations are concerned, the experience we are seeking is that of a disappearance. Just a disappearance! Nor do we experience any of the dramatic changes in our surroundings that contribute to making total eclipses of the sun (which, strictly speaking, are occultations of the sun) such magnificent spectacles.

The attraction of watching occultations, especially those of prominent objects, would seem to lie mainly in two areas outside the general attraction of astronomical observing. There is, firstly, the fact that, unlike most astronomical events, they involve immediately observable rapid action. The second attraction lies in their rarity. On paper, it would seem possible, from a given location, to see an average of one occultation of a bright planet or first magnitude star about once a year. But, in Ireland, at least, one will not achieve any such score. Our heavily clouded skies see to that!

Objects within 6¼° of the ecliptic, and only such, are liable to occultation by the moon. This is because the plane of the moon's orbit about the Earth is tilted at an angle of 6¼° to the plane of the Earth's orbit about the Sun - the ecliptic. The five bright planets - Mercury, Venus, Mars, Jupiter and Saturn are usually within these limits but it is in the nature of a lottery as to whether their paths in the sky will happen to intersect at some point with that of the moon in our satellite's monthly journey and so give rise to an occultation.

I observed my first planetary occultation in the year 1961. Since that time, I have watched out for predictions of such events and done my best to observe them. Most of my attempts were defeated by the weather, but, out of twenty seven possibilities, I succeeded seven times. The successes involved Venus three times, Mars and Jupiter once each and Saturn twice. In reckoning the twenty seven possibilities, I have not included three events involving Mercury. They would have been very difficult to observe since they occurred in daylight with the planet 23° or less from the sun and lower in the sky than the sun. As it turned out, I was abroad on the occasion of one of these Mercury events; the other two were clouded out.

VENUS, 1961 October 7: Disappearance was scheduled to take place at 6h 25.6m, about 12 minutes before sunrise and with the participants about 20° up in the south-eastern sky. Venus, 90% illuminated and presenting a disc 11.6" in diameter, was predicted to disappear near the mid-point of the bright limb of the 27.2-day old waning crescent moon. The juxtaposition of the crescent moon and brilliant Venus presented a remarkable and beautiful spectacle. There was intermittent fog but the sky was clear at the critical moment. Precise timing was impossible due to bad seeing but the event seems to have occurred precisely on schedule. I estimated the interval between first and second contacts at 22 seconds. I did not attempt to observe reappearance; I don't know why and my notes are silent in the matter.

SATURN, 1974 March 2/3: I observed this event under ideal conditions. The planet shone at magnitude zero and had the southern face of its rings tilted towards Earth at an angle of 27°, which is close to the maximum. Oddly enough, it was located in Orion - paying a short retrograding visit there. Seeing conditions were excellent and I could see the black line of Cassini’s Division right around the planet except where it was blocked by the globe of Saturn. Ring C, the Crepe Ring, was visible, as was detail in the Equatorial Belts. Disappearance was scheduled to take place at 23h 42.5m at the dark limb of a 10.5-day old moon.

The event began with the cutting of the tip of the western ansa and one minute later the
The entire planet had disappeared. I could clearly see the silhouette of irregularities in the profile of the lunar limb as it passed in front of Saturn. Reappearance at *circa* 0h 40m was equally dramatic. I first saw the delicate outline of the reappearing western ansa at the lunar limb close to Mare Crisium. One was not conscious of the great differences in distance of the two objects and so Saturn with its slender-looking rings looked fragile and tiny in juxtaposition to the seemingly enormous bulk of the moon. Its surface brightness stood up well against that of the moon, despite the fact that it receives per unit area only about \( \frac{1}{100} \)th of that received by the moon.

**VENUS, 1980 January 20:** This event took place in daylight with the participants about 25° up in the SSE sky. Disappearance at the dark limb of the 3-day old moon was due to take place at 11h 30.9m and reappearance at the bright limb at 12h 45.2m. The disc of Venus was 13” in diameter and 80% illuminated. The disappearance was obscured by cloud but I succeeded in observing the reappearance. I timed 3rd contact for 12h 45m 2s and 4th contact for 12h 45m 20s.

**VENUS, 1980 October 5:** This is the one that got away. Scheduled to occur in the small hours of the morning, it promised to be a splendid and almost unique event: occultations of two bright objects within a couple of hours of each other. The opener was to be an occultation of the first magnitude star Regulus at 3h 27m and the *pièce de resistance* a near-grazing occultation of Venus at 5h 20m. The graze-track for the Venus occultation, about 37 km wide, ran roughly from the Shannon estuary to Cahore Point. South of this track no occultation took place. When I rose at about 3h, I found (as I thought) the morning perfect for the purpose. The sky was absolutely clear and the two candidates for occultation shone brightly with the waning crescent moon in the eastern sky. I regarded success as “in the bag”. But it was not to be. Fog formed as if on cue and the brilliant scene was obliterated with incredible swiftness. I waited but the fog did not relent. I later realised that I could in all probability have retrieved the situation by taking my equipment up the nearby Dublin mountains. I used thisploy successfully on a later occasion but it wasn’t as big an event as that of 1980.

**MARS, 1999 December 12:** This event took place (with the planet in the constellation Capricornus) at an altitude of only 8° in the south-western evening sky. It was scheduled for 19h 10.8m. Mars was distant from Earth and had an angular diameter of only 5 seconds of arc. It shone at magnitude +1. Disappearance was at the earthlit dark limb of a 5-day old moon. The sky had been cloudy all day but cleared at the approach of evening. Mars remained readily visible to the naked eye right up to the time of disappearance. In the last moments before disappearance there was, in the naked eye view, the illusion that the planet was *inside* the lunar limb as indicated by the earthshine. The process of disappearance took about 15 seconds and occurred at just about the scheduled time. The disappearance of the last sliver of the planet was a memorable moment. Midway through the disappearance process I took my eye away from the telescope eyepiece and surveyed the scene momentarily with the naked eye. Mars was still easily visible. So this is the only occultation that I have observed both with the naked eye and telescopically!

**JUPITER and three satellites, 2002 January 26:** Disappearance was scheduled to take place at 17h 50m behind the dark limb of a 13-day old gibbous moon. The event took place in Gemini, less than one month after the Jupiter opposition. It was close to being a graze and so the lunar limb approached and left the planet at quite an oblique angle, so greatly lengthening the time taken for both the disappearance and reappearance processes. The sky was largely clear until 45 minutes before disappearance with Jupiter clearly visible as the moon drew steadily closer to it. However, conditions deteriorated thereafter and the participants were hidden by cloud for most of the time.

The beginnings of the disappearance were lost but I got a sighting at about 17h 50m when about half the planet had disappeared. I got intermittent glimpses thereafter and found irregularities of the lunar limb clearly visible in silhouette. Finally, at about 17h 52m, the
last fragment of Jupiter — the south polar regions — went out of sight.

An occultation of Jupiter’s largest satellite, Ganymede, due to take place at 17h 53m, was obscured by cloud but I observed the disappearance of Io (scheduled for 17h 56m). Europa was scheduled to disappear at 17h 59.8m but it coasted along, seemingly interminably, past various high points on the lunar terminator until it finally merged into the limb with one of them at 18h 04m. The fourth satellite, Callisto, was not occulted.

Conditions improved as the time for reappearance, scheduled for 18h 08.5m, approached. The planet was partly out when I first spotted it at 18h 10m. It appeared a pale blue in contrast to the yellowish moon and appreciably fainter. It was not immediately visible to the naked eye but soon became so.

SATURN, 2007 May 22: This event took place in daylight, about 10° west of Regulus in Leo, with disappearance behind the dark limb of a 6-day old moon. The southern face of Saturn’s rings was tilted 15° toward Earth, I found it easier to see the planet in the daytime sky than I had expected. Disappearance was scheduled for 19h 22m but a wisp of cirrus intervened at the wrong moment. I could see the planet one minute before that time but the intervention of the cloud blotted it from view. Reappearance at the bright limb (scheduled for 20h 7.9m) was not troubled by cloud. As in 1974, the gradual appearance of the frail-looking ringed planet from behind the moon was very interesting to watch. I timed the moment when it was entirely clear of the moon as 20h 8m 50s.

VENUS, 2008 December 1: This event was enhanced as a spectacle by the presence of Jupiter, shining brightly just 2° above the participants. Venus presented a disc 16.5” in angular diameter and 69% illuminated. Disappearance was scheduled to take place at 15h 37m behind the dark limb of a 4-day old crescent moon, with the participants 13° above the southern horizon and the sun still 3° up. I had a fully satisfactory view of the disappearance, which occurred just about on schedule. About 45 seconds elapsed between first and second contacts. Things did not work out so well for the reappearance at the moon’s bright limb. This was to occur at 17h 50m with the participants 9° above the horizon and the sun 8° below. Unfortunately, a cloud parked itself in the wrong place and the third and fourth contacts were missed. About five minutes after the scheduled time of reappearance, the cloud finally moved on and I could see the bright point of Venus adjacent to the bright moon. This was to occur at 17h 50m with the participants 9° above the horizon and the sun 8° below. Unfortunately, a cloud parked itself in the wrong place and the third and fourth contacts were missed. About five minutes after the scheduled time of reappearance, the cloud finally moved on and I could see the bright point of Venus adjacent to the lunar limb. The view a little later was strikingly beautiful. The bright crescent moon “with the old moon in its arms” continued in sight, though slipping ever lower, while brilliant Venus continued to move away from its bright western limb; bright Jupiter continued to preside over the scene.

So that’s it! Just seven successes over a period of some 50 years! To be sure, there will be some who will say that observing such events is pointless effort - that they represent merely chance simultaneous alignments of the Earth and Moon with some planetary body. However, I can say that, despite the disappointments, I thoroughly enjoyed the experiences and I hope that my descriptions of what I saw will encourage the reader to avail of any future similar opportunities. They will be as rare in the future as they were in the past but, as they say, “what’s rare is wonderful”.

By J.O’Neill.
The Present becomes the Past
by Liam Smyth

I recently moved house. The new smaller abode serves very well for most purposes including lower maintenance costs and convenience of location. However the smaller garden did not allow transferring my rotating dome observatory with its pier mounted Losmandy G 11 mount carrying a 18 cm Maksutov. Accordingly I have to set up my telescope anew most observing nights and hope for comfortable calm conditions for observing. I find all this rather irksome having become so accustomed to strolling out, opening the dome, pressing the GOTO button and getting under way for either visual or imaging. One might feel hard done by.

I remember a visit to Markree Castle in Co Sligo many years ago to see the remains of Cooper’s observatory which housed one of the biggest refractors in existence in the nineteenth century (actually for a period in the 1830s it was the biggest). It had an aperture of thirteen inches (33 cm). I was taken aback to see how the great telescope had been mounted in a brick lined pit without a dome or roof. I was told that the telescope was simply covered with tarpaulins when not in use. This refractor was used to make a detailed catalogue of stars close to the ecliptic. This must have been exacting work when one considers that lighting of micrometers and notebooks was probably dependant on oil lamps. I think the astronomers of Markree would have little sympathy for me with no dome but with an electrically driven equatorial with GOTO functions and fully controllable lighting and electronic data read-outs. The modern 18 cm Maksutov might not be too far behind the early 33 cm either.

With that achromatic refractor, Cooper and his co-workers probably considered themselves very well and comfortably equipped when they considered how their not too distant predecessors had to cope. As achromatic lenses had not yet been available they had to use simple small lenses in very long telescopes to achieve any sort of decent image. Here “long” really means “long”. For example James Bradley used a telescope of 65 m focal length to observe Venus. Just think 65 m. To run from one end of this telescope to the other an Olympic sprinter would be all out to do it in six full seconds.

These telescopes became utterly unwieldy. As long tubes, even of a skeletal type, suffered from flexure and wind vibration they were ultimately dispensed with. Objective and eyepiece were mounted separately, pointing and collimating being maintained by various arrangements of wires and strings. The effort was too great and the scientific results were of relatively low value. Reflectors of the day, despite their deficiencies gained in popularity and this tendency continued until the invention of the achromatic refractor.

All things considered modern amateurs are very well catered for when it comes to equipment. One does not have to be a wealthy landowner like Cooper to afford to engage in astronomical pursuits even up to research levels. And it might be possible to do it all without even leaving a warm sitting room on a cold night. We all know this but many of us are masochists at heart.
China’s Chang’e 4 is scheduled to launch late in the year. Its mission is to perform the first soft landing on the Moon’s far side. It will also deploy a rover. Communication will be maintained with a relay satellite in the L₂ Earth-Moon Lagrangian Point.

Due to problems with the Long March 5 rocket Chang’e 5, sample return lunar mission, has been delayed until 2019.

India’s Chandrayaan 2 is due to be the country’s first lunar soft-landing.

ESA’s long delayed Mercury orbiter BepiColombo is scheduled to be launched in October. Although not due to enter orbit around Mercury until 2025, the probe will have a number of Venus and Mercury fly-bys enroute starting in 2020.

NASA’s InSight probe is scheduled to be launched in May. Its mission is to land on Mars in November and investigate the planet’s seismology and heat flow.

ExoMars Trace Gas Orbiter (ESA and Roscosmos) is due to finish its aerobraking maneuvers in April and then commence its science mission from Mars orbit.

The OSIRIS-REx probe will rendezvous with asteroid 101955 Bappu in August. Soil samples from the asteroid are planned to be returned to Earth in 2023.

Due to technical problems, NASA has left the Juno probe in an elliptical 53 day orbit around Jupiter - rather than its planned close-in orbit. However, good science can still be done when the probe passes through perijove. Its mission may be extended beyond the planned mission end in July.

In late December NASA’s New Horizons will begin detailed imaging of the Edgeworth-Kuiper belt object 2014 MU₆₉. Ground observations in the summer of 2017 suggest this body has a moon. Closest approach occurs on 1st January 2019.

The TESS observatory’s launch has slipped to March. It will survey bright stars for exoplanet transits.

Another exoplanet mission is ESA’s Cheops. Launch is due at the end of the year. It carries a 30 cm telescope that will be used to study known exoplanets by the transit method. This method uses the minute dimming of light from the parent star as the planet transits (or blocks) the surface.

NASA’s Parker Solar Probe will swoop within 6 million km of the Solar Photosphere. Launch is planned for July.

ESA’s astrometry observatory Gaia continues its survey of the positions, parallaxes and proper motions of stars. In April, Data Release 2 (DR 2) is due for publication. With this, improved astrometry and also photometry should be available.

The Gaia satellite was launched in late 2013 and took up position at the L₂ Lagrangian Point. This is the “balance” point on the far side of the Earth in the Sun-Earth system.

Russia’s long delayed Spektr-RG is scheduled to be launched in the spring. Its mission is to study the sky in far ultra-violet and x-rays. It is a collaborative effort with Germany.
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Please note that IAS members get a free printed copy posted to them.

Note: In early 2018, Sky-High Resources will largely move to the IAS website under “Sky-High”. It will include specific links and also links to newly discovered phenomena.

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- A History
by James O’Connor

207 pages with illustrations and appendices. Priced at €10.

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Useful Websites used & Resources

Sky-High (includes updates):
  http://www.irishastrosoc.org/skyhigh/skyhigh.htm

IAS (with details of meetings and events):
  http://www.irishastrosoc.org

British Astronomical Association (publisher of BAA Handbook):
  http://britastro.org

DIAS (with details of public nights at Dunsink Obs.):
  http://www.dias.ie


IFAS Forum:  http://www.irishastronomy.org

RASC (publisher of RASC Observer’s Handbook):
  http://rasc.ca

Variable Star Nights (J. O’Neill’s website):
  http://www.variablestarstorms.net

Variable Stars

AAVSO:  https://www.aavso.org

AAVSO Variable Star Plotter (for Finder Charts):
  https://www.aavso.org/vsp

BAA V.S.S.:  http://www.britastro.org/vss

Comets

BAA/SPA Comet Visual Section:
  http://www.ast.cam.ac.uk/~jds/

Meteors

IMO:  http://www.imo.net/

Eclipses

NASA Eclipse site (F. Espenak):
  http://eclipse.gsfc.nasa.gov/eclipse.html

Irish Star Parties

Cosmos:
  http://www.tullamoreastronomy.com/

Galway Astronomy Festival:
  http://galwayastronomyclub.ie/

Mayo Dark Sky Festival:
  https://mayodarkskyfestival.ie/

Skellig:
  http://www.skelligstarparty.com

Sky-High 2017 Erratum

Page 21 - Under Daramona House both telescopes were reflectors not refractors.
Front Cover: IC 1396 in Cepheus, nicknamed the Elephant’s Trunk. 7th Dec 2016. 100 mm refractor. Starlight Xpress SX H16 CCD camera. Filters: Hα, O III, S II. Total exposure 16 hours (John Dolan).

1: Jupiter. 11th October 2010. The SEB disappeared that year, reappearing in November. Io and Europa are also shown. DBK 21AU04.AS camera used (John Dolan).


3: Total Solar Eclipse from Wyoming, USA. 21st Aug 2017. 70 mm refractor. Canon 500D DSLR. Stack of five images from 1/1000 to 1/10 s (John O’Neill).