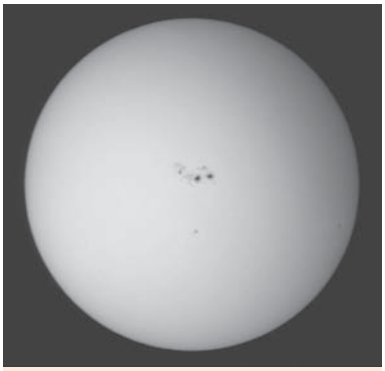
Sky notes

2004 December & 2005 January

by Neil Bone

Sun, Moon and Earth

The winter solstice occurs at 12h 42m Universal Time (UT, equivalent to GMT) on December 21, when the Sun reaches the farthest southerly declination on its annual apparent path against the 'fixed' star background (the ecliptic). For observers at the latitudes of the British Isles, the hours of daylight are at a minimum, and December and January bring long, dark nights for observing, weather permitting.



Sunspots on 2004 July 23, photographed by Martin Mobberley.

The Sun's low arc across the southern sky gives northern hemisphere solar observers a more difficult time in the coming weeks – not only is the viewing 'window' limited to a few hours either side of mid-day, the Sun may also be obscured behind local horizon obstructions. As ever, the safest way to observe the Sun is by projecting its image onto a shaded card.

Although sunspot cycle 23 is now winding down towards minimum – expected a couple of years hence – a fair amount of activity has remained evident throughout 2004. Typically, there have been as many as three spot groups present on the visible disk on most days. Some substantial, complex groups have been seen in the last 12 months (most recently in July), but most of the activity in the remaining part of the cycle will probably comprise simple, single spots.

The Moon is New on December 12 and January 10, meaning that evening skies will be darkest in the middle fortnight of the month in this interval. Full Moon falls on December 26 and January 25. Occupying a position a little north of that taken by the Sun at June's summer solstice, December's Christmas Full Moon will shine down strongly from among the stars of Gemini, swamping all but the brighter naked eye stars.

Earth reaches perihelion, the closest to the Sun in its elliptical orbit, on January 2. The difference between perihelion (147 million kilometres) and aphelion (152 million km) distance has little influence on the weather: seasonal effects due to differences in solar radiation received, as determined by Earth's axial tilt, are far more significant.

The planets

Mercury is at inferior conjunction between the Earth and Sun on December 10, then emerges into the morning sky towards the end of the year, rising nearly 90 minutes ahead of sunrise at Christmas. At this time, Mercury will be reasonably prominent, close to magnitude 0 in the predawn. Greatest elongation, 22° west of the Sun, is reached on December 29, and careful observers should be able to follow the planet into the first week or so of the New Year before it retreats back into the near-solar glare.

Venus remains a reasonably prominent 'morning star', rising 90 minutes before the Sun in December, and no doubt refuelling the perennial 'Star of Bethlehem' debate at this time. At magnitude –4, Venus is easy to pick out in the gathering dawn. On the morning of December 28 Venus is close to Mercury – a good guide for anyone struggling to find the rather fainter innermost planet – and the two remain fairly close in line of sight for several days to either side of this conjunction. During January, Venus closes quickly on the Sun, and it is unlikely to be seen after the month's second week. Indeed, Venus won't again be readily visible until late autumn, spending much of the middle parts of 2005 languishing low in the evening twilight.

Mars has re-emerged into the morning sky, but as usual the apparition is off to a very slow start, and the planet is a rather undistinguished second-magnitude red 'spark', rising a couple of hours before sunrise throughout this interval. In mid-January, Mars passes north of Antares, its nominal 'rival'. Antares wins out on this occasion, being half a magnitude brighter than the planet.

Jupiter becomes better placed, among the stars of Virgo and rising at 01h UT at the end of 2004. By mid-January, the giant planet rises at midnight, and is well presented for telescopic viewing during the early morning hours. The mag –2, 35 arcsecond diameter slightly flattened disk shows plenty of detail in medium aperture (100–150mm) telescopes, which will reveal dark belts and light zones, together with spots, festoons and other features. The four bright Galilean satellites can be seen in a continuously-changing pattern strung out in the planet's equatorial plane; steadily-held 10×50 binoculars are sufficient to reveal them.

Best-presented of all the planets in this interval is Saturn, reaching opposition (180° from the Sun in Earth's sky) on January 13. At this time, Saturn will be visible all night, culminating high in the south against the stars of Gemini (just southwest of Castor and Pollux) at midnight. The rings remain close to their maximum opening towards us, and can be made out with instruments as small as 50–60mm aperture – Saturn will surely be the 'first light' object for many Christmas telescopes in the closing week of 2004! Detail on the globe of Saturn is rather subtler than that on Jupiter, but again consists of dark belts and lighter zones.

During January, Saturn's largest satellite Titan will, of course, be the focus of much worldwide attention, as the *Huygens* probe finally makes its descent to the surface. Amateur observers can see this soon-to-be-visited miniature world quite easily in a small telescope. Reasonably bright at mag +8, Titan is visible east of Saturn by about four ring-spans around December 11 and 27, and January 12 and 28, and due west about eight days later.

Minor planets

Binocular users seeking an interesting challenge in January may like to attempt to follow asteroids (8) Flora and (532) Herculina, which come to opposition in mid-month. Flora is the easier target, at mag +8.5 among the stars of Gemini not far from Saturn's current location. As a general rule, higher-numbered asteroids tend to be fainter and more difficult to find in a small instrument. Herculina's current apparition should see it just brighter than magnitude +9, accessible in a pair of 10×50s. Herculina can be found near the Gemini/Cancer border in mid-January.

Comets

The New Year brings the exciting prospect of another naked-eye comet, conveniently-placed in evening skies. Discovered in August 2004, Comet C/2004Q2 Machholz could be as bright as third magnitude as it moves northwards past the Pleiades towards Perseus and Andromeda in mid-January. At worst, it should certainly be a bright binocular object.

Meteors

Moonless mid-December skies favour the peak activity of the Geminids, currently the most prolific of the regular annual showers. Peak rates are expected in late afternoon on December 13, and activity should be strong on the evening of Dec 13–14. As outlined on page 309, we can anticipate a healthy crop of bright events, and given clear skies the Geminids could more than make up for the loss of August's Perseids from the UK due to wet weather.

At maximum on December 22–23, the Ursids are rather badly affected by strong moonlight. Determined observers can squeeze in a couple of hours' watch time between moonset and dawn. Activity is usually fairly low – typical observed rates of 4 to 5 meteors/hr – but outbursts have been seen, most recently in 1982 and 1986. The Ursid radiant lies near the 'Guardians of the Pole' in Ursa Minor, and is high in the north-eastern sky in the early hours. Ursids can be seen between December 17 and 25.

The Quadrantids peak during morning daylight for UK-based observers on January 3. Around dawn on Jan 2–3, activity should be climbing, but the shower unfortunately has to contend with a broad, bright waning crescent Moon. A patient observer may still see 20–30 meteors/hr from this very active but short-lived shower. The radiant is in northern Boötes, like that of the Ursids highest in the later part of the night. Some activity will still be evident on the evening of Jan 3–4, but at very much reduced levels, further pegged back by the radiant's low altitude in the northern sky.

Variable stars

Algol (Beta Persei) undergoes eclipse on December 14–15, 17–18 and 20, and January 6–7, 9–10 and 29 at times favourable for UK-based observers. At minimum light, Algol dips to mag +3.4 from its maximum +2.1, the rise and fall each taking about 5 hours: the long hours of darkness in December and January afford the opportunity to follow Algol's eclipses in their entirety.

Mira (Omicron Ceti) is at minimum in mid-December, below 9th magnitude and therefore a challenging binocular object. This famous long period variable should start brightening through the opening weeks of 2005, with maximum light to come in May when the star is lost at solar conjunction.

Better-placed at peak light is R Andromedae, expected to be brightest in early January. Usually reaching 7th magnitude, this is a reasonable target for binocular observation, a couple of degrees WSW of M31, close to mag +4.5 Theta Andromedae. Charts showing the position of R And and suitable comparison stars can be obtained from the AAVSO website, **http://www. aavso.org/.**

Deep sky

Midwinter nights offer some stunning views in the direction of Orion and his surrounding retinue of bright constellations, including Taurus, Auriga, Perseus and Gemini. Many observers return year after year to the splendid Orion Nebula (M42) a few degrees south of the Hunter's distinctive 'Belt'. Also in Orion – a region swathed in nebulosity on the next spiral arm out from our own in the Milky Way galaxy – is a further Messier object, M78. Observers with larger telescopes, particularly, will visit this, the brightest of the reflection nebulae (dust illuminated by nearby stars), with renewed interest this winter following the appearance of a novel feature in the vicinity last January. Dubbed 'McNeil's Nebula', the object 15 arcminutes to the SW of M78 is now known to be a variable nebula, changing in brightness as a result of activity in an embedded young star. It has been seen before, but was dim for some time up to late 2003. Will it still be prominent this winter?

Orion is followed to his east by Sirius, brightest of all the night sky's stars at magnitude –1.5. Sirius is celebrated for its brilliance, and for the white dwarf companion known as the 'Pup'. Detecting Sirius' fainter partner is difficult, especially in smaller telescopes, thanks to the primary's glare. An easier prospect for observers wishing to see a white dwarf is provided by Omicron^2 Eridani, visible early on a December/January evening an hour or so before Orion comes to dominate the southern sky. Omicron^2 Eri is 15° west of Rigel, and has a slightly reddish primary star of mag +4.4. Careful inspection with a 70–80mm aperture telescope reveals a mag +9.5 white companion 83 arcseconds away to the east: this is a white dwarf, which itself has a faint (11th magnitude) red dwarf partner.

Winter skies have a number of celebrated multiple stars. Zeta Orionis (Alnitak), the easternmost – left-hand – star on Orion's Belt, is a fairly tight pairing with a mag +1.9 primary and +4.0 secondary separated by 2.4 arcseconds (I needed a steady night and a magnification of ×200 to split these in my 102mm refractor). Less testing is the quadruple system of the Trapezium (Theta^1 Orionis) at the end of the 'Fish's Mouth' dark intrusion on the Orion Nebula, easy to resolve in telescopes as small as 60mm aperture at ×30.

The two principal components of the Castor (Alpha Geminorum) multiple system are about 3 arcseconds apart and can be split with an 80mm telescope at ×100; these have respective magnitudes +1.9 and +2.9.

Perhaps one of the most attractive of winter's multiple stars is Beta Monocerotis, found just north of the line from Orion's Belt to Sirius, to the Hunter's east. The A–B pair are separated by just over 7 arcseconds, easily resolved in a small telescope, and with respective mags of +4.6 and +5.4. The fainter star has a mag +5.6 companion (C) at a distance of slightly less than 3 arcseconds. All three can be seen, nicely separated, in a 102mm aperture telescope at ×100.

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