Seasonal terrestrial optical effects

From Dr David Airey

Bill Livingston's recent interesting paper on 'Colour and light in nature' [*JBAA* vol.**115**(5) p.247] prompted me to offer two of my own photographs that may be of interest to members.

Figure 1. The longest legs on the (near) shortest day, 2003.

Figure 1 concerns the effects of bright, low angle Sun and terrain geometry on shadows. The image was taken during a walk in the New Forest on 2003 December 21 at 13:59 UT. The image is a shadow self-photograph of me and my walking stick. The Sun was at near winter-minimum mid-day altitude which results in long shadows. The shadow length is amplified by the initial downwards slope of the path in front of me, but the path slope rises again to horizontal in the region of my torso and head. The effect is compounded by the reducing image angle subtended at the camera lens with increasing object (shadow) distance. So, the overall effect on the image is that I have very long (fat) legs and an apparently foreshortened body, with a 'pin sized' head around 1/10th the width of my near-field leg.

Figure 2 demonstrates the reflective nature of some animals' eyes when fully dark-adapted (maximum iris aperture). The fox was imaged with camera 'flash' in the road, outside of my front gate, in the early snow of 2004 January 28 at 18:48 UT. This animal, I suspect, is one of the family that killed my baby bantams earlier in 2003. Nonetheless, the natural response of its eyes to the incoming 'flash' rays is to partially negate that input by reflection, in an attempt to preserve its night vision. Rabbits' eyes, on the other hand, do not seem to react in this way; only a red reflection photographic image ('red-eye'?) is seen. Following the encounter, the fox nonchalantly sloped off having decided that no dinner was available that night from number 29.

Figure 2. Fox in the snow with 'headlights'.

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The total solar eclipse of 2006 March 29

From Mr Peter Macdonald

The track of totality on 2006 March 29 crosses central and north Africa, Turkey and central Asia, the greatest duration of 4m 07s taking place in southern Libya, close to the border with Chad. The eclipse belongs to the same series as that of 2186 July 16 which has the longest duration of any known total eclipse.

In the British Isles a partial eclipse is visible during the morning, the magnitude ranging from 0.14 in the Outer Hebrides to 0.30 on the Kent coast. The Table gives some local circumstances. The angle P is measured from the north point of the Sun's disk through east while the angle V is reckoned anticlockwise from the vertex.

The penumbra over the British Isles is illustrated in the Figure, from which may be obtained the time and magnitude of greatest eclipse for any location.

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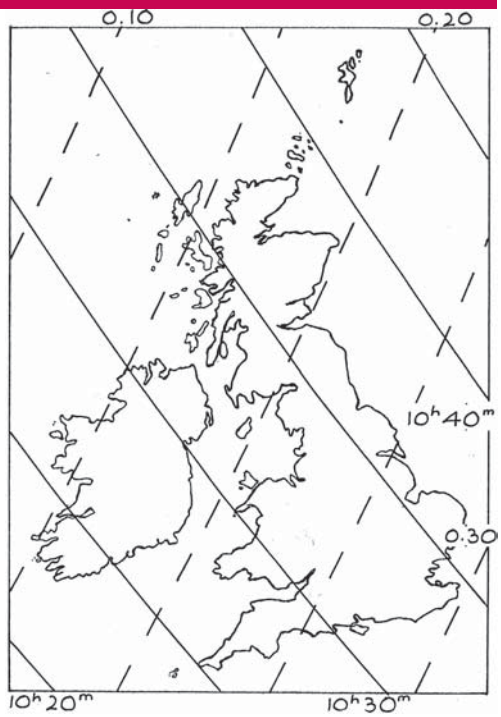

Local circumstances in the British Isles for the partial solar eclipse of 2006 March 29

	Begins			Middle		Ends		
	UT h m	P (°)	V (°)	UT h m	Mag	UT h m	P (°)	V (°)
Edinburgh	09 55	179	202	10 36	0.20	11 17	106	117
Greenwich	09 45	185	211	10 33	0.28	11 22	98	107
Liverpool	09 49	181	206	10 32	0.22	11 16	104	115
Plymouth	09 42	182	211	10 27	0.24	11 13	101	116

Blackout

From Mr David Frydman

On 2005 August 29/30 there was a major power cut at my address and in the surrounding area from 23:33 UT to 24:29 UT, and also later a second cut.

I was observing with binoculars and it instantaneously became dark. The sky was cloudless with fair transparency. The sky background became five to ten times darker, but obviously the whole of London was not affected. The extent of the cut was to 2,375 properties plus all street lights, a high voltage fault restored by switching. I estimate that just under one square mile was blacked out. This is one thousandth the area of London. Normally I suffer serious light pollution.

The limiting stellar magnitude was about 0.4m better. More stars were visible but not enormously so. Alcor was easy with the naked eye and distance glasses, although fairly low in a hazy area. However, I can see Alcor even with the normal light pollution.

What was dramatic was that I could not see anything in my flat and had to feel the walls until I could find a torch. I do not recall that happening previously in London. I could see nothing in my room until I was 15 minutes dark adapted, then I could see a glimmer of light leaking from the top of the drawn curtains. I do not know the limit of human vision, but it was less than my luxmeter which reads to 0.1 lux.

It would be wonderful if there were a power cut every night for two hours from midnight, but unfortunately they are very rare.

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Extreme declinations of the Moon in 2006

From Dr Darren Beard

The sidereal period of the Moon is about 27.32 days on average. During this period, the Moon has a maximum northerly declination, followed about 14 days later by a maximum southerly declination. However, the orbit of the Moon is very complicated and is affected by the influence of the Sun, the planets and even by the asteroids. Due to these effects, the extreme declinations of the Moon are not the same every month. There is a cycle of 18.61 years during which the extreme declinations range from about ±18.2° to ±28.7°. The maximum declinations occur when the ascending node of the Moon's orbit coincides with the vernal equinox.

During the year 2006, the Moon will reach an extreme southerly declination of –28° 43′ 23" on March 22 at 16:54 UT. The Moon has not had such an extreme southerly declination since 1950 September 19. It will not be further south in the sky until 2025 March 22.

The extreme northerly declinations immediately before and after March 22 are not the most extreme for the year 2006. The most extreme northerly declination of the Moon will occur on 2006 September 15 at 01:27 UT (Meeus J., personal communication). The Moon will then be at declination +28° 43′ 22". The Moon has not been further north in the sky since 1969 March 25.

When will the Moon next be further north in the sky? Not for many hundreds of years! One of the factors affecting the extreme positions of the Moon is changes in the orbit of the Earth around the Sun. The secular decrease of the obliquity of the ecliptic is gradually making the extreme declinations of the Moon less extreme as time passes (Meeus J., *Mathematical Astronomy Morsels*, Willmann–Bell, 1997). The result is that the extreme northerly declination of the Moon in 2006 September will not be exceeded for at least 800 years and probably much longer. Likewise, the extreme southerly declination in 2025 March will not be exceeded for at least 800 years and probably much longer.

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