Letters

The dispersion corrector revisited

From Mr Chris Hooker

Damian Peach's article 'Atmospheric dispersion and its effect on high resolution imaging' in the 2012 August *Journal* shows that dispersion correctors are important tools for expert planetary imagers like Damian who are trying to obtain the highest possible resolution in their images. However, there is a serious error in the diagrams of a Risley prism-pair in Figure 2 of the article (reproduced below as Diagram 1.) These diagrams, which originally appeared in the 2005 *Sky & Telescope* article cited as reference 4 and which purport to illustrate how the corrector works, show rays of light behaving in ways that are physically impossible. In the interests of correctness the errors should be pointed out, and a description given of how a dispersion corrector really works.

The rule of refraction from elementary optics is that when light enters an optically denser medium, in this case a piece of glass, it is refracted towards the normal to the surface, and on leaving the denser medium, it is refracted away from the normal. In 'Figure 2' (Diagram 1) we see three slightly separated rays, coloured red, green and blue, all incident on the face of the first prism at the same small angle. The red ray is indeed refracted towards the normal, as it should be, but the green ray is undeviated and the blue ray is refracted away from the normal, which is physically impossible.

The rays are then shown converging towards the narrow air-gap between the two prisms, which is the same in both parts of the figure. However, in the left-hand drawing the rays (correctly) continue through the gap without changing direction, whereas in the right-hand drawing the rays miraculously diverge after passing through an identical gap! At the exit face of the second prism we have more unphysical refraction, with the red and blue rays bending in opposite directions and the green once again passing through the surface as if it were not there.

It is surprising that this patently wrong description has persisted for so long, but as mentioned earlier it was present in the original *Sky & Telescope* article, and was copied in the description of the corrector made by Adirondack Video Astronomy on their website.

These errors aside, dispersion correctors do work, so what is the correct explanation for their behaviour? The dispersed planetary image at the focus of a telescope objective has its various wavelengths spread vertically over a small angular range, typically a few arcseconds at most, forming a short spectrum. The purpose of the dispersion corrector is to undo the dispersion caused by the atmosphere and bring all the different wavelengths to the same point so they overlap. This is achieved by a small-angle prism, which nevertheless introduces a far larger angle between the red and blue ends of the spectrum than the atmosphere did. For example, a BK-7 glass prism with an apex angle of only 2° will introduce dispersion of around 80 arcseconds between blue and red wavelengths, compared to only 2 to 3 arcseconds for severe atmospheric dispersion. This greater angle brings all the different wavelengths to an overlap point a few centimetres from the prism, after which they diverge again.

The key condition for the corrector to work properly is that the images formed in all wavelengths must overlap *at the point where they are in focus*. If this condition is not satisfied, the focused image will have residual dispersion and the image where the colours overlap correctly will be out of focus.

The action of the prism is shown in Diagram 2. Light from an object arrives from the left, with red and blue wavelengths dispersed at an angle **a**. If the prism is absent, the objective forms images in the two wavelengths that are separated in the focal plane by a distance **S = F.tan(a)**. With the prism in place at a distance **d** in front of focus, the rays are refracted as shown, converging at a much steeper angle **b** (for clarity only the centre ray of each bundle is shown). To correct for the atmospheric dispersion, the rays of different wavelengths must all overlap in the focal plane. If the overlap occurs in some other plane, the image that is correctly compensated for dispersion will not be in focus, and the focused image will exhibit coloured edges.

If the telescope is moved to view an object lower in the sky, where the atmospheric dispersion is greater, the two wavelengths will be more widely separated at the prism. They will then have to travel further before overlapping, so the overlap will occur beyond the focal plane. With a Risley prism-pair the effective apex angle can be increased, by adjusting the relative orientation of the two component prisms, to bring the overlap point back to the focal plane.

It is worth noting that a single prism could also compensate for the greater dispersion at lower elevations, provided it could be moved towards the objective thus increasing the distance from the prism to the focal plane. The difficulty of making a corrector with a movable prism means that dispersion correctors made for the amateur market have normally been of the dual-prism type.

Dispersion correctors are without doubt useful devices for high-resolution imaging and observing planets at low elevations. I hope the foregoing explanation of these devices will help those who have them to understand how they actually behave and to use them more effectively.

Chris Hooker

6 High Street, Didcot, Oxfordshire OX11 8EQ [chrishooker1 'at' virginmedia.com]

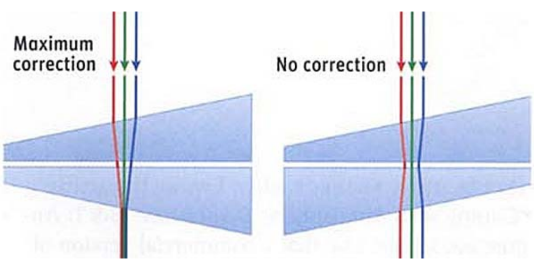

Diagram 1: Figure 2 of Peach's article from the August *Journal*.

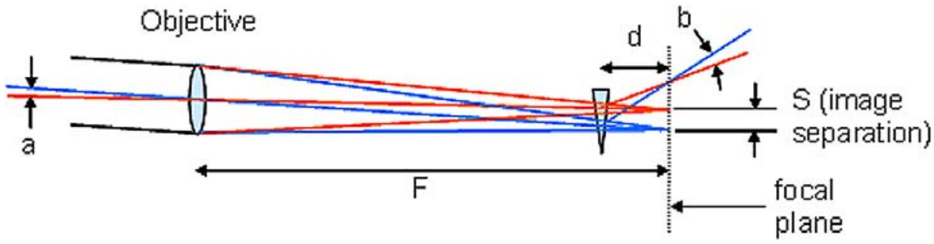

Diagram 2: Corrected action of the Risley prism.

Isolated total lunar eclipses

From Mr Alex Vincent

I read with great interest the paper about isolated total lunar eclipses (ITLEs) by Tony West in the 2012 August *Journal*. In our lifetime, the only ITLE visible from the UK was that of 1997 September 16. This makes it a rare event. I had the privilege to observe and photograph it between clouds. The two others in our lifetime on 1979 Sept 6 and 2021 May 26 are not visible from the UK.

However, another ITLE may occur in 2015. Lunar eclipses take place on April 4 and Sept 28 in this year. According to Boa-Lin Liu's *Canon of Lunar Eclipses*, the eclipse in April is just total with a magnitude of only 1.003, but according to Meeus in his *Canon of Lunar Eclipses*, its magnitude will be 0.998 (not quite total).

If the latter is correct then the total lunar eclipse of 2015 September 28 (magnitude 1.283) will also be an ITLE. This will mean that it will be an ITLE with the greatest magnitude between the years 0 and 3999. This event will be visible from the UK.

There is not much difference in the appearance of a very large partial umbral and a very small magnitude total umbral. Observations on 2015 April 4 may be inconclusive in determining which type of eclipse it is. This will not be visible from the UK.

Alex Vincent

Flat 4, 15 Shelley Road, Worthing, Sussex BN11 4BS

Information wanted on former BAA Council members

From the former Director, Historical Section

As part of the project of compiling as complete a list as possible of members of the BAA since 1890, I am also undertaking a similar project with all the members of the Council. While I have been able to identify the births, deaths etc. of a large number of Council members, there are several with whom I have had problems. In some cases I am not sure whether they are still living. Of these the most outstanding are:

Mrs Sheila Anne Boulter, Council 1960–'62, 1964–'65; Director, Historical Section, 1965–'68

John Venners Carey, member of Council 1975–'77 and 1982–'85

Louis Coombs, Treasurer 1982–'86; Vice-President 1986–'88

John Heywood, Director, Radio & Electronics, 1957–'64

Gerald Harper Lepper (b.1885, lived in USA later), Council 1921–'24

James Bennett McInnes, Director, Aurora Section

Donald Alistair Maclean, Director, Aurora & Zodiacal Light Section, 1951–'52

Ernest George Martin, Curator of Instruments, 1920–'22

Philip Albert Ringsdore (d. 1974, Jersey), Council 1965–'68, Vice-President 1969'72, Goodacre medallist, 1973

Charles Wilson, Acting Director, Aurora Section (d. 1984)

James Henry Worthington, Council 1913. Appears to have moved to USA later

Frank L. Grant, Secretary, *c.* 1914.

For other council members (those who have died, and many of those still living) I have the details I require.

Any assistance on the above would be greatly appreciated and fully acknowledged. I would also appreciate it if any member (or former members) could supply me with information about themselves. I need dates of birth & joining, full names (including any changes – e.g. by marriage or deed poll) and career/profession at the time of joining. If a doctor, whether a doctor of medicine or academic. All information will of course be treated in confidence.

The ultimate destination of this project is to a secure archive source.

Anthony Kinder

16 Atkinson House, Catesby Street, London SE17 1QU. [anthony_kinder 'at' hotmail.com]

Venus and Jupiter in daylight with an 8×20mm monocular

From Mr Peter Parish

I missed the early morning occultation of Jupiter by the Moon on 2012 July 15 due to cloud, but my observations later that same morning may be of interest. Many observers these days use ever bigger instruments so I have gone the other way and observe with one of the smallest.

The clouds cleared at last above where I live in North Kent and at 10:00 a.m. BST (9:00 a.m. GMT) on July 15 I could see the old crescent Moon very easily with the naked eye high in a rich blue sky.

Venus was about five or six degrees south and east of the Moon and using the Moon as a guide, I turned my 8×20mm monocular towards the planet. Through this tiny instrument, Venus still appeared bright, however the very small crescent was almost hidden by this brilliance and the planet looked almost starlike.

Venus itself was an easy naked eye object resembling an ordinary little star in the blue sky, visible below and to the left of the crescent Moon.

Jupiter was some three or four degrees due west of the Moon and again using the Moon as a guide, I turned my monocular towards it. Through this tiny instrument, Jupiter's disk looked very small but the planet itself was still easily visible.

I knew Jupiter's exact position relative to the Moon thanks to some convenient nearby cloud, but although the conditions were favourable with a good blue sky I could see no trace of the planet with the naked eye.

According to my shadow measurements, the Sun's altitude at this time was about 41°.

Peter Parish

30 Wooldeys Road, Rainham, Gillingham, Kent ME8 7NU [pwparish54 'at' yahoo.co.uk]

'Light pollution: penetrating the veil'

From Mr Ronald Livesey

I refer to Bob Mizon's article on light pollution in the 2012 August *Journal*.

I observe with a 65mm Russian instrument, principally used for variable star observations. I observe from a car park with a four-storey block of flats on one side and a tree belt on the other. There are two 'Rottweiler' security lights on the walls of the flats. On the one nearest my telescope I place a neatly-sized strong cardboard box over the lamp for the duration of my work. The other lamp is more distant and observations are carried out in the shadow of an open bin-house door.

A piece of hard plastic corrugated field drain pipe, 23cm long by 9cm diameter, is fitted firmly over the muzzle end of the telescope. This cuts out most of the extraneous light from distant street lights that would otherwise get into the 'scope. The pipe was found lying on a local beach.

Covering the head with any sort of cloth, like an old-fashioned plate photographer, is not satisfactory because the eyepiece invariably steams up especially in cold winter weather. An eye patch over the unused eye is helpful so that the eye muscles are not strained by trying to keep one eyelid shut. When using binoculars I blank out one side for the same reason.

At this site the sky towards the northwest lying over the city of Edinburgh is usually hazy, which reflects municipal lighting. To my south there is more open country and the sky is much clearer. Whereas it is possible to observe stars below 10th magnitude in general, towards the city the limit is 6th magnitude, which is four times the value of the atmospheric extinction for the same stellar value. The brightness ratio due to the city haze is practically 16 in value.

Ron Livesey

Block 1, Flat 2, East Parkside, Edinburgh EH16 5XJ

'A comparison of two simple magnetometers'

From Dr Thorsteinn Saemundsson

In his paper 'A comparison of two simple magnetometers' which appeared in the 2012 August issue of the *Journal*, author Sam Dick gives the impression that a variometer is an instrument for recording changes in the direction of a magnetic compass needle. He goes on to state: 'In contrast to the variometer, the fluxgate is a much more complex and recent sensor'.

This is misleading on two counts. The term variometer is generally applied to any instrument that registers magnetic variations, whether it be changes in magnetic declination or any other component of the field, horizontal or vertical. Fluxgates are commonly used as variometers. Both optical and electronic systems can be set up to measure variations in a direction of choice. At magnetic observatories, three components are routinely recorded to determine the direction and magnitude of the disturbance vector.

Thorsteinn Saemundsson

Science Institute, University of Iceland, Dunhaga 5, Reykjavik, IS-107, Iceland [halo 'at' hi.is]