Letters

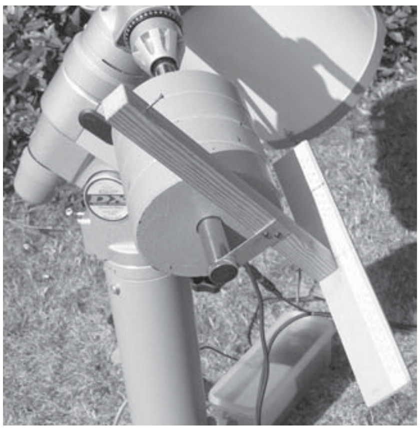
Finding Mercury in daylight

From Mr Chris Hooker

I am pleased John Vetterlein[1] appreciated my webcam images of Mercury in the December issue of the *Journal*.[2] However, in his letter he says that the technique I described for finding the planet during the day uses a GOTO mount, which in fact is not the case. To clear up any possible confusion, I offer here a more detailed description of the process for others who may wish to make similar observations.

For imaging Mercury I use a 25cm Newtonian mounted on a Vixen GP-DX mount, which has a built-in polar-axis sighting telescope to allow accurate polar alignment. I try to anticipate imaging opportunities, and set the mount up on Polaris the night before whenever possible. Experience has shown that attaching the counterweights and telescope the next day does not noticeably affect the polar axis alignment. With accurate polar alignment it is possible to use one object as a reference, and offset the telescope in RA and Dec to find another. For locating Mercury in daytime, the Sun is the only usable reference, and must obviously be observed only with a proper solar filter over the telescope.

To determine the required offsets I use ephemerides for the Sun and Mercury obtained from various Internet sources, and enter the data into an Excel spreadsheet that calculates the differences in RA and Dec of the two objects. These differences are then plotted on graphs, so the required offset in each coordinate can be read from them for any given date. The setting circles on the GP-DX are rather small, so to make the offset in RA more accurately I made a simple device resembling a sundial (see photograph), which attaches to the end of the Dec axis. It carries a scale drawn on graph paper, calibrated in minutes of RA, and a nail that casts a shadow on the scale. The distance between the nail and the scale is 229mm, at which 1mm corresponds to 0.25°, or 1 minute of RA. The field of view of the eyepiece I use when locating Mercury is about 1°, so a scale that can be read to 0.25° is quite accurate enough. The scale is flat, so the size of the divisions increases gradually away from the centre. The metal strip that supports the device is slightly flexible, so with the telescope centred on the Sun it can be twisted gently until the shadow falls on the central mark. I then rotate the telescope until the shadow falls on the scale at the RA offset for that day. The Dec offset can be made accurately enough using the setting circle.



The RA offset device described in the text.

One important point is that the scale was marked out assuming the equivalence of 1° with 4 minutes of RA, which is true only on a great circle, i.e. if the Sun is on the celestial equator. When the Sun is not on the equator, the RA offset must be multiplied by a correction factor that is the cosine of the Sun's declination. This can change the offset by as much as 8%, more than enough to put Mercury outside the field of view. In practice this correction is applied during the calculation of the RA offset in the spreadsheet, and the value read from the graph is then used directly.

With a good polar alignment, this technique usually results in Mercury being near the centre of the field of view of a 25mm eyepiece when the solar filter is removed. If it was not possible to set the mount up the night before, I position it as well as I can and try the technique anyway. If Mercury does not appear, then Plan B is to offset the telescope in RA to a position a degree or two west of where it should be. With the RA drive turned off, I scan the telescope up and down in declination over a range of about ±2° of the expected offset, taking ten seconds or so for each sweep up or down. Provided the polar axis is not too far out of position, Mercury will come into view as the correct offset in RA is reached. With this *ad hoc* positioning of the mount, the important thing to get right is the azimuth of the polar axis: small errors in elevation will not cause the telescope's pointing to deviate much from the correct position.

One other technique that I have not tried, but which in theory must work, is to identify from an atlas a star with the same declination as Mercury (at the time the planet

The apochromatic dialyte refracting telescope

From Mr Rick Blakley

John Wall and Peter Wise reference my paper, 'Dialyte-refractor design for self-correcting lateral color',[1] in their paper, 'The retrofocally corrected apochromatic dialyte refracting telescope'.[2] There are some misconceptions regarding my paper that occur in the Wall–Wise paper that I wish to clear up.

The major one is the statement that 'the colour correction [is] shared by all of the various lens combinations' in my design. If this is true, it occurs purely by accident, because I resorted to the use of certain glasses in the relay before and the refocusing optics after the corrector to avoid adding additional chromatic aberrations to those generated by the objective. I had also set up as a goal the correction of lateral and longitudinal chromatic aberrations such that the designs presented could be classed as 'superachromats'.[3] Thus the systems presented became quite long, and this accounts for the spacings between the various elements. Had I been willing to tolerate simple achromatic performance, I'm sure a significant lessening of the overall length could have been achieved, perhaps with a change of glasses.

I also anticipated using a corrector at the location shown in Figure 3 of the Wall-Wise paper, but I quickly realised that to acquire the performance that I desired using the same glass in the corrector as in the objective, the refocusing lens system following would grow to be about as large as the objective. I therefore discarded this approach. Mr Wall and Mr Wise have chosen to alter the corrector glass.

I would like to wish Mr Wall and Mr Wise good luck in their project, but the recent appearance of a new design by Roman Duplov renders, I believe, their approach and mine of my former paper most probably obsolete for use as astronomical instruments. I would suggest that they review Mr Duplov's paper.[4]

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1 Blakley I. R., *Opt. Eng.*, **42**(2) 400–404 (2003)
2 Wall J. & Wise P., *J. Brit. Astron. Assoc.*, **117**(1), 29–34 (2007)
3 Herzberger M. & McClure N., 'The design of superachromatic lenses', *Appl. Opt.*, **2**, 553–560 (1963)
4 Duplov R., 'Apochromatic telescope without anomalous dispersion glasses', *Appl. Opt.*, **45**, 5164–5167 (2006)

will be observed) which is visible at an acceptable hour the night before. The telescope is aimed at the star and fixed, and the time noted. Since the declination of Mercury is the same as the star, Mercury must pass through the field of view at some later time, which can be calculated from the difference in RA between the star and the planet. In this case the cosine correction is not needed, but the conversion factor from sidereal time to civil time must be used. The drawback with this technique is that the whole telescope must be left outdoors, rather than just the mounting, and there is a risk that covering and uncovering the instrument will change the pointing. Those lucky enough to have an observatory or other permanent setup may find this method worth a try.

Chris Hooker

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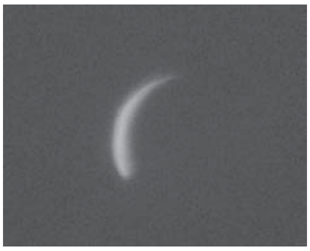
1 *J. Brit. Astron. Assoc.,* **117**(1), 38 (2007)
2 *ibid,* **116**(6), 340 (2006)

The myth of daylight poor seeing

From Mr J. C. Vetterlein

Seeing (a partial pun intended) Ayiomamitis' series of images of a lunar occultation of Venus (April *Journal*, page 74), it occurred to me readers might be interested in one of the images I took of the reappearance using a much smaller telescope (175mm Mak–Cas.).



Venus emerging from lunar occultation, 2004 May 31, 175mm Maksutov–Cassegrain. *J. C. Vetterlein.*

This also gives me a further opportunity to air the view I have held for many years, namely, that poor *seeing* during daylight hours is grossly overstated.

Throughout the period of the Venus occultation the seeing was superb, allowing powers of up to ×300 to be used. (I missed the initial stages owing to passing cumulus.) I have mentioned in previous correspondence the fact that much of my double star work was done in full daylight, or in strong twilight, when the seeing has frequently equalled conditions at night.

Recently I had occasion to test a 120mm apochromatic refractor. During daylight on March 24, I observed Castor at an elevation of between 22° and 24°. The components of this binary are 1.9 and 2.9 mag. (separation currently 4.4"). At ×190 the images of both stars displayed near perfect diffraction patterns. This indicated not only fine optics but also excellent seeing at the time. Indeed, to have seen a 2.9 mag star in daylight with such a modest aperture was an achievement in itself.

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Venus in 2004

From Mr Christopher Taylor

I have just read the interesting paper in April's *Journal* on Venus in 2004:[1] what a wonderful year that was for observers of the planet! I would like to add my sixpennyworth on the subject of that summer's cusp extensions, of which I was fortunate enough to have a fine view on the morning of June 13, just 5.0 days after inferior conjunction, the daylit sky being of an exceptionally transparent deep blue. With a 4 inch (102mm) refractor set up just within the heavy shade of a large tree at 08:30–09:00, this was the visual impression at ×38 and ×100 in unusually good daytime seeing: 'An indescribably fine crescent, only 1 arcsec. thick at its fattest, bright and white on a deep blue daylit field. It was immediately apparent that the needle-point horns of the crescent were significantly extended, the illumination being clearly traceable around at least 200° of the limb.' In nearly 40 years of occasional observations of the planet with a variety of telescopes from 2 to 36 inches aperture, this was surely Venus at her most beautiful.

More significantly, I have a historical bone to pick. The authors repeat the claim made in some advertising in the Spring of that year that 2004's transit was observable 'for the first time ever in hydrogen alpha light'. This assertion is not true, nor was it even probable, the open-slit spectroscopic method of viewing prominences and the chromosphere in Hα having been invented, as is well known, in 1868 by Janssen and by Lockyer, well before the two nineteenth century transits of Venus. It was actually pointed out in these pages nearly 30 years before the event of 2004[2] that Hα observation of transits has a history going back at least to 1914 (in that case of Mercury), and since writing that earlier letter the following passage has come to light in the BAA obituary[3] of Prof Antonio Abetti 1846–1928, onetime Director of Arcetri Observatory: 'In 1874 he joined the Italian expedition to India for observing the transit of Venus, and on this occasion had the good fortune to see the planet projected against the solar chromosphere on the C-line through the open slit of his spectroscope.' The historical truth is that Venus was observed in Hα 130 years ago, at the very first transit after the discovery of the Hα line itself. The DSB biographical entry on Abetti[4] says that *this* was the first such observation ever made.

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1 McKim R. J. *et al.*, *J. Brit. Astron. Assoc.,* **117**(2), 65 (2007)
2 Taylor C., *J. Brit. Astron. Assoc.,* **85**, 67 (1974 December) – letter by the present writer
3 *J. Brit. Astron. Assoc.,* **38**, 234 (1928 May)
4 'Abetti, Antonio', *Dictionary of Scientific Biography* (New York, 1970), vol. 1, p. 19