# Letters

## Gamma Virginis – an important observing opportunity in May

*From Mr Christopher Taylor*

Observers may be in danger of missing by far the most spectacular binary star event of the century: the now-imminent periastron passage of γ Virginis (Porrima). For over 160 of its 169-year period this pair of identical 3rd magnitude stars is very easily resolved at moderate power in a small telescope, but thanks to its extreme orbital eccentricity (about 0.9), Gamma closes for two or three months around minimum to no more than 1/3 arcsecond, a dramatic climax last seen in the winter of 1835–6 by John Herschel, W. R. Dawes and Admiral Smyth. This is not something only detectable by micrometric measurement but a progressive change in the visual appearance of the pair, plainly obvious at the eyepiece over an astonishingly short time.

We are about to witness the only instance visible from northern latitudes of a bright star pair visibly and obviously moving, as seen in a 150mm (6-inch) telescope, within a two-year period. Gamma Vir has changed its gross appearance completely even in a 102mm (4-inch) OG in each of the 12 months from spring 2001 ('disks tangent' – they were well separated a year earlier), 2002 ('disks heavily overlapping'), 2003 (a single elongated disk, 'olive') and 2004 ('round'), each of these changes being instantly obvious 'by eye'.

A careful analysis of the impressively consistent historical measures from the 1830s has yielded the following results. Firstly, the mutual symmetry of the distance measures on the arcs 1831–35 and 1837–40 implies that minimum separation was reached somewhere about 1836.32, a date within about two months of that given independently by the observations of the event itself by Smyth, Herschel and Dawes; on the basis of this concordance of evidence we can conclude with a high level of confidence that the apparent appulse occurred on 1836.15 ± 0.07, and that Gamma was definitely opening out again by 1836.25–.30. Secondly, the maximum rate of revolution of the system in position-angle, attained in the spring of 1836, was at least 120° per year and may have been substantially larger; this is a considerably higher figure than that usually quoted and has radical implications for the likely minimum separation of the two stars (see below). Thirdly, by 'matching' the Hanwell measures of p.a. taken with the 318mm reflector in the years 1998–2004 onto those of 1829–1835, it appears that this 'magnificent phenomenon', as John Herschel called it, will fall next in, or about, mid-May this year, i.e. 2005.37 ± 0.07.

The purpose of this note is therefore to alert observers to the imminence of this unique event which, in default, they may miss entirely if relying on older and now-superseded orbital predictions. In particular, the commonly-quoted periastron date of 2007–8 (still given in many current books, sky-mapping programs and even on some active websites) is based on Strand's orbit of 1937, which in reality has been defunct now for a decade or more: by spring 2001 its errors were so gross as to be obvious at a glance in a 4-inch telescope, Strand predicting a distance which would have made the two stars easily separated in that aperture, contra the 'disks tangent' actually seen. Anyone still relying on that erroneous ephemeris will therefore miss the action entirely, as by late 2007 Gamma will have opened out again to nearly 1 arcsec. and have slowed once more to a mere 20° per year in revolution. Meanwhile, in fact, the pace has really been hotting up over the last year or so. The morning measure of Gamma with the 318mm on 2004 December 27 showed the pair at about 0.4 arcsec. in p.a. 177° (approx.), a closing up of some 40%, and a revolution of no less than 42°, since the corresponding dawn observation of just 12 months earlier.

Evidently, to follow the events of the next few months will be a real challenge, good optics and high magnifications (at least ×60 per inch of aperture) being absolute essentials. While the star will certainly appear single in a 150mm telescope at minimum, it will be completely resolved again in that aperture within two years, and an acute observer will begin to see the two components opening out and rapidly revolving well before that. In 1836, Smyth with a 150mm OG and Dawes, with only 96mm, managed this convincingly only two months after closest approach! Here, then, is a challenge to today's observers - can you match the Smyth–Dawes record?

A further incentive to observe this remarkable event is that, despite all the many efforts of the orbit computers, we still have very little idea what to expect at apparent periastron. Despite persistent astronomical folklore to the contrary, the least separation of Gamma was not determined, or even estimated, in 1836; all we can say on the basis of those observations (Smyth, Dawes and subsequently Struve, who missed the appulse itself) is that minimum distance was almost certainly less than 0.3 arcsec. and probably less than 0.25. This, again, is independently verified by apply-

## The Star of Bethlehem

*From Mr Terence Moseley*

I read with great interest the article in the 2004 December *Journal* on the Star of Bethlehem by R. M. Jenkins. The following may lend some weight to his theory.

There is a certain folk history in parts of the west of Ireland (Clare & Galway) that there was a total, or almost total, eclipse of the Sun in that region just before the great potato famine in the mid-1840s, with the implication that it might in some way have contributed to the potato blight, which ruined the crop and led to the famine. The famine started in 1845 but was at its worst in 1846, and ended in 1847. Well over a million people died, or had to emigrate, so it was a seminal event in Irish history.

In fact there were two relatively small partial eclipses just before the famine was at its worst. There was a partial eclipse on 1845 May 6, magnitude about 48% in that area. Another smaller one, magnitude about 27%, occurred in that area on 1846 April 25. There was also one of around 69% on 1842 July 8, but that occurred just after sunrise, when very few people would have seen it.

However, there was an eclipse on 1836 May 15, which was total in the northern quarter of Ireland, including some areas later badly affected by the famine. It was about 93–95% in the relevant area, and it occurred at around midday. There was also an annular eclipse visible in the southern third of Ireland on 1847 Oct 9, again occurring just after sunrise. It also reached a magnitude of about 90%+ in that area.

So what seems to have happened is that the collective folk memory merged the smaller eclipses occurring before/during the famine with the total/almost total eclipse of a decade earlier, and the one which happened as the famine ended, giving the story of the total eclipse occurring just before the famine.

Something similar may have occurred with the 'folk memory' or 'tradition', of the visibility of the two returns of the comet before, and some years after the birth of Christ, to give an impression of the 'Star' as it was recounted in St Matthew very many years later.

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ing Kepler's law of areas to the apparent motion, using the maximum angular velocity quoted earlier, which implies an upper limit of 0.29 arcsec. at closest approach. The computed orbits, on the other hand, right down to the most recent (Soderhjelm 1999) at 0.35 arcsec., have consistently overestimated this parameter.

Gamma has yet another unresolved conundrum for us, however, in that its motion in 1836 appears to have violated Kepler's law. The observations show that the rate of revolution peaked some months after closest approach, a violation of Kepler II perhaps most easily explained by the presence of an unseen third body. If this should, indeed, prove to be the case, any predictions based on simple periodicity of the motion - including that made here, and all 2-body orbit computations - may turn out to be inaccurate: 2005 may not be an exact re-run of 1836. So even here, in one of the most famous of all binaries, the unknown confronts us and surprises may lie in wait. All of this surely makes for a fascinating observing challenge.

**Christopher Taylor**

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[A full account of the work on which this note is based will be put up shortly on the double star section of the Hanwell website **www.hanwellobservatory.org.uk**. For an interesting retelling of the full story of Porrima see Bob Argyle's article 'Porrima: a close approach' in Patrick Moore's *2005 Yearbook of Astronomy* (Macmillan, 2004).]

## Seeing for oneself

*From the Director of the Aurora Section*

I concur with Jeffrey Barham's article in the 2004 November issue of *Astronomy Now*. In spite of modern technology, Hubble Telescope images, CCTV and photography attached to telescopes, it is much better, particularly for beginners, to see for oneself. Visual amateur astronomy is luckily not yet dead.

Some years ago, my water supply survey party and myself were billeted in a Nigerian construction camp operated by a British contractor. In the mess the lorry, bulldozer and crane drivers together with other technicians looked upon us as a race of bushmen dressed in old army-surplus kit from Millets.

One evening there was a beautiful half-Moon so I borrowed our theodolite and set it up in the recreation area to have a look. One of the (well-upholstered) crane drivers saw me from the window of the camp bar, and to satisfy his curiosity he left his beer and strolled down to find out what I was up to. I told him to have a look into the theodolite.

It took but a few seconds for him to become very excited as he saw for the first time with his own eyes the craters, mountains and maria on the Moon. Letting out a string of expletives (religious, explicit and otherwise) as only a British construction worker can, my companion dashed for the bar. Within half a minute this emptied and I had a queue of new recruits to lunar observing, and a lot of satisfied customers who were venting their appreciation in unprintable form. It takes a good deal to persuade a portly British plant operator to part from his pint of beer.

As I once said to a class of civil engineering students, to the annoyance of their professor, if you are standing up to your oxters in thorn bushes throwing stones at the crocodiles, a computer is not much use to you. As in civil engineering so in amateur astronomy, there is nothing quite like seeing for oneself.

**Ron Livesey**

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## Some thoughts on 'doomsday asteroids'

*From the Director of the Asteroids & Remote Planets Section*

Much observing time is now spent identifying asteroids that may have a close encounter with the Earth, and there is a fear that eventually one will be found that will hit. There are currently no Near Earth Objects known which are on a collision course with us, but can we be sure this situation will last? The Moon bears witness to many past impacts in its crater record and we know of several such sites on Earth, such as Meteor Crater in Arizona and the legacy of the airburst of the Tunguska event in Siberia in 1908. It is known that we sweep up much debris every year during our annual orbital journey around the Sun, most of which is no larger than a grain of sand.

The American programme to identify Near Earth Asteroids is intended, by 2008, to identify all bodies larger than 1 km that are in orbits that can cross that of Earth. Inevitably this project has also found many smaller objects including 2004 FH, which passed by in March 2004 and was estimated to be in the 20m to 30m size range. What is true is that despite much speculation, we have no way, with the current state of our technology, to change an orbit to ensure it will no longer cross that of Earth.

If there is a risk of impact there have been many ideas proposed to mitigate this. Some have suggested blowing up the projectile as a solution, such as proposed by Hollywood in films such as 'Meteor', 'Deep Impact' and 'Armageddon'. This would produce debris that could cause widespread damage possibly as severe as that by the original body. Other ideas have included deflecting the object away. The concern with this is that any attempt to disperse with a loosely bound pile of rocks by explosive means may prove futile; it would merely absorb the force by a slight adjustment to its shape. If it did work however there would still be an intersection some time in the future so this solution would only postpone the inevitable. My own belief is that a second explosion when away from Earth would be required to cause another orbit adjustment to ensure it could not return.

The majority of objects flying by are in relatively eccentric orbits round the Sun so that the encounter is at a high velocity and, when near, they appear to rush across the sky moving several degrees an hour at closest. Those in Earth-like orbits have lower velocities relative to the Earth and so move much slower – however they still move quite rapidly relative to the stellar background compared to the planets for example. They quickly brighten when closing in on us and fade equally rapidly as they depart.

There will come a day when one will be seen that does not move relative to the stellar background. It will brighten as it nears. If it will miss us then eventually a small lateral motion will be detected which will increase as it nears. If it remains stationary against the stellar background then Earth is the target and it will hit. What effect it will have on the Earth depends on a number of factors, of which the most important are size, composition and configuration.

As a basic rule the bigger it is, the more damage it will do. The way I look at this is that a 10km diameter body is a planet killer, 3km is a country killer whilst a smaller one would be a city or district destroyer. I realise that this is a simplistic view, especially as the effect on the Earth as a planetary body would be minimal in the long term, but it is valid as a way of getting a handle on things. There has been much speculation about the consequences and there are many websites that discuss this, including at least one site where you can input data and get an idea of the resulting effect of an impact.

Composition of the impactor is important. A solid metallic body is more likely to make it through the atmosphere in one piece than an icy one that may boil away. A stony body is an intermediate case: it will ablate and may even airburst into fragments before it lands.

The configuration is also significant, and the risk here is really similar to composition as a solid body will be stronger than a 'rubble-pile' which will tend to fragment as it heats in the atmosphere. The difference in the resulting surface damage would be similar to that resulting from firing either a cannon ball or grapeshot.

None of these would cause major problems to the Earth itself; the main problem would be the effect on the biosphere. There has been much speculation since the discovery of the iridium layer by the Alvarez' in the 60s that impacts have been the cause of mass extinctions of species in the past. Others have put this down to volcanic activity or climate change. As so often is found, the truth is not provable but is probably a combination of all these. Perhaps such strikes brought about volcanic activity and the dust from this caused a 'nuclear winter'; it will be hard to be precise unless it happens again and we observe it.

The crater formed 65 million years ago was identified at Chicxulub in the Yucatan peninsula and this coincides with the dinosaur extinction. Recently the Bedout crater has been identified off the north west coast of Australia, which is 250 million years old and this coincides with the major extinction event popularly known as 'the great dying' when the majority of species alive at that time rapidly went extinct. If these cycles are periodic (unlikely?) then we have a while to go before the next is due.

For the last two or three years there has been much discussion about the possibility that many of the odd events described in older documents, such as the Old Testament, the Sagas, Gilgamesh and the like, may recount as fables a record of minor impacts. Many instances can be found of city states that rose to become dominant in an area but then disappeared almost overnight, sometimes with a story of associated supernatural events. Whilst the collapse of the Minoan civilisation is probably connected to the eruption of volcanic Thera (modern Santorini), some stories hold the prospect of being the aftermath of an impact since the descriptions seem to fit. We are unlikely ever to be able to prove this one way or the other but there are a sufficient number that it seems likely one or two could just be so.

Suffice it to say you will suffer if directly under the impact – if not then its effect will depend just how big the object is and how close it lands. It will be quite bright before it enters the atmosphere (small 2004 FH was mag 11 at its brightest when it was at three Earth diameters distance). So it will be detectable before it enters the atmosphere, and you could be the one to follow it in and possibly to chart the end of mankind.

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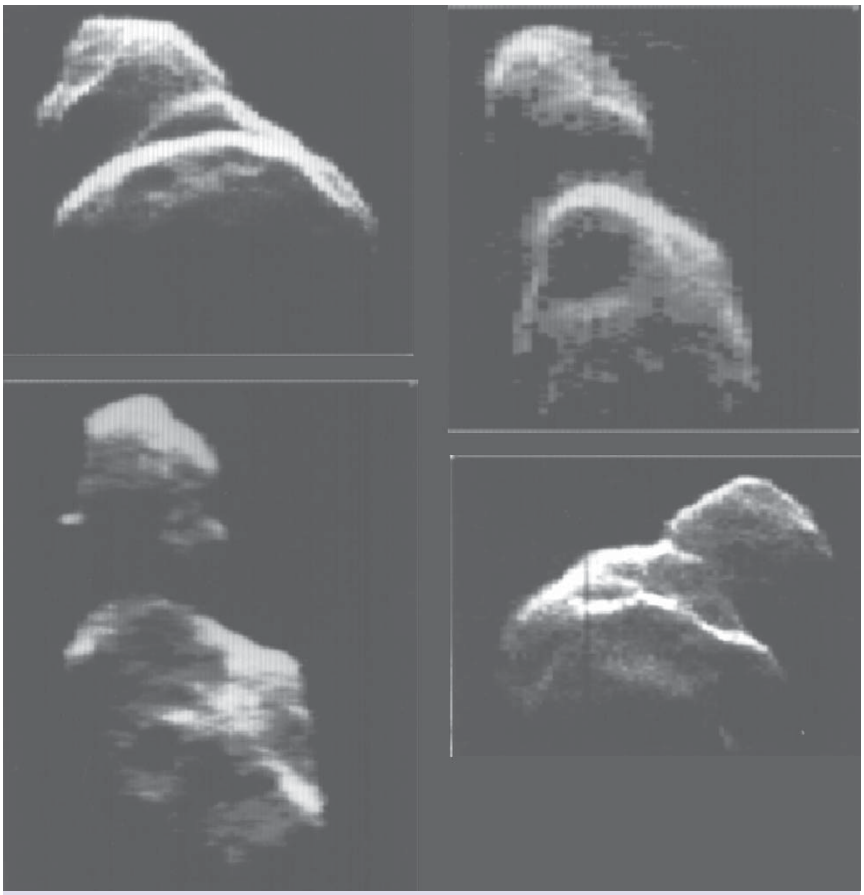

Earth-based radar images of near-Earth asteroid (4179) Toutatis, made using the NASA Goldstone DSN antennae on 1992 December 8, 9, 10, and 13, when Toutatis made a close approach (approx. 4 million km) to Earth. The radar illumination is from the top in each image, and each shows the asteroid in a different orientation. Toutatis is an irregularly shaped object of roughly 4.6×2.4×1.9 km, which appears to consist of two bodies in close contact. *NASA*

## An annular–total solar eclipse

*From Mr Alex Vincent*

On 2005 April 8 there will be an annular–total eclipse of the Sun, visible from Panama and Colombia. In this type of eclipse (called a hybrid) it is annular in the morning, total at local apparent noon and annular in the evening. The duration of annularity and totality are quite short and the ring of Sun around the Moon's limb is very thin. The total section is in the centre of the eclipse track because the Moon is 6000km closer to the Earth and therefore its umbra just touches the surface.

The last annular–total eclipse visible from Britain took place on 1858 March 15 and the next will be on 2545 April 12. The eclipse of AD 143 May 2 entered Wales as total, but was annular by the time it reached England. In the 1858 event, only the annular phase was visible from Britain, but in the case of the 2545 event totality will be seen across these islands.

If an annular–total eclipse is observed on the centre line just outside totality, then a complete ring of Baily's Beads known as a 'pearling eclipse' is seen, which must be a magnificent sight. Also it is possible to see more than one diamond ring effect at the same time in the right place, which would also be a grand sight.

An idea would be to travel under the Moon's shadow to record the event from start to finish, to see the eclipse go from annular to total and then back to annular. This would have to be done from a height of 30,000 feet or more and would mean that there would be more totality as one is nearer the umbra. Preparation could be made for the next annular–total eclipses on 2013 November 3, 2023 April 20, 2031 Nov 14, 2049 Nov 25 or 2050 May 20.

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