



CHRONOLOGY & CATASTROPHISM

REVIEW 2024:1

‘Writings of the Historians of the Roman and Early Medieval Periods’ Revisited, Part 4 by Trevor Palmer

An ancient Venus portent: comet or mirage? by Marinus Anthony van der Sluijs

The Hittite New Kingdom and Lydia by Barry Curnock

plus Society News



An electrum coin from the reign of Alyattes, King of Lydia, circa 610-560 BC, containing the inscription ‘Kukalim’ in Lydian script, which translates as belonging to Kuka / Gyges, the ancestor of Alyattes and the progenitor of the dynasty.

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Society for Interdisciplinary Studies ISSN 0953-0053

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An ancient Venus portent: comet or mirage?

Marinus Anthony van der Sluijs

... the discoverie of a truth formerly vnknowne,
doth rather conuince man of ignorance, then nature of error.

– Walter Raleigh (1614) [1]

Varro's Venus portent and the catastrophists

Towards the end of his famous work *On the City of God against the Pagans*, the Numidian theologian and bishop Augustine of Hippo (354-430) had a section entitled 'That it is not contrary to nature when, in an object whose nature is known, something starts to be different from what was known' [2]. Under this sage heading, he quoted Rome's preeminent intellectual Marcus Terentius Varro (116-27 BC; fig. 1) *verbatim*:

In the sky ... appeared a marvellous portent; for on the very renowned star Venus, which Plautus terms 'Vesperugo', Homer 'Hesperos', calling it most beautiful, Castor writes that a portent appeared, such that it changed colour, size, shape, course; which happened neither before nor after in this way. Adrastus of Cyzicus and Dio of Naples, esteemed mathematicians, said that this happened under king Ogygus [3].



Figure 1: Marcus Terentius Varro (116-27 BC): Venus was transformed once, in the time of Ogygus. Imaginary portrait. A. Thevet, *Les vrais portraits et vies des hommes illustres* [...], vol. 3, 1584, p. 598r.

The operative words are that Venus 'changed colour, size, shape, course' (*mutaret colorem, magnitudinem, figuram, cursum*). Augustine was struck by the profoundness of the event:

... when He so willed who by His supreme command and power rules what He created, the star most known compared to others for its size and brightness altered its colour, size, shape and (what is more marvellous) the pattern and rule of its course. He definitely upset the astronomers' tables then, if there were any already ... [4]

This snippet of information was grist to the mill of many a catastrophist. Velikovsky, of course, made it a pillar of his 'comet Venus' theory. [5] It was, in fact, this very passage that put him on the track of thinking about planets shifting orbits. He came across it in the last week of October 1940, in a volume from 1864 by Charles-Étienne Brasseur de Bourbourg, held in the library of Columbia University, New York. [6] This eccentric French savant-priest had compared the prodigy to an Aztec tradition in which the morning star Tlāhuizcalpantēuctli and other deities fall from the sky at the deluge [7]. He envisioned assorted terrestrial disasters troubling the atmosphere and hence the appearance of astronomical objects – not "a cosmic disturbance in which planets participated", as Velikovsky was keen to point out. As it turns out, however, Velikovsky was not original with his more provocative understanding along such lines.

Bellamy *alias* Schindler (1948) had "intelligently" treated Varro's account as proof of Earth's capture of a former planet to become the moon some 13,500 years ago; [8] Braghine (1938) enlisted it as evidence for Venus' adoption of its current orbit, smaller than before, under the gravitational influence of a giant comet around 4000 BC; [9] Beaumont (1925, 1932) used it as an example of another planet than Earth changing its orbit in response to dumping of cometary matter on it; [10] Radlof (1823) took it to be a record of Venus' origin as a fragment of a giant planet that had orbited between Mars and Jupiter and exploded mere millennia ago; [11] the Count of Carli-Rubbi (1778) related it to a comet that supposedly also devastated the earth, in the style of Whiston, around 4000 BC; [12] the Count of Boulainvilliers (1722) suspected that the disruption consisted in a deluge or conflagration on Venus; [13] Huet (1690) grouped it with a whole catalogue of classical, Biblical and Chinese reports about sudden mutations in the movements of celestial bodies; [14] and Burnet (1684) made much of its simultaneity with "the great Deluge":

This is a great presumption that she suffer'd her dissolution about the same time that our Earth did. I do not know that any such thing is recorded concerning any of the other Planets, but the body of *Mars* looks very rugged, broken, and much disorder'd [15].

Earlier still, Johann Hewelcke touched on the topic in his magisterial *Cometographia* of 1668. Better known as Hevelius, this German-Polish mayor and astronomer toyed with the possibility that something extraordinary had occurred in the denser matter around Venus, like de Boulainvilliers did after him, but he provided no details and preferred to conjecture that Venus suffered a loss of atmosphere on the calamitous occasion [16]. This sentiment would seem to qualify him as the earliest known theorist of catastrophes on other planets [17]. Had he lived in the scholastic age, he might not have got away with the heresy of postulating change in the supralunar heavens, limited though it was to a few words buried in a heavy Latin tome. Just a few decades later, after Burnet had gone to press, Isaac Newton's law of gravitation once more "pulled down the curtain on the use of ancient sources as an inspiration" for any research showing that "the solar system may have a history", as Stecchini aptly remarked [18].

What to make of all this?

A fresh look

Augustine's testimony invites no less than seven essential observations. First, there is no indication that the incident belonged to myth or other folklore, except the mention of Ogygus. Second, Varro learned about it in the writings of Castor of Rhodes, a Greek grammarian and rhetorician who probably lived in the 1st century BC, close in time to Varro. These writings are not extant but included a chronicle and a treatise on chronological errors. Third, the association with Ogygus or Ogyges was apparently not in the original report, but only in commentary by Adrastus of Cyzicus and Dio of Naples. Although 'esteemed' (*nobiles*) to Varro, these two are utterly obscure today. Even so, the Cytherean event was clearly felt to be of some antiquity. Fourth, the names *Vesperugo* (Latin) and *Hesperos* (Greek) are specific to the evening star. Fifth, the episode was inconsequential, for Augustine went on: 'the changed course of that star did not long continue, but it returned to the usual one' [19]. Sixth, nothing is said about the spatial extent of the anomaly. This more likely points to a small scale than a large one. And seventh, sweeping though it may be to combine colour, shape, size and course in a single metamorphosis, that most characteristic element of a comet is not spelled out – the tail. All this amounts to an innocuous fleeting affair in the evening sky, at the dawn of Greek history, which need not have evoked a comet.

In a contribution published in these pages in 2010, I contemplated temporary visibility of Venus' magnetotail as an explanation for a number of ancient traditions, but was not satisfied that that would work for the Varro passage [20]. Four years later, I came around to the 'pseudocomet' with visible magnetotail after drawing a blank with atmospheric-optical effects such as the 'green flash'; the latter could well have been responsible for Venus' alteration in colour, if not also size and shape, but fell short of explaining the change in orbit [21]. At that time, I had not yet seen Bob Forrest's insightful take on the subject. Forrest rightly called the portent's catastrophic nature into question and noted that the changes were fully reversed, by Augustine's own account. He confidently fingered "a freak of atmospheric refraction" as the cause of all four types of change involved, citing one modern case of a "dancing Venus" from Corliss' compilations [22]. This assessment is surely conclusive and so I rescind my previous judgments on this score.

Solutions in visual misperception

This result can be fleshed out with some historical context. A chain of thinkers parallel to the early catastrophists sought the answer in the category of transient events that only made it appear as if something dramatic befell Venus. Two developments set the stage for their deliberations. Galileo's telescopic discovery of Venus' phases in 1610 was a watershed. The other factor was a popular confusion of Venus with comets. Kepler, in a letter to his mentor dated 11 June 1598, anecdotally told of 'our countrymen calling the star Venus seen by day a comet' [23]. Evidently, some folks had spotted Venus in the daytime, as happens sometimes, and in their bafflement deemed it to be a comet. Kepler reassured them that no 'star' was more benevolent than this one [24]. The same mindset surfaced in Italy during the 'comet fever' of 1618. In the autumn of that year, three successive comets appeared. When the rumours of the first one arrived, the Jesuit priest, astronomer and architect Orazio Grassi (1583-1654) was sceptical about their reliability:

In the August month, news was conveyed to us from many parts of Italy that during those days a Comet was seen licking the hind feet of the Great Bear. But we, who had heard that Venus repeatedly was a Comet instead to ignorant commoners, suspecting something similar this time as well, considered those vigilant watchmen easily deluded ... [25]

The last of the three was a Great Comet, which reinforced the sensationalism:

... and it happened at last that people had no greater concern than inspection of the Sky, and if Venus chanced to sparkle more brilliantly than usual, it was changed into a Comet: If at sunset a cloud was not immediately taken away but formed a cross, it was considered an omen instead. But so thinks the public for itself, lighter than a feather ... [26]

As a sidelight, Velikovsky construed these words as evidence for a cultural memory of Venus as a comet surviving into 17th-century Europe [27]. That is a disingenuous stretch, because the populace then as now knew full well that Venus and comets are different, but lacked the acuity to tell them apart in practice sometimes, not least when bent on seeing a comet. A modern analogy could be the way that ‘unidentified flying objects’ (UFOs) sometimes turn out to be nothing more than naïve misperceptions of Venus – or the moon, for that matter. What is more, the Spanish ambassador at Isfahan, García de Silva y Figueroa (1550-1624), found the third comet of 1618, as it rose due east, to be initially ‘maned or long-haired, with a common form, a colour similar to Venus, and similar to it in size, or a bit larger.’ [28] Venus was then in the evening sky, but one can cut the great unwashed some slack.

Back to the subject at hand, the Italian physician and philosopher Fortunio Liceti (1577-1657) took these precedents on board when he investigated the Varro passage in his book on novae and comets, published in 1622 [29]. He conceded that variations in Venus’ hue, form and size are genuinely seen, but only by telescope, while the orbit is at any rate immutable. The recent popular delusion of Venus as a comet prompted his speculation that a nova had anciently been misidentified as Venus when it shone in the spot where this planet had been just before its regular disappearance in the sun’s overwhelming glow. This stab at a uniformitarian approach, positing no radical changes anywhere in the solar system, was arguably the first in history for this particular problem.

Hewelcke settled for a physical transformation of Venus itself, as seen, but not before briefly considering a third scenario: subtle changes in the *earth’s* atmosphere. Nicolas Fréret (1688-1749) was a French mythologist and historian who dedicated an entire article to this puzzle in 1732 [30]. In this, he rejected all of Hewelcke’s thought experiments and came



Figure 2: Walter Raleigh (c1552-1618): it was because of unusual conditions in the earth’s atmosphere that Venus appeared to change its properties in the time of Ogyges. Portrait engraved by Simon van de Passe (c1595-1647) in 1617, with Raleigh pointing to Guyana on a globe. Used as the frontispiece to the third edition of Raleigh’s *The History of the World*, but also separately published. John Carter Brown Library, Providence, Rhode Island.

[https://commons.wikimedia.org/wiki/File:Sir_Walter_Raleigh_by_Simon_van_de_Passe_\(1617\).jpg](https://commons.wikimedia.org/wiki/File:Sir_Walter_Raleigh_by_Simon_van_de_Passe_(1617).jpg)

up with an alternative based on mistaken identity, similar to Liceti’s attempt but with a more credible agent than a nova. Ingeniously, he traced Castor’s statement to the actions of a comet – the progenitor of the Great Comet of 1680 no less – that would have appeared as an evening star in the place where Venus had just completed that phase and vanished from sight. Nicolaas Struyck (1686-1769), a Dutch mathematician, kept an open mind to this idea [31]. Alexandre Guy Pingré (1711-1796), French astronomer and naval geographer, seconded it resolutely [32]. By contrast, his later compatriot Dominique François Jean Arago (1786-1853) made passing mention of the Varro quote in a chapter on Venus’ sporadic visibility in full daylight, hinting that that was the best key. In doing so, he was economical with the truth when he only listed the planet’s changes “in brightness and colour”, leaving out those in size and orbit [33]. Most recently, Keith Mills has wondered whether “what was observed was a meteoritic fireball in the apparent vicinity of Venus” [34].

Yet not everyone was happy to dismiss atmospheric refraction as a solution. It may have been what Brasseur de Bourbourg was driving at, but others were more explicit in this regard. Enter Walter Raleigh (c1552-1618; fig. 2), ill-fated man of letters and explorer in the Elizabethan era. Writing from the Tower of London prior to 1614, in-between his quests for El Dorado, his starting point was what the flood of Ogyges would have done to our atmosphere:

And surely it is not improbable, that the floud of *Ogyges*, being so great, as Histories haue reported it, was accompanied with much alteration of the ayre sensibly discerned in those parts, and some vnusuall face of the skies. [35]

The Ogygian state of astronomy would not yet have been advanced enough to ascertain a variation of orbit, said Raleigh, but the damp air could readily have affected Venus’ apparent colour and size: “Of the colour and magnitude, I see no reason why the difference found in the

starre of *Venus* should bee held miraculous; considering that lesser mistes and fogges, than those which couered *Greece* with so long darknesse doe familiarly present our senses, with as great alterations in the *Sunne* and *Moone*.” [36] As for shape, Raleigh fell back on Venus’ phases, which the peculiar conditions of Ogyges’ time might have magnified:

That the figure should vary, questionlesse it was very strange: Yet I cannot hold it any prodigie: for it stands well with good reason, that the side of *Venus* which the *Sunne* beholdes, being enlightened by him, the opposite halfe should remaine shadowed; whereby that *Planet*, would vnto our eies, descrying onely that part whereon the light falleth, appeare to bee horned, as the *Moone* doth seeme; if distance (as in other things) did not hinder the apprehension of our senses.

Galileus, Galileus, a worthy *Astrologer* now liuing, who by the helpe of perspectiue glasses hath found in the starres many things vnknown to the ancients, affirmeth so much to haue beene discovered in *Venus* by his late obseruations. Whether some waterie disposition of the aire might present as much to them that liued with *Ogyges* as *Galileus* hath scene through his instrument; I cannot tell ... [37]

Unlike Raleigh, the English theologian Erasmus Warren (c1642-1718) is now almost forgotten. He published a book-length rebuttal of Burnet’s theories in 1690. Praising Raleigh in it as “no bad Historian”, [38] he had obviously taken a leaf out of his book when, on the preceding two pages, he took the same stance regarding the Varro quote:

... we need not impute this ... to her then present *dissolution*: but rather to the disposition and temperament of the Air, which perhaps will be able to solve all the *Phænomena*’s. For grant but *that* to have been full of moist Vapours, and of a constitution so watry, as it never was before nor since (which it might very well be, and could scarce be otherwise about the time of the Deluge) *Venus*, by unusual refraction of her Beams would easily put on a different *hue*, and larger *Phase* than she used to wear. The same Air also might alter her *shape*, while the humid *medium*, performing the part of a *Telescope*, truly represented her *gibbous*, *corniculate*, or the like [39].

Even Venus’ swerving formed no obstacle to Warren:

And then it might put her *Course* into seeming Disorder too. For the Air above being unequally thick, and subject at times to uneven agitations; as it chanced to be variously driven or moved, might fling the Planet into unsteadiness as to appearance, or into a kind of fluctuating or salient Motion in the Eyes of Spectators. ... the Air which was then so out of order too as it never was before or after, might be the cause of all [40].

Venus’ atmospheric makeovers

Such optical distortions are rare indeed, but not quite as unique as Warren believed them to be. Nor do they require a diluvial cataclysm. Some of the more salient instances recovered from historical sources will be reviewed here (fig. 3).

For 16 March AD 904, the annals of the Chinese Táng dynasty have this omen: ‘In the evening, Venus was seen west of the Pleiades, its colour red with flames like fire’. The next night, ‘it had a triple horn like a flower and was swaying’ [41]. An American Orientalist gathered that this was about some fixed “tricornal peak of the Pleiades”, which he connected with iconography from Mesopotamia to Japan [42]. It is a contrived argument, however. If correct, why would the tricorn have been included in the omen? There is no change of grammatical subject between the two clauses [43]. Therefore, the natural sense is that it was Venus that exhibited these forms in a mirage.

John Gadbury (1627-1704; fig. 4) was an astrologer in Westminster, who kept a weather diary that was published posthumously. For 29 January and 21 February 1686 (Old Style), it reads: “☿ like a *Comet*.” [44] (fig. 5). Though there is little else to go on, this presentation may have entailed a tail of some sort, but what sort exactly? Hawke rediscovered these curious entries in 1948 and surmised that “the rays of the planet were reflected from a cloud of ice-flakes floating with their bases slightly inclined relative to the horizontal position”, so that “Venus, when near setting, might be seen to grow a ‘tail’, just as the sun sometimes becomes surmounted by a shaft or pillar of light in similar circumstances.” [45] Such ‘Venus pillars’ are certainly not unheard of (fig. 6) [46]. The oldest incontrovertible example known to date is from 18 February 1820 and has Venus’ actual body elongate perpendicularly in the process [47]. The German and Italian peasants of a few generations prior deserve some more exoneration in light of such possibilities.

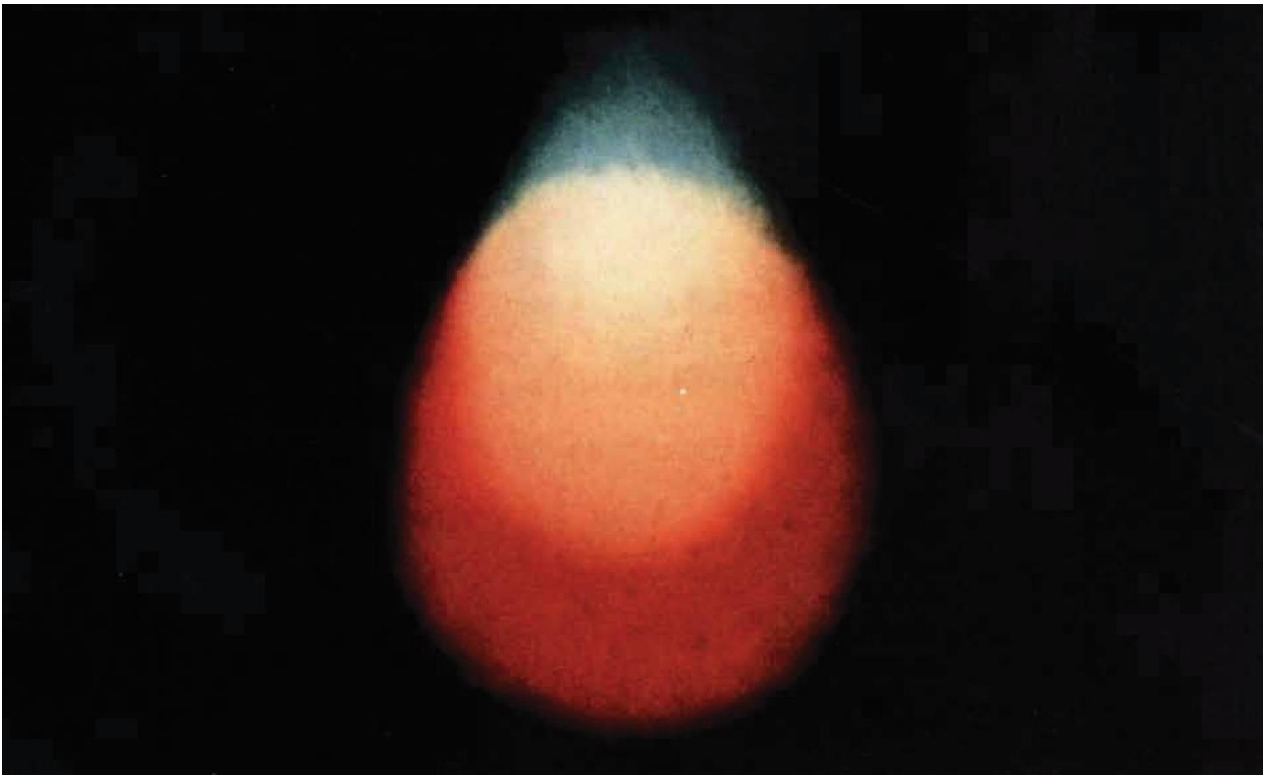


Figure 3: Venus setting with a range of overlapping colours from blue-green at the top to red at the bottom, due to atmospheric dispersion. To the eye, the blue was at least twice as elongated as shown. Best viewed in colour. Photographed *c*1959 on Kodak Ektachrome film with a refracting telescope 20 feet in focal length, at Castel Gandolfo, Holy See. © Carl Treusch (1906-1995). D. J. K. O’Connell, in *Scientific American*, 202 (1960), p. 115 bottom.

Baum adduced what he dubbed the ‘Mädler phenomenon’ [48]. This is the singular and still mysterious observation made by Johann Heinrich von Mädler (1794-1874) on the evening of 7 April 1833, close to Venus’ inferior conjunction: a number of rays emanated from Venus’ illuminated limb in the direction away from the sun, reminiscent of a broad, fan-tailed comet (fig. 7) [49]. Fascinating, but it was seen through a telescope magnifying 140 times and accordingly has less of a bearing on Castor’s words. For those, mirages still have the edge, if only because of Venus’ purported departure from its wonted path.

In Europe, the observational history of such displacements could be said to begin on the early dawn of 22 June 1799, when the celebrated Prussian naturalist and explorer Friedrich Alexander, baron von Humboldt (1769-1859), beheld what he later described as an ‘undulation of stars’ (*Sternschwanken*) from Teide, the volcanic peak of Tenerife [50]. He experienced this only once in his career. Living in a time when mirages were still poorly understood, he would not rule one out, intuited a rôle for thermal layers and asked observers of like spectacles to come forward. He was not disappointed. The young astronomer Eduard Ludwig Vogel (1829-1856) responded from Libya, having just embarked on an expedition from which he was sadly never to return. His letter told of the caprices he had seen Venus making at its setting on the early evening of 1 July 1853, from the mountains of Tarhuna, near the coast of western Libya:

When I happened to turn my eye to this star on the evening of the said day, I saw it swaying back and forth in vivid motion now from right to left, now from top to bottom. It was at most two degrees above the horizon at that time. The motion did not amount to more than a lunar diameter in any direction. The twilight was extremely weak already [51].

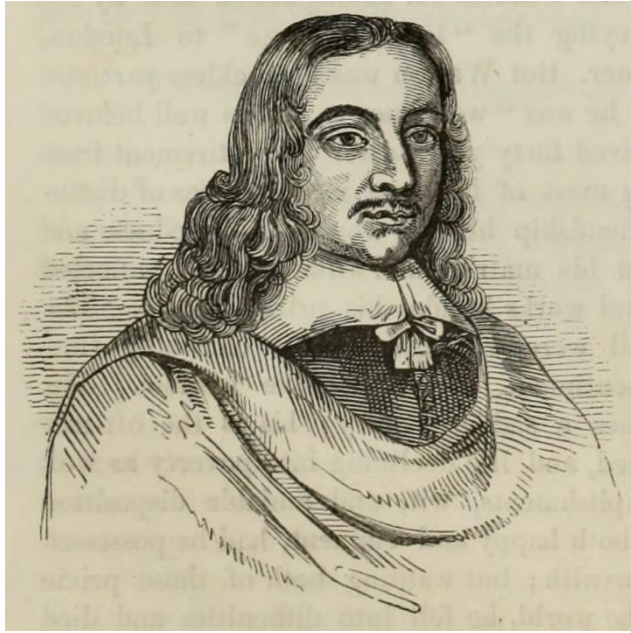


Figure 4: John Gadbury (1627-1704). Engraved in 1658. Ch. Knight, *Old England* [...], vol. 2. 2, 1845, p. 240 fig. 2157.

224		<i>A Diary of the Weather.</i>	
15	Cldy, calm, dry, wd, S.	15	Like the former.
16	Cldy, mif. p. Sn. n. gr. w. SW	16	Frost, cold, pleaf. wd, W.
17	☉ Mift m. Fair. Ra. n. gr. w. W	17	Fr. cold, fair, W. Halo
18	Cold cldy, Ra. n. gr. w. W.	18	Cldy, sharp wd, N. VV.
19	Much ra hail, f. fi. w. W.	19	Mifty m. Mifle p. wd, west.
20	Cold & moist, wd, N. VV.	20	Frost m. Mift p. wd, N. W.
21	Mift, hard frost, wd, west.	☉	Fr. fair, W. ♀ like a Comet.
22	Frosty, pleafant, wind,	22	Cloudy, cold, wd, west.
23	west, great Circle a-	23	} Cloudy, cold, wd, west.
24	bout 23d. at nig.	24	
25	Frost, fog, m. Pleafant,	25	} Frost, cold, cloudy, wd,
26	wind, north.	26	
27	Rainy, cldy, wind, S. VV.	27	north east.
28	Fr. m. Thaw noon. Tem. n.	☉	Fr. fair, very cold, N. E.
29	Temp. of wd, ra. contin.		
	♀ like a Comet.		
30	Fr. pleaf. wd, VV. Halo ♀		
	Cldy, rain, great wds, W.		
March 1686.		April 1686.	

Figure 5: A portion of John Gadbury’s weather diary, showing the two occasions in early 1686 when Venus looked “like a Comet”. As printed in J. Gadbury, *Nauticum Astrologicum* [...], 1710, p. 224.



Figure 6: ‘Pillars’ above and below Venus as it set on 12 April 2010. © John Gauvreau, of Hamilton Amateur Astronomers, Canada. <https://www.amateurastronomy.org/venus-pillar/> (Used with permission)

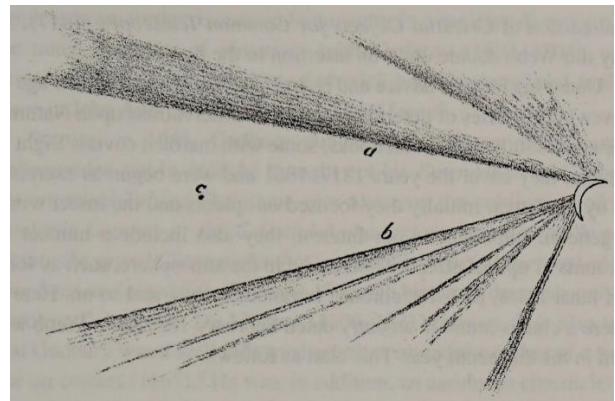


Figure 7: The Mädlar phenomenon: brushes of light emanate from the extremities of Venus’ illuminated limb, as seen by Johann Heinrich von Mädler around 8 o’clock in the evening of 7 April 1833. Seen at a magnification of 140. Drawing. G. Beer & J. H. Mädler, *Fragments sur les corps celestes du systeme solaire*, 1840 = W. Beer & J. H. Mädler, *Beiträge zur physischen Kenntniss der himmlischen Körper im Sonnensysteme*, 1841, plate III bottom.

Vogel saw more of these oscillations: of Venus again over the following evenings, and of Sirius and Regulus in the two subsequent months. The case of Sirius reminded him of a comparison a peer had made not long before – with the flight of ‘a paper dragon with a lantern attached to it’ [52]. He worked out that twilight and an altitude below 10° are requisite, the motion being parallel to the horizon for an altitude of 5° or 6° [53].

Under the catchy heading ‘Jumping Stars’, an anonymous editor brought these and some other examples to his readers’ attention in the October 1888 issue of *The Observatory* [54]. This elicited several replies. Seven or eight personal observations, including some of Jupiter shaking, had inspired astronomer William Henry Maw (1838-1924) to classify the phenomenon as an inferior mirage, to use its modern designation, and determine its main constraints. Among these was that the object be bright and at an elevation of some 5° to 8°, while “the line of sight should cross a district having a temperature above that of the air.” [55] John Ballot (1858-1922), an amateur geologist and astronomer, wrote in from South Africa with “a remarkable case” of “jumping by the planet Venus”, which he had witnessed on the evening of 16 April 1882. He had penned the following in his notebook:

Venus scintillating very decidedly; on nearing horizon she suddenly, and to my astonishment, began to jump in a zigzag manner, and seemed to sink on and set behind horizon more rapidly than she would under ordinary circumstances ... Scintillation seems to affect all the stars to-night. Capella twinkles magnificently. Sirius is more steady, so also Canopus; but the stars of Crux Aust. and all stars at lower altitudes, even of small magnitude, scintillate decidedly. Thus this strange zigzag motion may be an optical illusion, or be some freak of refraction. [56]

Ballot reflected that Venus’ zigzagging had “happened during the short twilight, and so far as I remember, while the planet was still about 5° or 6° above horizon. The sky was clear, except for a few streaks of cloud round western horizon.” He recalled his puzzlement at the time:

I felt certain of the apparent jumping motion of the planet; but was it due to my eyes or to some freak of refraction only, such as an eddy or series of eddies caused by layers of differently heated and vapour-laden air suddenly rising across the line of sight? For after looking at it for a few minutes, I also fetched and directed a field-glass at the planet, but could see no sign of motion again. [57]

Ballot’s suspicion of anomalous refraction is undoubtedly spot on. In retrospect, the low-lying “streaks of cloud” suggest a ‘blind strip’ or ‘haze zone’. First defined by Alfred Lothar Wegener in 1918, this is a narrow horizontal dark or grey band of atmospheric absorption centred on the astronomical horizon [58]. It results from an atmospheric duct produced by thermal inversion, which guides rays around the curve of the earth. Framing a superior mirage, it maintains a constant width and forms over ideally flat featureless terrain. A special case with a very long duct is the classic Novaya Zemlya effect, which deforms the sun into a dim or dark red, stratified rectangle. When, to Ballot, Venus “seemed to sink ... more rapidly than she would under ordinary circumstances”, chances are that it actually slipped into the blind strip and had been appearing higher than with normal refraction all along. The blind strip can also be recognised in the “fog bank, very uniformly extended”, that von Humboldt noticed on the morning of the librating stars and identified as the reason why the ensuing sunrise lasted three times longer than normal [59].

Shapeshifting may go as far as a complete duplication of the planetary form, though not necessarily to the naked eye. Astronomer John Evershed (1864-1956) saw a second image of the setting Venus, along with the elusive ‘green flash’, from the coast of Algeria in May 1900:

Observing with a 3-in. inverting telescope, I saw the planet when very near the horizon suddenly change in colour from dull red to vivid green, and as I lowered the telescope to the point where the sea horizon about bisected the field of view I was amazed to see *two* green images of Venus, one, the normal image, ascending from below, and the other sloping down from above. This was probably reflected from the sea itself. The setting took place at the moment of meeting of these two images. The whole apparition, from the moment when the colour changed from red to green, to the instantaneous disappearance of the two images, cannot have lasted more than four or five seconds. The sea about this time was found to be excessively cold, although the air was hot during the daytime, and this state of things would doubtless favour the production of a relatively dense layer of air on the surface of the sea in calm weather. [60]

In September 1922, Evershed was at sea between northwest Australia and Java when he watched a repeat occurrence. This time around, there was no question of reflection in sea water:

... I was able to observe also what happened when Venus set in the sea. On this voyage the ordinary mirage effect was conspicuous, that is, distant land appeared raised above the sea horizon by a small interval, due to the total reflection of sky and land at the surface of a thin layer of air of low density in contact with the sea. ...

The striking thing about the setting of Venus was the sudden appearance of a reflected image moving upwards to meet the descending image, and the instantaneous and conspicuous change of colour from dull red to green at the moment of meeting of the two images. The vertical spectrum of the planet caused by atmospheric dispersion was at no time visible in the binoculars, but the change of colour was probably due to the setting of the lower red of the spectrum. It seems to me evident from these observations that the mirage layer greatly intensifies the ordinary dispersion effect, by adding the light from the reflected image to the direct image at the moment of setting. [61]

Similarity of Venus to a comet again impressed itself upon the mind of Arnold Henry Savage-Landor (1865-1924) once. On the evening of 25 May 1911, this Italian-English painter and explorer was encamped at the foot of the Paredão Grande in the central-Brazilian state of Mato Grosso:

... we saw to the west-northwest, quite low on the horizon, a brilliant planet – possibly Venus. The stars and planets appeared always wonderfully bright and extraordinarily large on fine nights. Whether it was an optical illusion or not I do not know, but a phenomenon, which lasted some hours, was seen by all my men, and appeared also when the planet was seen through a powerful hand telescope. It seemed to discharge powerful intermittent flashes, red and greenish, only toward the earth. Those flashes were similar to and more luminous than the tail of a small comet, and of course much shorter – perhaps four to five times the diameter of the planet in their entire length.

Whether this phenomenon was due to an actual astral disturbance, or to light-signalling to the earth or other planet, it would be difficult, in fact, impossible to ascertain, with the means I had at my command. Perhaps it was only an optical illusion caused by refraction and deflected rays of vision, owing to the effect upon the atmosphere of the heated rocky mass by our side and under us, such as is the case in effects of mirage. I am not prepared to express an opinion, and only state what my men and I saw, merely suggesting what seem to me the most plausible explanations. [62]

Retrocalculation confirms that the traveller was looking at Venus. He expanded on how the variegated flashes modified its shape: “At moments the planet seemed perfectly spherical, with a marvellously definite outline, and then the flashes were shot out especially to the right, as one looked at the planet, and downward slightly at an angle, not quite perpendicularly.” [63] This description is rather suggestive of the Mädlar phenomenon, but are ice-crystals the inevitable explanation? That a superior mirage with blind strip was at play can perhaps be gleaned from intimations of rapid temperature change and ‘delicate’ horizontally disposed strata of ‘mist’:

That night, May 25-26, was cold: minimum 58° Fahrenheit. But during the day, at nine a.m., the thermometer already registered 85° Fahrenheit. The sky ... developed later in the day into a charming mackerel sky, with two great arches of mist to the south, and delicate, horizontal layers of mist near the earth. [64]

The scene recurred: “Again during the night I saw to the west the phenomenon of the previous evening repeated: the strange flashes directly under and occasionally to the left of the brilliant planet, that is to say to the right of the person observing it. This was from Camp Areal ...” [65] The morning after again revealed “heavy, horizontal clouds low in the sky” [66].

The American anomalist Charles Hoy Fort (1874-1932) released his iconoclastic book *New Lands* in 1923. It spoke of “striking data indicating that, whether conceivable or not, luminous objects have appeared from somewhere, or presumably from outer space, and have been seen temporarily suspended over the planet Venus.” [67] None of the data marshalled in that chapter deal with Venus as such, but the examples examined above *a priori* tip the balance towards plain meteorological effects rather than Fort’s alien astronauts.

Closer to the present, one Captain W. Wigham on the merchant vessel *San Veronico* logged another instructive manifestation in the Caribbean, at 16°40’ N, 62°20’ W. The date was 28 December 1952, the local time 21.10:

Venus was about to set. When at altitude 45’ the planet was bright, its colours alternating red and white; it appeared as a flare. At altitude 20’ Venus appeared to increase in size to about three or four times normal. At altitude 10’ an image appeared immediately above the planet then suddenly disappeared, and was replaced by an image below the planet. This happened four times in quick succession. Before finally setting the planet appeared elongated to a vertical white streak which immediately turned a bright green. All these changes were visible to the unaided eye. [68]

The editor inferred that “extreme conditions of abnormal refraction prevailed near the horizon on this evening and that they were subject to rapid changes.” [69]

Rounding off this survey, others testified to Venus’ doubling at setting again. On the Indian Ocean (at 1°40’ N, 84°32’ E), J. C. Vint, supernumerary second officer on SS *Strathnaver*, saw it on 6 December 1957, with concomitant colour changes from orange to red and then green (fig. 8 top) [70]. Another case was observed on 11 November 1965 in the Gulf of Aden (at 12°35’ N, 44°37’ E) by M. H. Murray, third officer on the merchant vessel *Delphic* (fig. 8 bottom):

At 1744 GMT when Venus was about to set, bearing 237°, it changed from yellowish white to red. Shortly afterwards the planet appeared double, i.e. with a red image a short distance beneath the true disc. The image was below the horizon line and it gradually rose to meet the horizon as Venus decreased in altitude. At the moment of disappearing the two red discs coalesced and for an instant changed to a light green colour. [71]

Dutch physicist Siebren van der Werf, who has considerable expertise in mirages, was kind enough to produce ray trajectories, temperature and transformation curves, and even a video simulation of these observations as a so-called ‘mock mirage’, in which the observer looks down on a temperature inversion. His analysis replicates the shifting colours and apparent deformations, but the jittering was not yet modelled [72].

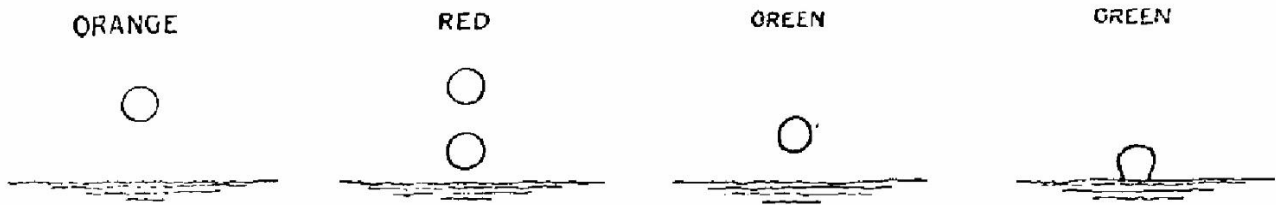
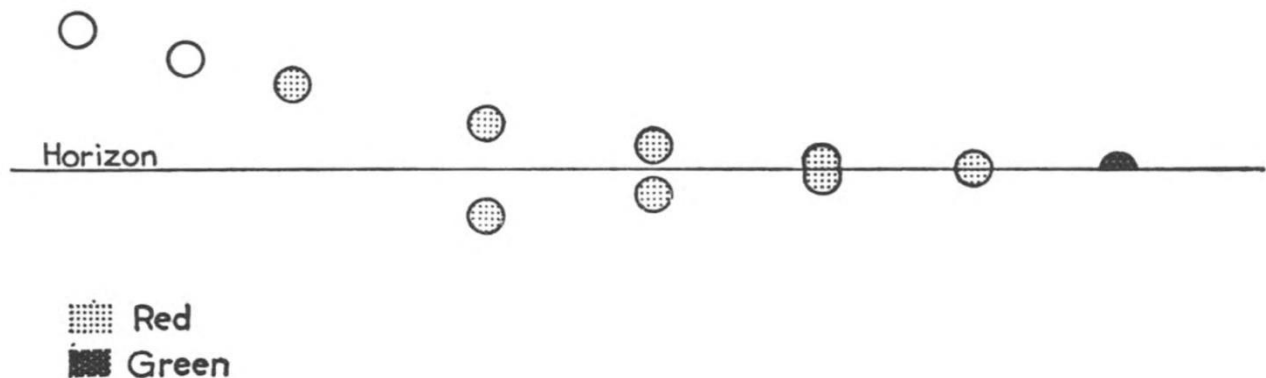


Figure 8: Venus changes colour and duplicates as it sets.

above: As seen by J. C. Vint on the Indian Ocean on 6 December 1957. I. M. Sinclair, in *The Marine Observer*, 28 (1958), p. 194.

below: As seen by M. H. Murray in the Gulf of Aden on 11 November 1965. C. A. Borthwick, in *The Marine Observer*, 36 (1966), p. 183.



Conclusion

Summing up, there are no two ways about it: ice crystals in our atmosphere can lend Venus an appendage like a comet, but – like it or not – what Castor relayed fits better with a mirage than a Venus pillar, let alone a real comet. The Holy Grail of a single contemporary parallel involving all four variables – colour, size, shape and path – lies undiscovered, but the cases enumerated above collectively prove the feasibility of such convergence. The cause may be wholly uniformitarian. Should a ‘flood of Ogyges’ have been concurrent, however local it may have been, the inundated plains may have set up a cold layer close to ground level that facilitated superior mirages.

Refractory effects on planets as a way of explaining some mythical and other historical data from around the world would make for an interesting paper and I have already collected substantial material to this end. It will have to wait for a future occasion, however. For now, suffice it to refer to my work on the ‘smoking Venus’ of Mesoamerica, [73] and, with Peter James, on the colours of planets in ancient Greek and Near Eastern astronomy, with a note on mirages. [74] Motifs like Venus’ coloured crowns, beard and hair are likely contenders in this pursuit, especially when the sources do not blame such attributes for havoc [75].

That said, neither this nor the related symbolism of haloes and so on should give *carte blanche* to a full-blown uniformitarian attitude across the board. A robust body of traditional evidence remains that is not reducible to benign quirks of the propagation of light and would be more compatible with such occurrences as cosmic impacts, geoeffective solar storms, fires and floods of magnitudes rarely seen in history, if ever.

Acknowledgments

With thanks to Huub de Mul and Phillip Clapham for helping me access pages from Raspil and Straka.

Notes and References

1. W. Raleigh, *The History of the World*, Walter Bvrre, London, 1614, pp. 100-101.
2. “*Non esse contra naturam, cum in aliqua re, cuius natura innotuit, aliquid ab eo quod erat notum incipit esse diversum.*” Varro, *De Gente Populi Romani (On the Race of the Roman People)*, in Augustine, *De Civitate Dei contra Paganos (On the City of God against the Pagans)*, 21. 8, eds. B. Dombart & A. Kalb, *Sancti Avrelii Avgvstini Episcopi De Civitate Dei Libri XXII*, vol. 2: *Lib. XIV-XXII*, B. G. Tevbnerus, Stuttgart, 5th edition, 1993, p. 503. All translations are my own, except where indicated otherwise.
3. “*In caelo ... mirabile extitit portentum; nam stella Veneris nobilissima, quam Plautus Vesperuginem, Homerus Hesperon appellat, pulcherrimam dicens, Castor scribit tantum portentum extitisse, ut mutaret colorem,*

- magnitudinem, figuram, cursum; quod factum ita neque antea nec postea sit. Hoc factum Ogygo rege dicebant Adrastos Cyzicenos et Dion Neapolites, mathematici nobiles.” *ibid.*, p. 504. I omit *in* before *stella* as it is absent from the manuscripts (p. 504 note). J. E. C. Welldon (*S. Aurelii Augustini Episcopi Hipponensis De Civitate Dei contra Paganos Libri XXII* [...], vol. 2, Society for Promoting Christian Knowledge, London, 1924, p. 536) opted for *stellam ... nobilissimam* in some manuscripts as the harder and therefore probably authentic reading, which would have been ungrammatical from the start. The citation from Plautus is of *Amphitryo*, 275, that from Homer of *Iliad*, 22. 318.
4. “... quando ille voluit, qui summo regit imperio ac potestate quod condidit, stella prae ceteris magnitudine ac splendore notissima colorem, magnitudinem, figuram et (quod est mirabilius) sui cursus ordinem legemque mutavit. Turbavit profecto tunc, si ulli iam fuerunt, canones astrologorum ...” Augustine, *De Civitate Dei*, 21. 8, eds. Dombart & Kalb, *op. cit.* [2], p. 505.
 5. I. Velikovsky, *Worlds in Collision*, The MacMillan Company, New York, 1950, pp. 158-159, 171; ‘Answer to Professor Stewart’, *Harper’s Magazine* (June 1951), p. 64; ‘Venus – A Youthful Planet’, *Yale Scientific Magazine*, 41. 7 (April 1967), p. 8.
 6. I. Velikovsky, *Stargazers and Gravediggers; Memoirs to Worlds in Collision*, William Morrow and Company, New York, 1983, pp. 39-40.
 7. [Ch.-É.] Brasseur de Bourbourg, *S’il Existe des sources de l’histoire primitive du Mexique* [...], Maisonneuve et C^{ie}, Paris, 1864, p. 48; cf. R. Forrest, *Velikovsky’s Sources: Worlds in Collision; A Study of an Interdisciplinary Fantasy*, Donald Keith Mills, Aspley Guise, 3rd edition, 2024 (1981), pp. 735-737; M. A. van der Sluijs, *Traditional Cosmology: The Global Mythology of Cosmic Creation and Destruction*, vol. 6: *Miscellaneous Themes*, All-Round Publications, Vancouver, Canada, 2018, pp. 85-86.
 8. H. S. Bellamy [= H. Schindler], *The Atlantis Myth*, Faber and Faber, London, 1948, pp. 44, 72, 126, 130, 153-154 note 56.
 9. A. Braghine, *The Shadow of Atlantis*, Rider & Co., London, 1938, pp. 105, 107-110, 120.
 10. C. Beaumont [Appian Way], *The Riddle of the Earth*, Chapman & Hall, London, 1925, p. 222; *The Mysterious Comet* [...], Rider & Co., London, 1932, p. 133.
 11. J. G. Radlof, *Zertrümmerung der großen Planeten Hesperus und Phaëthon* [...], G. Reimer, Berlin, 1823, pp. 22-25, tr. A.-M. de Grazia, *The Shattering of the Great Planets Hesperus and Phaëthon* [...], Metron Publications, Princeton, NJ, 2nd edition, 2009 (2006), pp. 45-48; cf. R. [= M. A.] van der Sluijs, ‘Johann Radlof: The Father of Planetary Catastrophism’, in I. Tresman (ed.), *Quantavolution; Challenges to Conventional Science; Dedicated to Alfred de Grazia on his 90th Birthday (Dec 29, 2009)* (Knowledge Computing, 2010), p. 343.
 12. C. Carli [anonymous], *Delle Lettere Americane*, vol. 2, Cosmopoli, Florence, 1780, p. 264.
 13. [N.] Freret, ‘Réflexions sur un ancien phénomène celeste, observé au temps d’Ogygès’ (14 November 1732), *Memoires de litterature* [...], 10 (1736), p. 358. Freret cited Henri de Boulainvilliers’ *Abrégé de l’histoire universelle* without a page number. This is an unpublished manuscript held in the Bibliothèque interuniversitaire de la Sorbonne, cote: MS 2650, at <https://nubis.univ-paris1.fr/ark:/15733/mvki>. Despite much searching in the volume *Abrégé de l’histoire universelle jusqu’à l’Exode*, I have not yet succeeded in locating this passage.
 14. Petrus Danielus Huetius [Pierre Daniel Huet], *Alnetanae Quaestiones de Concordia Rationis et Fidei*, Joannes Cavalier, Caen, 1690, p. 229.
 15. Th. Burnet, *The Theory of the Earth* [...], vol. 1: *The Two First Books Concerning The Deluge and Concerning Paradise*, R. Norton, London, 1684, p. 168, cf. 278-279. This was not yet in the Latin edition: Th. Burnetius, *Telluris Theoria Sacra* [...], vol. 1: *Libri Duo Priores de Diluvio & Paradiso*, R. N., London, 1681 – see p. 108.
 16. Johannes Hevelius [Johann Hewelcke], *Cometographia* [...], Simon Reiniger, Gdańsk, 1668, pp. 372-373.
 17. This supersedes M. A. van der Sluijs, ‘Thereby Hangs a Tail’ (17 December 2014), at <https://www.thunderbolts.info/wp/2014/12/17/thereby-hangs-a-tail/> in which this title went to Burnet.
 18. L. C. Stecchini, ‘The Inconstant Heavens: Velikovsky in Relation to Some Past Cosmic Perplexities’, *American Behavioral Scientist*, 7. 1 (September 1963), p. 21, reprinted as ‘The Inconstant Heavens’, in A. de Grazia, R. E. Juergens & L. C. Stecchini (eds.), *The Velikovsky Affair; Scientism vs. Science*, University Books, New Hyde Park, NY, 1967, p. 88.
 19. “non diu mansit alius eiusdem sideris cursus, sed reditum est ad solitum”, Augustine, *De Civitate Dei*, 21. 8, eds. Dombart & Kalb, *op. cit.* [2], p. 506.
 20. M. A. van der Sluijs, ‘Plasma Mythology – A Research Programme’, *C&C Review* (2010), p. 8; cf. ‘Velikovskian Chaff and Wheat: Venus’ (27 March 2009), at <http://thunderbolts.info/tpod/2009/arch09/090327chaff.htm>; ‘Joining the Dots Part Two: The Dating Scene in the Sky’ (8 May 2009), at <http://thunderbolts.info/tpod/2009/arch09/090508dots2.htm>.
 21. van der Sluijs, *op. cit.* [17]. See also *op. cit.* [7], p. 21.
 22. R. Forrest, *A Guide to Velikovsky’s Sources*, Donald Keith Mills, Aspley Guise, 2nd edition, 2017, p. 24 (= 1987, pp. 24-25). In 1981, before Corliss had published his valuable catalogue of atmospheric anomalies, Forrest was still at a loss, in particular where the change in motion was concerned (*op. cit.* [7], pp. 385-386, cf. 545). See W. R. Corliss (ed.), *Rare Halos, Mirages, Anomalous Rainbows and Related Electromagnetic Phenomena; A Catalog of Geophysical Anomalies*, The Sourcebook Project, Glen Arm, MD, 1984, pp. 115-120; *Mysterious Universe: A Handbook of Astronomical Anomalies*, The Sourcebook Project, Glen Arm, MD, 1979, p. 125.
 23. “Cometam dixere nostrates, stellam Veneris interdiu visam”, Kepler to Michael Mästlin (11 June 1598, from Graz), ed. M. Caspar, *Johannes Kepler: Gesammelte Werke*, vol. 13: *Briefe 1590-1599*, C. H. Beck’sche Verlagsbuchhandlung, Munich, 1945, p. 229. C. Baumgardt (*Johannes Kepler: Life and Letters*, Philosophical

- Library, New York, 1951, p. 47) translated erroneously: “My countrymen maintained that they have seen at times Venus as a comet [an omen of threat and disaster].” She must have misread *interdiu* (‘in the daytime’) as *interdum* (‘occasionally, at times’). Unfortunately, she was followed in R. Baum, *The Haunted Observatory; Curiosities from the Astronomer’s Cabinet*, Prometheus Books, Amherst, NY, 2007, p. 200; ‘The Mädler Phenomenon’, *Journal of the British Astronomical Association*, 98. 6 (October 1988), p. 313.
24. Similarly, Edmond Halley (‘An Account of the Cause of the Late Remarkable Appearance of the Planet Venus [...]’, *Philosophical Transactions*, 29. 349 [July-September 1716], pp. 466, 468) informed that “about London and elsewhere” Venus was “very plainly seen in the Day time, for many Days together”, beginning on the 10th of July and about the time “when the Sun grew low”. It was “by some reckoned to be Prodigious”, but he did not specifically implicate a comet in this “Superstition of the unskilful Vulgar”. See further J. Powell, *Rare Astronomical Sights and Sounds*, Springer, Cham, 2018, p. 127; Baum, *op. cit.* [23], 2007, p. 211.
 25. “Augusto mense ex pluribus Italiae partibus perlatum ad nos fuit, visum per eos dies Cometam Vrsae maioris postremos pedes lambentem. At nos, qui Venerem subinde ignaræ plebi Cometæ loco fuisse audieramus, simile quid etiam eo tempore suspicati, vigiles illos excubitores facilè hallucinatos existimauiimus ...” Grassi [anonymous], *De Tribus Cometis Anni M. DC. XVIII. Disputatio Astronomica Pvblica Habita in Collegio Romano Societatis Iesv*, Iacobus Mascardi, Rome, 1619, p. 5.
 26. “factumq; est aliquando, vt nulla iam sollicitudo maior hominum sit, quam Cæli suspiciendi, ac si forte Venus solito splendidius scintillarit, in Cometam abierit: Si nubes ad Solis occasum non se subito abdiderit, crucemq; formauerit, monstri id loco habeatur. Sed hæc sibi habeat vulgus pluma leuius ...” Grassi, *op. cit.* [25], p. 4. O’Malley perverted *monstri id loco* (‘it ... an omen instead’) into “a monstrous thing” – in S. Drake & C. D. O’Malley (trs.), *The Controversy on the Comets of 1618 [...]*, University of Pennsylvania Press, Philadelphia, PA, 1960, p. 6. For the comets, see G. W. Kronk, *Cometography; A Catalog of Comets*, vol. 1: *Ancient-1799*, Cambridge University Press, Cambridge, 1999, pp. 333-341. See also van der Sluijs, *op. cit.* [7], pp. 59-60.
 27. Velikovskiy, *op. cit.* [5], 1967, p. 8.
 28. “jubatus seu crinitus, communi facie, colore Veneris astro similis, pariq; illi magnitudine, aut paullo majore.” García de Silva y Figueroa, letter to Alfonso de la Cueva, marquis of Bedmar (5 March 1619), ed. Christianus Severinus Longomontanus [Christen Sørensen of Lomborg], *Astronomia Danica [...]*, Ioh. & Cornelivs Blæv, Amsterdam, 1640, appendix, p. 38. For *magnitudine*, Kronk (*op. cit.* [26], p. 338) read “brightness” instead of ‘size’, but *majore* (‘larger’) supports the literal sense. Thus, e.g., [A. G.] Pingré, *Cométographie ou traité historique et théorique des comètes*, vol. 2, L’Imprimerie Royale, Paris, 1784, p. 7; [S.] Pvrchas (tr.), *His Pilgrimes. In Five Bookes*, vol. 2, William Stansby, London, 1625, p. 1535.
 29. Fortvniuvus Licetvs, *De Novis Astris, et Cometis Libb. Sex [...]*, Io. Guerilius, Venice, 1622, pp. 266-267.
 30. Freret, *op. cit.* [13], p. 359; cf. Ludovic Lalanne, commenting on [P.-H.] Boutigny, no title, *Comptes rendus des séances de l’Académie des sciences*, 85. 24 (10 December 1877), p. 1119.
 31. N. Struyck, ‘Inleiding tot de Algemeene Kennis der Comeeten, of Staartsterren’, in his *Inleiding tot de Algemeene Geographie, benevens Eenige Sterrekundige en Andere Verhandelingen*, Isaak Tirion, Amsterdam, 1740, p. 18.
 32. Pingré, *op. cit.* [28], vol. 1, 1783, pp. 247-248; cf. J. N. Lockyer [anonymous], ‘Varro’s Story of the Anomalous Track and Figure of Venus’, *Nature*, 20. 510 (7 August 1879), p. 351.
 33. “d’intensité et de couleur”, F. Arago, *Astronomie populaire*, vol. 2, Gide et J. Baudry, Paris, 1855, p. 533 = *Popular Astronomy*, vol. 1, trs. W. H. Smyth & R. Grant, Longman, Brown, Green, and Longmans, London, 1855, p. 701.
 34. Keith Mills, note to Forrest, *op. cit.* [7], p. 385 note 232.
 35. Raleigh, *op. cit.* [1], p. 100 (= 85 in another edition of the same year).
 36. *ibid.* He based the darkness on an interpretation of the myth of the birth of Apollo and Artemis on Ortygia.
 37. *ibid.*
 38. E. Warren, *Geologia: Or, a Discourse Concerning the Earth before the Deluge [...]*, R. Chiswell, London, 1690, p. 162.
 39. *ibid.*, pp. 160-161.
 40. *ibid.*, p. 161.
 41. “太白夕見昴西，色赤，炎焰如火”，“壬辰，有三角如花而動搖”，Ōuyáng Xiū & Sòng Qí (eds.), *Xīn Tángshū (New Book of Tang; AD 1060)*, 33. 8a (864). ‘Venus’ translates *tàibái*, ‘Pleiades’ *mǎo*, ‘red’ *chì*, ‘fire’ *huǒ*, ‘triple horn’ *sānjiǎo*, ‘flower’ *huā* and ‘swaying’ *dòngyáo*. E. H. Schafer (*Pacing the Void; T’ang Approaches to the Stars*, University of California Press, Berkeley, 1977, pp. 71-72) rendered: “colored red, ablaze and flaming like fire” as well as “it had three horns, like a flower, while it trembled and shook”. And R. A. Miller (‘Pleiades Perceived: MUL.MUL to Subaru’, *Journal of the American Oriental Society*, 108. 1 [January-March 1988], p. 24): “Venus was observed in the west of the Pleiades, red in hue and incandescent as fire. ... It had three horns ... that were as flowers shuddering tremulously.” Neo-Velikovskian Charles Raspil added this marvel to his collection of ‘trisms’ (‘Trisms and Planetary Iconography’, *The Velikovskian*, 2. 2 [1994], p. 87). He asked: “what are the implications of Venus’s behaviour?” (‘Planetary Observations of the T’ang Dynasty’, *C&C Review* [1996: 2], #76; cf. anonymous, ‘Discussion on Wal Thornhill & Ev Cochrane’s Papers’, *C&C Review* [2000: 1], p. 92).
 42. Miller, *op. cit.* [41], p. 24, cf. 14 figure 8, 18, 23.
 43. David W. Pankenier, personal communication, 27 December 2023.
 44. J. Gadbury, *Nauticum Astrologicum: Or, the Astrological Seaman [...]*, George Sawbridge, London, 1710, p. 224.
 45. E. L. Hawke, ‘Changes in the Climate of London. Part II’, *Weather*, 3. 5 (1948), p. 135. This was picked up on in P. Doig [anonymous], ‘A Cometary Venus’, *The Journal of the British Astronomical Association*, 58. 5 (June 1948), p.

- 195, who mistyped '1686' as '1896'. W. C. Straka cited them to impugn Velikovsky, in: 'Velikovsky: Science or Anti-Science?', *Pensée*, 2. 3 (Fall 1972), p. 15. C. J. Ransom countered that Gadbury was irrelevant for Velikovsky's case (*The Age of Velikovsky*, Kronos Press, Glassboro, NJ, 1976, pp. 76-77). Forrest challenged that in turn, misspelling the year as '1666' (*op. cit.* [7], pp. 386, 704; *cf. op. cit.* [22], p. 22 = 1987, p. 23).
46. e.g., L. Cowley, 'Venus Pillars', at <https://atoptics.co.uk/blog/venus-pillars/>.
 47. Thomas William Webb (1807-1885), *Observations upon Nature* (unpublished notebooks), in Baum, *op. cit.* [23], 2007, p. 198.
 48. R. Baum, 'The Maedler Phenomenon', *The Journal of the Association of Lunar and Planetary Observers; The Strolling Astronomer*, 27. 5-6 (July 1978), pp. 118-119; *op. cit.* [23], 1988; 2007, pp. 195-204. See also Corliss, *op. cit.* [22], 1979, p. 126; Keith Mills, note to Forrest, *op. cit.* [7], p. 704.
 49. G. Beer & J. H. Mädler, *Fragments sur les corps celestes du systeme solaire*, Bachelier, Paris, 1840, pp. 203-204 = W. Beer & J. H. Mädler, *Beiträge zur physischen Kenntniss der himmlischen Körper im Sonnensysteme*, Bernhard Friedrich Voigt, Weimar, 1841, pp. 139-140.
 50. A. von Humboldt, *Kosmos* [...], vol. 3, J. G. Cotta'scher Verlag, Stuttgart, 1850, pp. 73-74, 116 notes 24-25 = *Cosmos* [...], vol. 3, tr. E. C. Otté, Henry G. Bohn, London, 1851, pp. 75-77. In the English version published in the same year by Harper & Brothers in New York the pages are 58-60. Von Humboldt's first report on this was 'Nachrichten aus Süd-Amerika', *Monatliche Correspondenz zur Beförderung der Erd- und Himmels-Kunde*, 1. 4 (April 1800), p. 398. His most detailed one was *Voyage aux régions équinoxiales du nouveau continent* [...], vol. 1, F. Schœll, Paris, 1814, pp. 125-128 = *Personal Narrative of Travels to the Equinoctial Regions of the New Continent* [...], vol. 1, tr. H. M. Williams, Longman, Hurst, Rees, Orme, and Brown, London, 1814, pp. 157-161.
 51. "Als ich am Abend des erwähnten Tages mein Auge zufällig auf diesen Stern richtete, sah ich ihn in lebhafter Bewegung bald von rechts nach links, bald von oben nach unten hin und herschwanken. Er war damals höchstens zwei Grad über dem Horizonte. Die Bewegung betrug in keiner Richtung mehr als einen Mondsdurchmesser. Die Dämmerung war schon äusserst schwach." E. Vogel, 'Auszug eines Briefes an Alexander v. Humboldt' (10 October 1853), *Astronomische Nachrichten*, 38. 24 [911] (18 July 1854), p. 371.
 52. "ein Papierdrache mit einer Laterne daran befestigt", Vogel, *op. cit.* [51], pp. 371-372.
 53. *ibid.*, pp. 372-374.
 54. anonymous, 'Jumping Stars', *The Observatory*, 11. 141 (October 1888), pp. 385-386.
 55. W. H. Maw, 'Jumping Stars', *The Observatory*, 11. 142 (November 1888), p. 404.
 56. J. Ballot, 'Jumping Stars', *The Observatory*, 12. 145 (January 1889), p. 75.
 57. *Ibid.*
 58. A. T. Young, 'Wegener's Blank (or Reflecting) Strip' (2005-2022), at <https://aty.sdsu.edu/explain/simulations/BS/blank.html>; 'Mirages and 'Fog'' (2008-2012), at <https://aty.sdsu.edu/mirages/fog.html>; W. H. Lehn & B. A. German, 'Novaya Zemlya Effect: Analysis of an Observation', *Applied Optics*, 20. 12 (15 June 1981), p. 2044; W. H. Lehn & I. I. Schroeder, 'Polar Mirages as Aids to Norse Navigation', *Polarforschung*, 49. 2 (1979), pp. 174-176, 180 fig. 3, 185; W. H. Lehn, 'The Novaya Zemlya Effect: An Arctic Mirage', *Journal of the Optical Society of America*, 69. 5 (May 1979), pp. 776-781; M. Minnaert, *The Nature of Light & Colour in the Open Air*, tr. H. M. Kremer-Priest, Dover Publications, New York, 1954, pp. 56-57; A. Wegener, 'Elementare Theorie der atmosphärischen Spiegelungen', *Annalen der Physik*, series 4, 57. 3 [362. 3] (1918), pp. 222-230.
 59. von Humboldt, *op. cit.* [50], 1814, p. 127 (French) = 161 (English).
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