

THURSDAY, DECEMBER 22, 1887.

## THE STAR OF BETHLEHEM.

THE fact that a little more than a month ago the planet Venus arrived at its maximum brilliancy when to the west of the sun, and therefore when the planet rises before the sun, has given rise to a flood of superstitious fears in this country, only to be equalled in modern times by that which the members of the Eclipse Expedition observed in Grenada last year, and chronicled in these columns, as having been met with among the semi-civilized inhabitants of that island.

In spite of School Boards and all the present stock-in-trade of elementary education, perhaps partly because that elementary education deals so little with natural science; and because before School Boards so many children scarcely went to school at all, the planet Venus, one of the most stable and the most brilliant member of the solar system, is being regarded as a second appearance of the star of Bethlehem!

This being the idea which ignorance has conjured up, superstition next comes in to bear her part, and hence very naturally all sorts of woe and desolations, the end of this world being naturally included among them, have been predicted, and in some places a considerable amount of alarm has really arisen. Nor is this all: thousands of people who ought to be able to look up pocket-books and almanacs for themselves have been for the last month pestering everybody who is known to possess a telescope for information on the subject.

We think it, therefore, worth while to refer to this subject, for we have in this ignorant fright an additional reason, which it may be worth while to dwell upon, why the young population of a country like England should not be allowed to grow up without some knowledge, however slight, of the natural phenomena which are always being unfolded around them—phenomena which will always delight, instruct, and interest them if understood, but which will be apt to cause alarm so long as they are shrouded in mystery.

As before stated, the brilliant body in the east which is the innocent cause of all the alarm is nothing but the planet Venus near that position in her orbit in which she can send the greatest amount of light towards us.

If our youngest reader will place a candle in the middle of a table, and support a little ball some six or eight inches away from the candle, on the same level, and then retire some little distance away, to represent a spectator on the earth, the reason why Venus sometimes appears to the right or to the west of the sun and at other times to the east or left of it will be at once clear to him, if the ball be imagined to go round the candle in a direction contrary to that of the hands of a watch. Further, the fact that when the ball is on the other side of the candle it is further away, and therefore appears smaller than it is when exactly between the candle and the spectator, will give a reason why in neither of these cases will the maximum brilliancy be observed, because in one case the planet is as far away as it can be, and in the other, though the planet is as near to us as it can be, it has its dark side turned towards us; for it must be

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clearly understood that Venus, like the earth, receives its light from the sun, represented in our experiment by the candle; and when the spectator is on one side of the little ball, representing Venus, and the candle is on the other, naturally the non-illuminated side of the ball alone is turned towards the spectator. The period of maximum brilliancy will be when the planet is to the right or left of a line adjoining the spectator and the candle, and nearer the observer than the candle is. When the planet is to the right of this line, and therefore to the westward of it, speaking celestially, the planet must set before the sun, and therefore rise before the sun: it will be a morning star. On the other hand, when to the left of it, it must set after the sun, and therefore it will be visible as an evening star; and because it sets after the sun it will rise after it, and therefore be invisible as a morning star on account of the overpowering light of the sun. We might apologize to the readers of NATURE for referring to such elementary astronomy as this, were it not quite possible that many of them will have an opportunity, if the scare continues, of showing several young minds how to make the experiment for themselves.

The accompanying diagram will show the positions of Venus and the earth for the last few months, and will

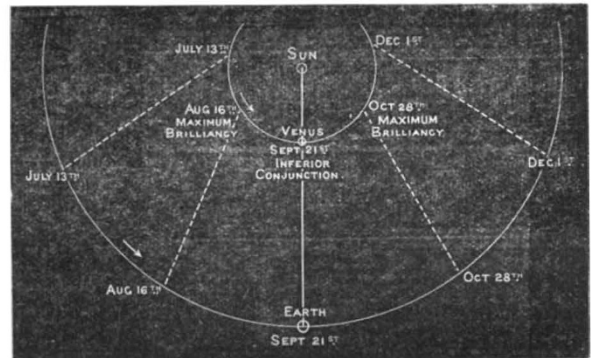


Diagram showing the paths of the Earth and Venus from July 13 to December 1, 1887, with the points of maximum brilliancy on August 16 and October 28. Synodic period of Venus, 583.92 mean solar days.

indicate why it was at its brightest *as a morning star*, on October 28, and *as an evening star* on August 16.

It will be in the memory of some of our readers that on the appearance of the new star observed by Tycho Brahe in 1572 the general opinion was that that also was the star of Bethlehem returned. It mattered little to the vulgar that the latter was called "the star in the East," and that the new star was nearly in the zenith, and at about the same time of the year (November).

A reference to Grant's admirable history of physical astronomy will show us that such new stars were also recorded in 130, 390, 945, and 1264. The authority for these statements is Cyprian Leowitz, whose work was published in 1573. Although his statements have been discredited, there is nothing improbable in them. The "new star" of which we have heard the most, because there was a man living who was capable of chronicling and more or less understanding the phenomenon, was that to which we have referred above as having appeared in the year 1572. This was carefully watched by Tycho

Brahe. It suddenly appeared brighter than any of the stars, and brighter than Jupiter, though not brighter than Venus. This star remained visible for nearly two years. Its colour changed as it grew dimmer: first it was white, then yellow, then red, and finally, according to the record, exhibited a leaden hue like the planet Saturn. Tycho Brahe imagined it generated from the ethereal substance of which he held the Milky Way to be composed, and when it disappeared it was thought to have dissolved spontaneously from some internal cause.

It is not a gratifying thing to find, when we come to inquire further into the state of public feeling at the time when Tycho's star appeared, that after all we have advanced very little beyond the sixteenth century in matters relating to superstition. The world was to end in 1532, according to Simon Goulart, because a mountain in Assyria had been seen to open, and exposed to the gaze of those present a scroll with letters written in Greek stating that the end of the world was at hand.

Goulart was followed by a famous astrologer, Leovitus, who put on the date to 1584; and Gayon reports that the fright at that time was almost universal, and the churches would not hold those who sought shelter in them.

This end of the world mania was not confined to the unlearned, for a famous mathematician, Stöffler, who was actually engaged on the reform of the calendar undertaken by the Council of Constance, put down the end for February 1524. According to him, the end was to be by water and not by fire, and the basis of his prediction was that Saturn, Jupiter, and Mars would then be together in the sign Pisces. It was a rare time for the boat-builders, for many "arks" were built; a doctor of Toulouse, named Auriol, making himself immortal by building the biggest.

Stöffler and Regiomontanus were not, however, discouraged by the fact that not a drop of rain fell during the whole of that month in Central Europe: they merely put the date on to 1588.

It must be remembered that in those days of unusual superstition these predictions were carried broadcast through the land, and it was the consternation of the ignorant which caused everybody to believe that Tycho's star, which appeared in 1572, was really the star of Bethlehem, returned to announce the second coming of Christ.

But as a matter of fact this star of Tycho's is really connected with the present excitement, and again the idea of the return of the star of Bethlehem has been associated with it—although the year 1572 passed off quite quietly, and the planet still survives—for the following reasons. The star appeared between the constellations of Cassiopeiæ and Cepheus—that is, in the same part of the heavens in which in former times, in 945 and 1264, similar appearances had been recorded. Argelander, who inquired into the matter, found a  $10\frac{1}{2}$ -magnitude star catalogued by D'Arrest, but seen some years before, when the same part of the heavens (R.A. 4h. 19m. 58s., Decl.  $+63^{\circ} 23' 55''$ ) was under scrutiny. It was suggested, therefore, that the star in question might be a variable one with a period of 314 years: this would very closely account for appearances in the years 0, 945, 1264, 1672, and 1887! and if it were really the star of Bethlehem, it would be naturally seen about Christmas-time. Nothing

is more curious than to watch how a piece of scientific knowledge has thus settled down to form a nucleus for a haze of sensational nonsense.

But it is not impossible that, after all, we are really again in presence of the star of Bethlehem; for if we read the account in St. Matthew, and assume that some celestial body is really alluded to, and not a miraculous appearance similar to those recorded by St. Luke (chapter ii. 8-15), then it would seem that Venus, as she has been seen lately—that is, at her maximum brightness—will do as well as any other, and there is no necessity to assume either a "new star," or a comet, as giving rise to the phenomena recorded.

We give that part of the narrative which chiefly concerns us, and it is necessary to bear in mind that Bethlehem lies nearly due south of Jerusalem, and is about five miles distant.

"... There came wise men *from the east* to Jerusalem, saying, ... we have seen his star *in the east*. ... When they had heard the king, they departed [to Bethlehem]; and, lo, the star, which they saw [had seen] in the east, went before them; till it came and stood over where the young child was. When they saw the star, they rejoiced."

The fact that the star was stated to be seen "in the East" would imply that it was not seen anywhere else. This is best explained by supposing a *morning* observation of a body soon rendered invisible by the light of the sun. A star seen in the East at evening would be visible all night, and could no longer be properly designated as a "star in the East." This is against the views which have been held and supported by Kepler, to the effect that a conjunction of superior planets was in question; and indeed they have already been demolished by Prof. Pritchard.

If we assume that the star was Venus at maximum brightness seen in the East in the morning, and that it rose, say, two hours before the sun, it would be about south at 10 a.m. It would seem not improbable that the journey to Bethlehem should be made before noon. The gathering of the priests and scribes would probably last till sundown, and it would be natural that the journey should be undertaken next morning. Journeys in the East are not generally now, and were probably not then, undertaken in the evening. The latter part of the extract indicates that the "wise men" did not see the star till they got to Bethlehem, and that the statement that "the star went before them" is rather an attempted explanation of its change of place than a reference to any actual observation.

The simple facts, then, seem to be that the "wise men"—no wiser, it would appear, than the average Englishman of the present day, in astronomical matters—being struck by the exceeding brilliancy of Venus, which they did not recognize, felt sufficient interest in it, or, more probably, were so soundly frightened at it, that they went to the nearest important town, Jerusalem, to find out something about it. It has been assumed that the Magi came from a *great* distance, but there is nothing to justify this, apparently; and if we go beyond the record at all we may as well accept them at once as Melchior, Balthazar, and Jasper, the kings respectively of Nubia, Chaldea, and Tarshish, whose bones are supposed to be at Cologne, though their connection with the Biblical narrative is not clear, as it

is not on record where these personages joined company before they set out *westwards* for Jerusalem.

As comets long afterwards were supposed to pre-  
sage disaster, so the star may have been regarded as  
an indication of the approaching death of King Herod.  
This would start the question as to his successor, whom  
the "wise" men would desire to stand well with, or  
to "worship." With what happened at Jerusalem we  
have nothing to do. On approaching Bethlehem about  
noon, they again recognized the star over the town, as  
Venus would be at that time, on the supposition that the  
"star in the East" which they had first seen was really  
that planet.

Another point connected with this matter relates to the  
question of new stars. Supposing there were a new star  
in the east, why should the population be affrighted?  
The records of astronomy, as we have seen, tell of a con-  
siderable number of such stars, and during the last few  
years we have been favoured with our fair share of such  
appearances, and yet the world is none the worse for  
them. The view which has recently been put forward,  
with an amount of evidence to back it which almost puts  
it beyond question, is that in new stars we see only such  
phenomena as we must expect; we see the result of  
no unnatural dealings with the regulated order of the  
universe, but simply the collisions of swarms of meteorites,  
these meteorites being not only not in our own system,  
but lost, it may be, in the very depths of space. Why  
should such a thing as this affright us? It is simply  
what happens at a level crossing when a train runs into a  
cart, and it does not seem likely that such an ordinary  
piece of mechanism as this would be chosen as a means  
of frightening or ringing the death-knell of a world.

Modern science, while thus abolishing mystery from the  
skies, is only enhancing the majesty of all created things.  
The universal law and order are more clearly seen in  
every great advance; and yet, with a population so super-  
stitious that the least uncomprehended thing affrights  
them, our statesmen are still on the side of ignorance,  
and hinder rather than aid the introduction of science  
into our schools.

#### THE MICROSCOPE.

*The Microscope in Theory and Practice.* Translated  
from the German of Prof. Carl Naegeli and Prof. S.  
Schwendener. (London: Swan Sonnenschein and  
Co., 1887.)

THIS book opens to English readers an entirely new  
page in microscopical literature. It leads the way  
in supplying a want which every thorough microscopist has  
realized for the last twenty years. In a complete form  
this treatise has been accessible to the German reader  
for at least ten years. The absence of it, or an equivalent,  
in the English language has been a most serious draw-  
back to the advancement of the highest optical work  
in English microscopes. In optical manipulation, the  
English optician at his best proves not only equal to any  
in the world, but, in the highest class of work, has shown  
lately that he takes a foremost place. But with no  
attempt on the part of English mathematicians and  
microscopists to become masters and expounders of the  
theory of the microscope and of microscopic vision, the

practical optician can make no real advance. English  
"stands," and those made in America on English models,  
are of exquisite construction, and are quite equal to our  
present necessities; but, for all the great advances and  
improvements that have been made in *English* object-  
glasses during the last fifteen years, we are, for all  
practical purposes, primarily indebted to Germany. And  
this is readily explained by the fact that the German  
specialists have made a systematic and persistent study  
of the theory of the microscope.

It is not forgotten that it was to the suggestion of Mr.  
J. W. Stephenson that we are indebted for the invaluable  
improvements that belong to the homogeneous system of  
lenses.<sup>1</sup> But, without doubt, it was on account of the in-  
sight which a study of the theory of microscopic vision  
brought with it, that Mr. Stephenson perceived at once  
the advantages of great numerical aperture, and the new  
way to obtain it. Moreover, it is certain that Prof. Abbe  
was approaching this very method of employing lenses,  
though from another point, and not in so direct a way. It  
would have been shortly reached by him there can be but  
little question; but when it was reached, what did a con-  
stant, enthusiastic, and laborious study of the theory of  
the microscope carry with it? A perception, that with  
glass of greater range of refractive and dispersive indices  
than any we possessed, we might not only secure great  
numerical apertures, but secure them devoid of all colour;  
that we could not only annul the primary, but also the  
secondary and tertiary, spectra. It need not surprise us  
then, that, in a country where such splendid theoretical  
and mathematical work had been done by experts on the  
principles of microscopic lenses and the laws of their  
construction and use, even the Government should be  
convinced that the time to aid the optical expert had  
come; that theory had demonstrated the practical possi-  
bility of a great improvement in the construction of  
lenses. The sum of £6000 was granted by the German  
Government to Abbe and his collaborateurs, and with,  
as we have reason to believe, an equivalent outlay on  
Abbe's own part, the new glass was prepared; and the  
new Apochromatic lenses with their systems of com-  
pensating eye-pieces devised.

It is in no spirit of boast, but rather in a spirit of  
humiliation and regret, that we say that we have examined  
many of these apochromatic objectives of all the  
powers made in Germany, and we have examined all the  
principal ones that have, since the new glass has reached  
London, been made there; and we are bound to say that  
the English work, based on the principles laid down  
by Abbe, is so fine as to make the regret immeasurably  
keener that English microscopical literature has been for  
all these years a blank, for practical purposes, on the  
theory and principles of optical construction, and on the  
theory of microscopical observation and interpretation.  
Such a paper as that of Prof. G. G. Stokes, P.R.S.,  
on the question of a theoretical limit to the apertures of  
microscopic objectives (Journ. R.M.S., vol. i. p. 139) from  
its very loneliness only gives emphasis and point to our  
contention. Those who have any doubt of the full force of  
what we are here contending for, have only to compare a  
dry  $\frac{1}{8}$ -inch objective, say of twenty-five years ago, made

<sup>1</sup> "On a Large-angled Immersion Objective, without Adjustment Collar  
with some Observations on Numerical Aperture," by J. W. Stephenson  
P.R.A.S. (Journ. Roy. Micros. Soc. vol. i. p. 51).