

## CORRESPONDENCE.

To the Editors of 'The Observatory.'

*Cause of the Gegenschein.*

GENTLEMEN,—

I have carefully observed the Gegenschein on many occasions during the past two years, at seasons when it is favourably situated among the stars; but I have never seen any indication of a dark centre, or any such appearance as would tend to confirm Mr. Anderson's theory that it is a contrast effect due to the dark shadow of the Earth projected upon an extension of the zodiacal light.

On the 5th inst., while engaged in photographing the spectrum of Mira, I left the guiding telescope for a few minutes, and on looking up at Cetus my attention was at once arrested by the Gegenschein, situated in the triangular space defined by the stars  $\alpha$  Arietis,  $\alpha$  Ceti, and the Pleiades. I do not know whether it was due to the exceptional transparency of the air, or to increased sensitiveness of the retina after working in the dark for an hour or so, but on this occasion the light seemed to me more obvious and distinct than I have ever before seen it. I should describe it as a uniformly luminous patch of light, not round, or distinctly elliptical, but much extended in the direction of the ecliptic, being some 20 degrees long by 8 or 10 wide. I estimated the centre to be equidistant from  $\alpha$  Arietis and  $\gamma$  Ceti, but slightly to the east of a line joining those stars, say at R.A.  $2^h 30^m$ , Dec.  $+14^\circ$ ; a position which would place it some 3 degrees to the west, or *behind* the anti-sun.

I do not, however, place any great reliance on this estimate, because I found it difficult to judge the R.A. of the centre on account of the elongated shape of the object; but according to Barnard, who has determined the position with great care over a series of years\*,

\* 'Astronomical Journal,' No. 403.

there is distinct evidence of a slight lagging of the Gegenschein behind the point on the ecliptic opposite the Sun, and it is this fact which first suggested to me the following theory of the origin of the light.

Dr. Stoney has shown that in the atmospheres of planets a molecular sifting-out process must take place; that is to say, the gaseous elements of low molecular weight tend to be eliminated and to disperse into space, because the velocities of such molecules must frequently be great enough to counteract the force of gravity. In the case of the smaller bodies of the solar system, such as the minor planets and comets, and even the Moon, no permanent atmosphere of any kind can exist, as the heaviest molecules of the substances which are gaseous at temperatures to which solar radiation may raise them are moving swiftly enough to counteract the feeble gravitational attraction.

On the Earth, however, gravity is powerful enough to permanently retain the elements oxygen and nitrogen, whilst the swifter-moving molecules of hydrogen and helium can escape, consequently the latter elements are not present in our atmosphere, or only in minute traces. It is, however, highly probable, as Dr. Stoney has pointed out, that these lighter elements are continuously being supplied to the atmosphere from various terrestrial sources; therefore the sifting-out process must be in continual operation, even at the present time.

But what becomes of the escaping molecules? Do they disperse into space equally in all directions?

Now in the case of a comet approaching perihelion evaporation of condensed gases produces a temporary atmosphere which the comet is totally unable to retain owing to its small mass; consequently a quite analogous molecular dispersion occurs. This, however, by no means takes place equally in all directions because the dispersing molecules come under the influence of a force, varying as the surface rather than the mass of the particles, which repels them with enormous velocities from the Sun.

Is it not therefore probable that molecules escaping from the *Earth* are similarly repelled with enormous velocity from the Sun? In other words, why should not the Earth possess a tail of escaping hydrogen and helium similar in every respect to a cometary tail, and visible to us in projection as the Gegenschein!

Such a tail, streaming away for many millions of miles, would not, however, appear exactly opposite the Sun. The orbital motion of the Earth would produce a slight aberration displacing it a little to the west, the amount of the displacement depending on the ratio of velocities of the Earth in its orbit and the matter streaming away. Thus the slight lagging of the Gegenschein behind the anti-sun is accounted for. But the velocity of the escaping molecules would not be constant, under the influence of the force of solar repulsion they would move away with an accelerating velocity, and probably the lighter hydrogen molecules

would be repelled with much greater force than the heavier molecules of helium. The tail would therefore be more or less curved, and would be of a composite structure, exactly as in the case of the cometary tails investigated by Herr Bredichin.

If we assume the existence of such a tail of extremely attenuated gaseous matter, I think that, viewed end on, it would present just such appearances as the Gegenschein is known to present.

We should, for instance, expect to find it varying somewhat both in shape and position, while keeping pretty closely about a mean position nearly opposite the Sun. It would, of course, be visible to us by reflected sunlight, notwithstanding that the shadow of the Earth would be projected upon it.

That our hypothetical tail must be of the last degree of tenuity is evident, seeing how small an amount of matter is required to produce even the most splendid tail of a comet. But, it may be asked, why should we alone be favoured with such an appendage? why, for instance, should not Venus or Mars be furnished with tails?

It is, evident, however, that the illumination of our atmosphere near so bright an object as a major planet would completely obliterate any such tails as they might reasonably be supposed to possess. Our own tail is, of course, most favourably situated for observation, being always in opposition! Yet it is but a poor affair after all, and can only be seen with any certainty when in a part of the sky free from planets or bright stars.

The concluding lines of Mr. Anderson's letter in your last number make it unnecessary for me to offer any apology in submitting for his acceptance so outrageous a theory!

Yours faithfully,

J. EVERSHED.

Kenley, 1898, Nov. 13.