nothing of strictly scientific interest in the book; but we may say that Mr. Baddeley has the great merit of always trying to see things with his own eyes, that in his judgments of men and places there is no trace of any kind of British prejudice, and that his style is fresh and interesting. Among the subjects of which he has something to say are Bulgaria, Buenos Ayres, Constantinople, and Tunis.

LETTERS TO THE EDITOR.

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Large Fireball.

ON the night of Monday, April 15 last, at 12h. 26m., a meteor of very exceptional proportions was observed from many parts of the country. The full moon was shining at the time, and near its meridian passage, but the brilliancy of the fireball was such that it vividly illuminated the sky and landscape with a flash which many people mistook for sheet lightning. Several observers describe the meteor as larger and considerably more brilliant than the moon, and at Swindon and Ramsbury a detonation was heard. At the former place the meteor "appeared so close that people thought it descending upon the town; it startled the rooks out of the trees, and suddenly illuminated the country round like the electric light."

At Worthing the meteor is described as falling almost perpendicularly from west-north-west to due north. At Clapham it seemed to take a slanting course from the south towards the west. At Bath the meteor was seen in the east moving horizontally, at a considerable altitude, from right to left. Probably therefore the body was situated over the region of Berks, but the data are altogether too imperfect to admit of trustworthy inferences either as to its position or height above the earth's surface.

It will be important if other observers can furnish accounts in which the position and direction of this fireball are more definitely given. The phenomenon was clearly one of uncommon character, but its apparition occurred at such a late hour that comparatively few persons must have witnessed it.

Bishopston, Bristol, April 20. W. F. DENNING.

Variable Stars and the Constitution of the Sun.

IN NATURE of March 21 (p. 492), Mr. A. Fowler has given an excellent account of my theory of the constitution of the sun, but he has not succeeded so well in describing my theory of the variable stars. I may here draw attention to some of the cardinal points not sufficiently noticed by Mr. Fowler:—

(1) The proof that the chemical combination at the external layers of the stars must be intermittent with regular intervals. This proof, pp. 8, 9, and 10, is mentioned as the very basis of my theory of the sun and stars.

(2) The fact that the intermittent eruptions of heat, if produced in this manner, cannot become visible through some perceptible increase of the heat of the star.

(3) The high probability that in the case of some red stars the vapours, noticed by the spectroscope in their external layers, are cooled to their dew-point, and so, with the smallest radiation of heat, are made ready to change into clouds, which suddenly withdraw the invariable inner light from our view.

(4) The high probability, too, that only those stars will be variable in which the external layers are cooled down to their dew-point, and that the intermittent eruptions of heat become visible because at intervals they cause the evaporation of the clouds, which surround the invariable inner light of the star during the minimum.

Therefore only those stars of Class III. will be variable, whose external vapours are cooled to their dew-point. The others also have their periodical eruptions of heat, but these are inperceptible to our eye.

The changes of the variable stars, therefore, are never associated with important changes of temperature. It would be possible for them to take place without the least change of temperature if the calories produced by an eruption of heat were entirely used for the evaporation of the clouds. And so even an increase of temperature of 1° would be sufficient to make a seemingly extinguished orb glitter again as a new star, whilst a similar decrease of temperature would suffice to restore the veil, which, steadily growing thicker, would make it invisible again, perhaps for centuries together.

Mr. Fowler is mistaken in saying that I do not seem to be aware that Algol is one of the hottest stars in the heavens, and that its spectrum is the same at maximum as at minimum. On the contrary, on p. 15, I have stated the exceptional case of Algol, and, seeing the impossibility of making it agree with my theory as in the case of those Algol-stars which are red at minimum, I ascribed the variability of Algol to the periodicity of its spots. Moreover, I added that this seeming contradiction to my theory was only a physical peculiarity of little importance. For the spots, too, are caused by periodical eruptions of heat in clouds. The only difference is that the clouds—I mean on the sun and Algol—are photospheric, and by vaporization cause dark spots which diminish the light, whilst in the cooler red stars, the clouds form a dark veil round the star, and therefore by vaporization increase its interior light.

In this defence of my theory, gradually passing from the variable stars by means of Algol to the sun, I must observe that my theory by no means suggests, as Mr. Fowler thinks, that the sun should have more spots in the Polar regions than near the equator. I only say that the spots must be found in parallel zones; of the breadth of those zones I say nothing. The spots can only be produced in places where the temperature and the chemical compositions work together to produce eruptions of heat. As the places of equal chemical composition and of equal temperature are only possible in the photosphere in two parallel zones of equal latitudes on opposites sides of the equator, it is plain that the spots must be produced there.

I conclude with an expression of gratitude to the Editor of NATURE and to Mr. Fowler for the trouble they have taken in noticing my theory. A. BRESTER, Jz.

Delft, April 1.

IN reply to Dr. Brester I have to remark, in the first place, that I made no attempt to give all the details of the theory, limitations of space not permitting. One of my principal arguments against the theory was that, if it were true, *all* cool stars should be variable, and I still see no reason to alter my views. The observations of the red stars by Dunér show that the spectra of some of the stars which are not variable are identical with some of those which are. For example, the spectra of 120 Schj., and D.M. + 47°·2291, which are not variable, are exactly like those of χ Cygni and R Leonis. The *compositions and temperatures* of the gaseous surroundings of these bodies are therefore similar, and there is no reason, from Dr. Brester's point of view, why one should be variable more than another, since, if they are cooling, they all start cooling under exactly equal conditions. (It may fairly be assumed that the spectra of the variables have been generally taken at maximum.) The cooling to dew-point is therefore not in question in the variable any more than in the apparently invariable stars.

The high probability that by far the greater number of variables are uncondensed meteor-swarms which are increasing in temperature, as demonstrated by Mr. Lockyer, is also obviously against any theory of variability which assumes a state of cooling.

The same objections which apply to the red stars apply also to the "unimportant" case of Algol; there are many other stars with identical spectra, and therefore temperatures, which exhibit no variability at all.

With regard to the sun, I remarked that the theory would suggest that spots should be most numerous at the poles, for the reason that it would be there where the atmosphere in the neighbourhood of the sun would be coolest, and where, therefore, chemical combinations would be most likely to take place. To this Dr. Brester replies that his theory only requires that spots should be formed in equal zones on opposite sides of the equator, and says nothing about the breadth of the zones. Of course, if it be assumed that the substances present in Polar regions are not such as to form combinations competent to produce spots, the difficulty is overcome, but an explanation depending upon such an assumption is far from satisfactory.

London, April 5. A. FOWLER.