usual way by means of Nicol's prisms, glass plates or other appropriate polariscope. The beautiful chromatic phenomena thus brought out at once indicate that amongst the causes which operate to produce the hardness of glass, powerful compression of the interior by the contracting exterior must be one. The phenomena are, in fact, essentially those of compressed glass, and the curves of colour, or black and yellow, seen when the glass is examined by white or monochromatic light, indicate successive curves of tension and balanced, or no-tension. In a carefully prepared glass rod of half-inch length these curves are rings traversed by a well-marked black cross. In an oval the rings assume the character of those seen in biaxial crystals. When plates are examined, the light being transmitted from back to front, they appear to act essentially as bi-refracting plates, but with crosses and bands somewhat irregularly distributed, and capable of being referred to the angles of the plates or to centres of unequal heating.

My experiments on the mechanical properties of the glass have chiefly been confined to testing its hardness and the possibility of grinding it. So far as I have gone at present I make it to be nearly twice as hard as ordinary glass, which it scratches with ease. It can be cut with a good file well moistened with turpentine, and can be ground on a stone with sand, without fracturing, if great care be taken and the glass be well prepared. One piece, which manifested when under the polariscope evidences of ill-balanced tension, the neutral line lying near one surface, submitted to transverse grooving, but disintegrated on being ground on one surface as soon as the outer surface had been ground away to near the neutral line. There appears to be an easily reached limit beyond which the surfaces must not be unequally removed, but as my friend Mr. Thos. Fairley, F.R.S.E., has been good enough to show me, there is practically no limit beyond which *both* surfaces may not be *simultaneously* removed. This result, foretold by me from polariscopical analysis, Mr. Fairley has kindly shown by dissolving the opposing surfaces away by hydrofluoric acid. The least hard portions dissolved much more readily than the thoroughly hardened, and the etched surfaces show wavy lines closely following the tension lines shown by the polariscope. There is further this remarkable feature, that the inner portion of the glass proves to be essentially common glass, which fractures in the ordinary way. Further experiments are necessary for the complete elucidation of the subject, and are in progress, but the preceding may be useful to fellow-workers on the subject.

Leeds, June 12 HENRY POCKLINGTON

The House-fly—A Query

IN one of the rooms in the Science Schools lately built here, I have noticed, in the last week or so, great numbers of the large house-fly (*Musca domestica*) lying dead on the floor. Last Tuesday I saw one fall dead, but this is the only one. This morning I counted thirty-two in a space of about three square yards. I examined one under a microscope, and found that most of the small hairs on its body were covered with a yellowish powder. Can any of your readers give me any explanation of this?

Harrow, June 8 HARROVIAN

OUR ASTRONOMICAL COLUMN

VARIABLE STARS.—Mr. J. E. Gore (Umballa, Punjâb) writes, under date May 5, that he believes 27 Canis Majoris to be a variable star. It is 4 in Harding's Atlas, but at present about $5\frac{1}{2}$ or 6, and much inferior to 28 in the same constellation, which Harding rates at 5. The change of brightness was first noticed in 1874. This star is 4·5 in the Radcliffe Catalogues, 5 in Arg. Zones, $5\frac{1}{2}$ in Lacaille, and 6·5 in Heis's Catalogue; Behrmann has 6, and the lowest estimate of magnitude is 7, in Flamsteed's Catalogue, with respect to which Baily remarks that there is no magnitude recorded in the original observation-book, and that modern observations make it $4\frac{1}{2}$. Mr. Gore states he has also "suspected some variation of light in the red star 22 Canis Majoris (between δ and ϵ); it is usually rated as of magnitude 3 or $3\frac{1}{2}$, but for some time past it has seemed rather fainter than an ordinary star of the fourth magnitude." Bradley and Piazzi have this star 3·4, Flamsteed, Brisbane, and Heis, 4, the Washington General Catalogue 5, and it is so rated once by Argelander; in Behrmann it is 4·5.

We will take this opportunity of directing the attention of our astronomical readers in the southern hemisphere to Behrmann's valuable Atlas and accompanying Catalogue, which, pending the publication of Dr. Gould's Cordoba "Uranometria," is the only real authority for recent magnitudes of the naked-eye stars of the southern heavens. It is entitled "Atlas des Südlichen Gestirnten Himmels, von Dr. Carl Behrmann" (Leipsic, 1874), and contains the stars in forty-six constellations between 20° of south declination and the south pole, and is arranged upon the plan of Argelander's well-known work. The number of stars included in the Atlas is 2,344. It was formed by Behrmann in the short space of from nine to ten months, beginning in the autumn of 1866, and on that account, as the author remarks, there may probably be some omissions and errors, but it is nevertheless a very meritorious and important work. It appears, from Dr. Gould's report to the Minister of Public Instruction of the Argentine Republic, that his "Uranometria" has undergone the intended revision, and is now completed, and that steps are being taken for its publication. It is only one of the extensive scientific undertakings which will mark the residence of this distinguished and energetic astronomer at Cordoba.

THE BINARY STAR η CORONÆ BOREALIS.—Mr. Wilson, Temple Observatory, Rugby, has published some remarks upon the tendency of recent measures of this star to shorten the period of revolution assigned by computers hitherto, and refers to Winnecke's careful discussion of the measures to 1856. Winnecke's orbit, however, is not the latest that has been calculated, that of Wijkander including measures to 1870, and the period he finds, 41·58 years, is not much different from that which Mr. Wilson considers to be required by the more recent measures. Still, these later observations point to a further diminution of the period, the exact amount of which may probably be soon determined. The following angles and distances are calculated from Wijkander's orbit, and on comparison of the former with the results of observation, it will be found that the computed value is now about 3° behind the true one.

1872·0	Angle 48°·07	Distance 0″·90
73.0	„ 51 ·98	„ 0 ·86
74.0	„ 56 ·35	„ 0 ·81
75.0	„ 61 ·32	„ 0 ·76
76.0	„ 67 ·05	„ 0 ·70

This orbit gives the angle too small by 5°·3 for Sir W. Herschel's measure in 1782, and also too small by 4°·3 for his measures in 1802, or, if these differences are expressed in the form Δ sin. d P, −0″·09 and −0″·04 respectively.

Sir W. Herschel's description of his experience with this star is found in *Philosoph. Trans.* 1804. On Sept. 9, 1781, the position was 59° 19′ *n.f.*, and on Sept. 6, 1802, by "a mean of two very accurate measures" it was 89° 40′ *n.p.* (This is now found to require correction of 180°.) Herschel further states "the distance of the two stars has not been subject to any sensible alteration. Sept. 9, 1781, a very small division might be seen with 460. Aug. 30, 1794, they were so close that with a 10-feet reflector and power of 600 a very minute division could but just be perceived. April 15, 1803, with a 10-feet reflector, a very small division was also visible, with 400, though better with 600. And May 15, 1803, I saw the separation between the two stars with the same 7-feet reflector and magnifying power of 460, with which I had seen it twenty-two years before." We have from Wijkander's orbit for comparison with this account:—

1781·69	Angle 25°·4	Position 0″·98
1794·66	„ 80 ·2	„ 0 ·69
1802·68	„ 175 ·5	„ 0 ·57
1803·37	„ 181 ·6	„ 0 ·59

Except in 1781, it will be remarked, the distances at the dates of Herschel's observations are given sensibly the same.

PROPER MOTION OF B.A.C. 793.—Prof. C. P. Smyth has lately drawn attention to an apparent variation in the amount of proper motion of the star B.A.C. 793, shown by the Edinburgh observations between 1837 and 1868, involving a diminution in the motion in R.A. and an increase in that in N.P.D. The star is No. 31 of the list included in Argelander's *Untersuchungen über die Eigenbewegungen von* 250 *Sternen*, Bonn Observations, Vol. vii., Part I., where, from a rigorous discussion of seventy years' observations, the proper motion in R.A. is found to be + 0·1245s, and that in N.P.D., – 1″·456. The comparison of the normal place for 1855·0 with the whole course of published observations to 1865, in which every refinement of calculation is introduced and the above proper motions employed, with Bessel's precession-constants, does not afford any indication of the variability of proper motion suspected by Prof. Smyth. The last Edinburgh observations in 1866 and 1867 show a difference from Argelander's formula of only – 0·08s. in R.A., and agree exactly with the N.P.D. The Washington position, depending upon two observations towards the end of 1870, is in close agreement with Argelander in R.A., and differs – 2″·0 in N.P.D. If a position of the star depending upon a good number of observations should be obtained during the present year, the point may be definitively settled, but thus far variation of the proper motion appears to be at least questionable. Upon this subject see Bonn Observations as above, pp. 20, 54, and 109.

MINOR PLANET NO. 146.—The number of small planets is rapidly approaching *one hundred and fifty*. M. Borrelly, of the Observatory at Marseilles, announces his discovery of No. 146 on the evening of June 8. At 10 P.M. its place was in R.A. 17h. 20m. 16s., and N.P.D. 111° 20′ 15″; it is as bright as stars of the eleventh magnitude, and therefore for the present should be readily identified by means of Chacornac's Chart No. 52.

SCIENCE IN GERMANY

(*From German Correspondents.*)

HERR VON BEZOLD, of Munich, has published some interesting researches on the periodical changes in the frequency of thunderstorms during long periods of time. These researches are particularly noteworthy for the original manner in which the author has used the statistical materials on thunderstorms which he could obtain (principally within the kingdom of Bavaria). As the character of our reports will not permit us to give details with regard to the manner of treatment, we pass at once to the results which Herr von Bezold has arrived at.

First of all it was found that the frequency of thunderstorms during a long period is generally either on a continuous increase or decrease, and that these variations are periodical.

If we ask on which other meteorological phenomena these variations could possibly depend, the first thing to be considered is the temperature. It is further advisable, on account of the numerous relations that have lately been discovered to exist between sunspots and meteorological phenomena, to turn attention also in this direction. It has been found in reality, that if we represent the variations of the frequency of thunderstorms by a curve and compare the same with the curve of the frequency of sunspots, the minima of the thunderstorm curve coincide exactly with the maxima in the sunspot curve. On the other hand, the thunderstorm curve forms, to a certain extent, the mean between the sunspot curve and the curve of the deviation of the average yearly temperature for our latitudes.

We must observe here that although the path of the thunderstorm curve shows a general and unmistakeable connection with that of the sunspot curve (so that, for instance, for the period from 1775 to 1822 the maxima of the thunderstorm curve coincide almost completely with the minima of the sunspot curve), yet the details of the thunderstorm curve coincide better with the details of the curve of temperatures, so that nearly every rise or fall in the latter can be distinctly traced in the former. This connection between thunderstorms and the deviations of the yearly temperatures from the total average, shows itself still clearly, even where that between the thunderstorm and sunspot curves is less apparent.

Herr von Bezold recapitulates the results of his investigations as follows:—High temperatures, as well as a solar surface free from spots, cause a greater number of thunderstorms during a year than the reverse. Now, as the maxima in the frequency of sunspots coincide with the maxima of the intensity of aurora borealis, it follows that both groups of electrical phenomena, thunderstorms and auroræ, complement each other, as it were, so that in years with many thunderstorms auroræ will be rare, and *vice versâ*.

From this connection between sunspots and thunderstorms an immediate electric action between the earth and the sun does not necessarily follow, but it may be simply a consequence of the magnitude of insolation, which depends on the frequency of spots. These changes in the insolation are not felt simultaneously but successively in the different latitudes. The phenomena of thunderstorms, however, do not only depend on the conditions of temperature at a given locality, but also on the state of the atmosphere at far distant points, belonging to another zone; and this is most evident with thunderstorms accompanying strong currents of wind or tempests. In this manner the peculiar intermediary position which the thunderstorm curve occupies between the curves of temperature and sunspots might perhaps find its explanation eventually.

IN zoological investigations experiments are rare, and therefore the results obtained by them are all the more valuable. The latest work of this kind—"Researches on the Theory of Descent: I. On the Season-dimorphism of Butterflies," by Dr. August Weismann, Professor at Freiburg—will, however, interest not only the narrower circle of entomologists, but also the amateurs in this branch of science, as it will furnish them with a sort of guide for the pursuit of their hobbies in such a manner as to do great service to science. Weismann bases his researches on the fact, which has been known for some time, and which has been called "season-dimorphism" by Wallace, that certain butterflies, when issuing from their winter chrysalis in the spring, show a different coloration and design upon their wings than do those which appear in the following summer; so that until this fact was discovered, the two forms were thought to be two distinct species of butterflies. We will only mention one of many examples, as it refers to one of the commonest kinds of day-butterflies. *Vanessa levana* is only the winter form of *Vanessa prorsa*, which is the summer form produced by the former; the latest offspring of the latter, which survive the winter, reappear as *Vanessa levana* in the following spring. Weismann exposed the caterpillars produced by *V. levana* in May, which in the normal state should have produced the imago of *V. prorsa*, to a continuous temperature of 0° – 1° C., after they had changed to nymphæ. The result was that they yielded the winter form *V. levana*, with few exceptions. The same result was obtained with the second summer generation, which under ordinary conditions would still have appeared as *V. prorsa*. On the other hand, Weismann succeeded only very rarely in forcing the last generation in the year again to take the *Prorsa* form, by keeping the nymphæ in hothouses at 15° – 30° C., instead