Treating the first case as undemonstrative, we can conclude that in each of the others there was a very close approach to Uranus. We know that A.D. 1053 is not the date when the swarm was brought into its present orbit, because there are well-attested records of a shower in A.D. 902. But there are none earlier than this, and I can see no objection to the date A.D. 885 for the decisive encounter.

If this is accepted, it is evident that the Leonids cannot be the source of meteors which produce sun-spots; if it is rejected, I do not know, in view of the difficulty as to the position of aphelion, when we shall find a date that is probable.

Note on the Appley Bridge Aerolite of 1914 *October* 13. By W. C. Jenkins, Godlee Observatory, Manchester, and E. L. Rhead, M.Sc. Tech., F.I.C. (Plate 8.)

Having received numerous communications on the appearance of the meteor which caused such widespread alarm in this district on the night of Tuesday, October 13th, at 8-43 p.m., a note was sent to the local press stating its meteoric nature. This brought the information of its discovery from Dr. Wilson of Wigan.

In the interval of correspondence the mass had been removed by the County Police authorities, and it is by the courtesy of the Chief Constable that an examination has been possible.

A comparison with the Catalogue of Meteorites issued by the British (Natural History) Museum indicates that this will rank as the second largest recorded fall in Great Britain.

The dimensions of the mass were:—

Length 9·65 inches
Depth 9·13 ,,
Width 6·62 ,,

with an axial diameter of 10·76 inches.

The weight of the fragments as received by me was 28 lbs. 13 oz., although described by the finders as being of 33 lbs. weight. This may be taken as illustrating the manner in which it had been treated during the week between its fall and reaching the Godlee Observatory.

The form of the aerolite was roughly pyramidal, with more or less a triangular aspect at its lower end. The large end was fractured. Some small portions of material were missing, so that perfect reconstruction was impossible. One detached piece of considerable size accompanied the main body. The fractured surface and also the detached piece exhibited surfaces which were polished almost like slikenside surfaces, and these had a more or less metallic appearance. The latter effect was caused by the quantity of pyrites in the mass, and the surface was the result of the shearing effect caused by the aerolite striking the ground more or less sideways with considerable force. By this means, the part of the enlarged end that was unsupported by contact with the ground was sheared by the energy of its own impact, with the result stated. These surfaces were not flat, but more or less undulating, so that the actual amount of lateral movement in contact must have been very small. Externally, the aerolite presents all the characteristic appearance of such bodies, and it is in fact a most excellent example of the peculiarities generally exhibited. The exterior of the uninjured portion is covered with the characteristic dark-brown to brown-black skin or cortex, which is quite distinct from the interior. This varies in thickness and in appearance on different parts of the specimen. In some parts it is merely a very thin film, almost a discoloration, and on others attains a thickness of nearly 1·8 mm.

Parts of this skin in the region marked A are quite rough and pimply; others on the lower and narrower end of the pyramid are smoother and smoky in aspect. On the portions which have clearly been well fused, as indicated by their shiny appearance and granulated surface, the effect of the friction produced by the rapid passage of the body through the atmosphere can be clearly traced. The thickness of the coating increases as the base is approached; and at the place marked B, where there has evidently been an irregularity of the surface, the liquid which has been pushed by the friction towards the back of the mass has accumulated as a distinct ridge, giving it almost the appearance of a knife edge which has been melted and is irregular in outline.

Another interesting point is noted just above the ridge referred to. On the fractured surface at the edge of the fracture is a fragment of the outer skin C firmly attached to the surface of the stony fracture, and a little beyond several other small patches can be seen. The first is clearly a detached portion of the outer envelope; the others appear to be splashes only of the fused matter.

The surface of the body presents all the outward appearances usually associated with aerolites. The finely striped and more or less radiately channelled crust and the characteristic pit-like depressions—thumb marks, piezoglyphs—are very clearly marked.

That the origin of all portions of the crust are not simultaneous is shown by the fact that on some surfaces it is limited to a discoloration, and in some cases to a very well-marked tarnishing of the (pyrites) metallic minerals, showing that they had only been heated to a slight extent, probably during the latter part of the flight of the aerolite after the explosion that burst it into fragments, and which was so distinctly heard over a very large area.

From the position of one of these exposed patches near the large end of the mass, it would appear that the production of the pits above referred to might result from the more ready removal by combustion of the sulphur and the oxidation of the iron contained by the pyrites in the mass. The oxide of iron resulting would, at the temperature of the cortex, unite with the other silicates present in the matrix, producing a very fusible mixture. This would account in some measure for the varying thickness of the outer coating and for the development of the pits. The patch C referred to indicates the extremely liquid condition of the fused outer layer at the moment of fracture, while the chemical composition of the silicates present indicates the low fusibility of the mass as a whole.

The familiar checking and cracking of the crust, due to unequal expansion, is visible on some parts of the surface.

Cracks of a deeper character are also visible, and the whole mass is more or less friable, due to the same cause, to which must be added the shattering effect of the impact of the mass with the earth. It is unlikely that the mass itself was at a high temperature when it struck the ground or that the coating was then molten, as no scoring of the surface such as would result from the friction of the fluid envelope with the ground it penetrated is visible, and it was possible to detect traces of material apparently from vegetable sources on some parts of the specimen. Whether these were acquired when the mass came into contact with the ground or in the subsequent handling, it is now impossible to say. The small depth of penetration is, however, an indication of the low speed of the latter part of the flight, due to retardation by friction—apparently it fell much at the same rate as would a falling body.

The specific gravity of the mass as determined on a detached fragment is 3·336. The specific gravity of the whole mass may slightly differ, but not greatly.

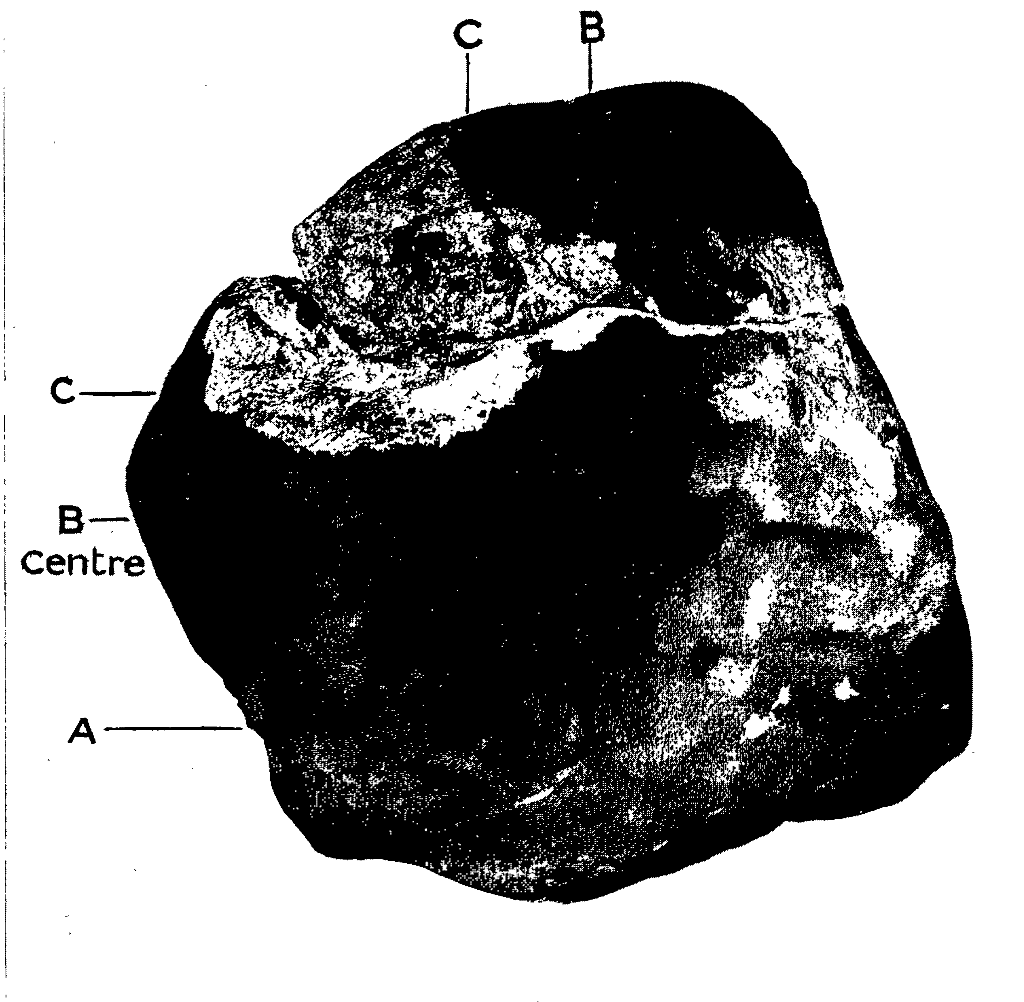
This agrees with the specific gravity that would be anticipated from its chemical and mineralogical composition.

Mineralogical Constitution.—A macrological survey of the material indicates that the main mass of the aerolite consists apparently of olivine and enstatite. There are in addition various other silicate minerals in small quantity, but in the absence of microscopic sections (not yet arrived) it is impossible to identify them. A considerable amount of pyritic matter is also present.

The mineral aspect and also the general form and character of the aerolite under consideration agrees very closely with the larger stones of the Aztec or Holbrook shower of aerolites which fell in Navajo County, Arizona, 1912 July 19, and of which hundreds of small fragments were collected. (See *Am. Jour. Sc.*, ser. iv., vol. xxxiv. pp. 437–456.)

Under a hand lens the surface presents a light ashy-grey colour and a perfectly granulated texture (see photo). The identification of chondrules was not made with certainty. Here and there indications which on microscopic examination may prove to be of this nature were observed, but it was not possible to definitely assert that they were due to this cause. In any case no perfectly formed chondrules were observed.

The olivine present is of a pale yellowish-green colour and is in places well crystallised. The enstatite is whitish or grey or



The Appley Bridge Aerolite, 1914 Oct. 13. Scale $\frac{1}{3}$.

faintly coloured. The fracture displays a considerable amount of pyritic material. Most of this is pyrrhotitic or troilitic (monosulphide) in character and is strongly magnetic. It contains nickel in addition to iron. Some of it is crystalline, and even under a hand lens facets can be clearly seen. It is distributed with a fair amount of uniformity throughout the mass as a whole, but in some parts appeared to form a meshed network in the main body, with here and there distinct aggregations.

In addition to these substances, there is also present a small amount of metallic iron. This is found in very fine particles and in small irregular flakes and granules distributed through the mass. Some of the dust is very fine and some of the granules appear spongy. The largest particles separated did not exceed one mm. in length by half that in width and was in the form of a flat flake with roughened faces. A very marked characteristic is the softness and malleability of the metal. When grinding the small portions used for the analysis, some of the particles rolled up into little cylinders of almost perfect form under the pestle. The iron is very strongly magnetic. It was impossible to estimate the amount of metallic iron in the mass from the small quantity ground up for the analysis, but it is very small. The amount of the pyritical matter can be calculated from the percentage of sulphur found. On this basis it forms 5·06 per cent. of the sample. Nickel is present in notable quantity. It is probably in alloy with the metallic iron and also in the pyrrhotite. In addition, the mass is found to contain small amounts of chlorine as chlorides, insoluble in water, but soluble in nitric acid. The amount is small but distinct. Sodium is a very definite constituent of the mass. Phosphorus is also present in estimable quantities, pointing to the possible presence of schreibersite, the phosphide of iron and nickel often present in aerolites. The amount of lime compounds is small but detectable, and it was thought that a very faint appearance of strontium could be observed. It is somewhat remarkable that the amount of potash present is very small. Traces of antimony and possibly lead were suspected, but the amount of material used was too small to make confirmation of their presence. Professor Knecht informs me that a careful search for titanium gave negative results.

At present no spectrum analysis of the body has been made, but preparations for making it are in progress. The identification of the minerals will be made as soon as the sections arrive. Appended is an analysis of a small portion of the material. As the composition varies in different parts of the mass it only indicates the general character of the body.

The proportions of the minerals worked out on the basis of the composition and solubility, neglecting those occurring in small amounts, would become approximately:—

Pyritic and metallic matter . . .	5·07
Enstatite	31·5
Olivine	63·43

Calculated on the specific gravities of the minerals in question, viz. 4·6, 3·1, and 3·4 respectively, this would give a mean specific gravity of 3·37. The actual specific gravity as determined being 3·336.

Reference has previously been made to the Holbrook stones. The specific gravity of these was nearly the same, namely, 3·22, and a determination on a large portion of the mass of the one now under notice would probably yield a closer approximation.

Mr. W. F. Denning deduced from the various reports of the visible track of the meteor that the motion was from S.S.E. to N.N.W. The position when over Stoke-on-Trent was an altitude of twenty miles, which decreased until it reached the ground at Appley Bridge.

Ultimate analysis as follows :—

Silica (SiO_2)	39·7
Iron (Fe)	20·72
Nickel (Ni)	1·3
Oxygen to combine with excess of Fe and Ni. After deducting sufficient to combine with S present	5·25
Magnesia (MgO)	23·64
Lime (CaO)	traces
Phosphorus (P)	0·23
Sulphur (S)	1·84
Alumina (Al_2O_3)	6·2
Soda, potash, chlorine, etc., by difference	1·12
	100·00

Micrometrical Measures of 110 *Wide Double Stars.*

By W. S. Franks.

The following measures were made with the 6⅛-inch Cooke refractor at Mr. Frederick J. Hanbury's observatory, Brockhurst, East Grinstead, some particulars of which were given in a former paper (*Monthly Notices*, April 1914). The height above sea-level is about 435 feet. Besides the equatorial there is a 2¾-inch Troughton & Simms transit instrument, and a sidereal clock by Frodsham (No. 860), formerly belonging to the late John