Our Astronomical Column.

THE MASSES OF THE STARS.—The mass of a star is perhaps its most important element, but it is one that can be ascertained only in exceptional cases. Prof. H. N. Russell, in a paper read at the twenty-first meeting of the American Astronomical Society, gathered together all the evidence, direct and indirect, on the subject, grouping the results by spectral type.

Method I. is the usual one for visual binaries the orbits and parallaxes of which are known; Method II. is similar, where the parallax and relative motion, but not the orbit, are known; Method III. is from spectroscopic binaries where both spectra are shown, a mean inclination being assumed; and Method IV., the vaguest of all, derives the parallaxes of binaries from their proper motions.

The resulting mean masses for the pairs of stars are:—

Spectrum		I.	II.	III.	IV.
B_0–B_5		—	10·4	17·5	7·1
B_8–A_5		5·9	3·0	4·0	8·4
F–G	giant	—	—	3·9	8·1
K–M	giant	—	—	—	9·8
F–F_5	dwarf	3·5	3·4	—	2·5
F_8–K_0	dwarf	1·8	1·4	—	0·7
K_5–M	dwarf	0·7	1·0	—	—

The sun's mass is taken as 1.

The following formulæ are given for the hypothetical parallax (h) of systems of mean distance a, and period P: $h=f\frac{a^3}{P^2}$; or where s is the apparent distance and w the apparent relative motion, in seconds of arc per annum, $h=0{\cdot}409fs^3w^2$.

The constant f has the value 0·50 for all giant stars, 0·58 for dwarfs of spectrum A, 0·72 spectrum F, 0·86 spectrum G, 1·00 spectrum K, and 1·14 spectrum M. The probable error is given as 12 per cent. where the first formula can be used, and as 22 per cent. in other cases.

THE PLANET JUPITER.—The Rev. T. E. R. Phillips, director of the Jupiter section of the British Astronomical Association, contributes an interesting article on the planet to the June number of *Scientia*. After giving a *résumé* of Jovian phenomena during the last twenty years, including the red spot and the south tropical disturbance, Mr. Phillips notes the startling change in the aspect of the planet which took place early in 1919; the disturbance and the red-spot hollow both practically disappeared, though the spot itself survived. Discussing the physical condition of Jupiter, he notes the similarity to the sun in density, in varying rotation periods according to latitude, and in the dark belts which are comparable with the spot zones. He suggests that the red spot may indicate a vast cyclonic movement in the atmosphere, noting that this view would explain the rapid passage of the dark matter of the tropical disturbance round the spot when the two are in conjunction. He notes, in conclusion, the importance of Jovian study from the point of view of cosmogony, since it illustrates a stage intermediate between the solar condition and the earliest geological periods.

PARALLAX WORK AT THE SPROUL OBSERVATORY.—The list of stars with known parallaxes is being rapidly extended, thanks to the extensive organised campaign carried on by many observatories which possess large equatorials. Dr. Miller, of the Sproul Observatory, has published a useful list of fifty observed parallaxes (Proc. Amer. Phil. Soc., vol. lix., No. 2). Five stars on the list have parallaxes above 0·1″, viz. W.B. (1) V. 592=0·146″, 9 Argus=0·121″, *i* Persei=0·120″, Lalande 17161=0·104″, and W.B. (1) IV. 1189+0·103″. The values found for γ^1 and γ^2 Andromedæ are 0·021″ and 0·005″; those for the preceding and following components of the wide pair 16 Cygni are +0·037″ and +0·018″. In each of these systems the true parallaxes of the components are presumably the same. The discordances are a measure of the probable errors, which in each case are of the order of 0·01″.

An interesting feature is the closeness with which the new figures verify many of Prof. H. N. Russell's hypothetical parallaxes, deduced from assumptions regarding the masses of binaries.

Nuclear Constitution of Atoms.[1]

BY SIR ERNEST RUTHERFORD, F.R.S.

THE idea of the nuclear constitution of atoms was developed from an examination of the scattering of swift α-particles in passing through matter, and the advance afterwards made was due to the proof by Moseley of the close connection between the atomic number of an element and the nuclear charge. The accurate determination of the nuclear charge is of prime importance. Recent unpublished experiments by Mr. Chadwick in the Cavendish Laboratory indicate that the nuclear charge on an atom in fundamental units is equal to the atomic number within an accuracy of about 1 per cent. It follows that there is a region surrounding the nucleus where the law of the inverse square holds accurately. The problem of the constitution of the atom divides itself naturally into two parts: one the arrangement of the external electrons on which the ordinary chemical and physical properties of the atom depend, and the other the constitution of the nucleus on which depend the mass of the element, the possibility of isotopes, and radio-activity. The nucleus is composed of positively charged units and negative electrons in very close combination, and estimates of its dimensions are possible from a study of the collision of α-particles with light atoms. Close to the nucleus there is a rapid change in the magnitude and direction of the forces, probably in part connected with the deformation of the nucleus structure under the intense forces which arise in a close collision.

Unless the nuclei are very stable, it is to be anticipated that they would be deformed, and possibly broken up, as a result of a direct collision with swift α-particles. In previous experiments evidence was given that long-range particles resembling hydrogen atoms were liberated by the passage of α-particles through pure nitrogen. New experiments have been made to determine by a modified method the nature of these particles by bending them in a magnetic field. The amount of deflection of the particles liberated from the nitrogen of the air was shown to be the same as for H atoms arising from a mixture of hydrogen and carbon dioxide. This showed definitely that hydrogen is one of the products of the disintegration of the nitrogen atom, and is one of the original components of the nitrogen nucleus. The possibility that the long-range particles are atoms of mass 2, 3, or 4 carrying a single charge may be definitely excluded.

The deflection in a magnetic field of the short-range particles which are liberated from nitrogen and oxygen, and were originally assumed to be recoil atoms of these elements, is not only much greater than that to be expected for such recoil atoms, but is also greater than the α-particle but less than the H atoms liberated from a mixture of hydrogen and carbon dioxide.

[1] Synopsis of the Bakerian Lecture delivered before the Royal Society on June 3.