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.

There is evidence that these particles are atoms of mass about 3, carrying two charges. Consequently the atom of nitrogen can be disintegrated in two ways by collision with α-particles: one by the escape of an H atom, and the other by the expulsion of mass 3, and both processes occur independently. Atoms of mass 3 are also released from oxygen atoms, but H atoms cannot be detected.

It may be concluded, therefore, that atoms of mass 3, carrying two positive charges, are components of the nuclei of nitrogen and oxygen.

This new atom is to be regarded as an isotope of helium, and should give nearly the same spectrum. The energy of motion of the atom of mass 3 expelled from nitrogen and oxygen is about 8 per cent. greater than the original energy of the α-particle, showing that energy is liberated as a result of the disintegration. The atoms of mass 3 probably consist of three hydrogen nuclei with one binding electron, and atoms of helium of four hydrogen nuclei and two electrons. Apart from hydrogen itself, these atoms are important secondary units in the building up of atomic nuclei. In the light of the new experimental evidence, examples are given of the possible modes of formation of isotopes and possible structures of nitrogen and oxygen nuclei are considered. It is pointed out that close combinations may exist of H nuclei and electrons, giving rise to atoms of zero nuclear charge, and that such a conception is needed to explain the evolution of the heavy elements.

The Rockefeller Gift to Medical Science.

AS was announced in the *Daily Mail* of June 11, the Rockefeller Foundation for Medical Research has made the generous gift of a sum of 1,205,000*l.* for the advancement of teaching and research in the Medical School of University College and Hospital. Owing to the inconsiderate and premature manner in which the statement was made public, it is natural that some mistakes should have been made and the objects of the gift in certain respects misunderstood.

The reason for the delay in making a public announcement is that the Senate of the University of London has as yet had no opportunity of formally accepting the gift. When this had been done it was the intention to make it public through appropriate channels and in such a way that the people of England might appreciate the intention of the donors to give a manifest proof of the friendliness of their feelings towards the work that we are doing here and their appreciation of its value. We have reason to believe that they particularly wish this aspect to be emphasised. It should be remembered that the object of the Rockefeller Foundation is "the welfare of mankind," so that its benefits were not intended to be confined to the United States. The members of the Foundation desire it to be regarded as entrusted to them for this purpose, and the present endowment is not meant in any way as a charitable gift. In view of statements to the contrary, it is necessary to make it plain that no conditions are attached, and that the recipients are left free in a very wide sense to make the best use of the money for the benefit of medical science, and especially as to the details of its application. It will naturally be understood that the manner of its use has been the subject of much discussion between representatives of the Rockefeller Foundation and the institutions receiving the gift.

With regard to the objects to which it is proposed to devote the endowment, a few words on the history of the negotiations may be of interest. Towards the end of last year two representatives of the Rockefeller Foundation, Dr. Wickliffe Rose (General Director of the International Health Board) and Dr. Pearce (Adviser in Medical Education to the Foundation) arrived in London. Before proceeding further they called at University College. In the absence of Prof. Starling, they were received by the present writer, whom they gave to understand that they had come to make inquiries into the conditions of medical education in London. They were accordingly informed of the recent creation of medical and surgical "units," of their situations and the names of various gentlemen associated with these units from whom they might obtain further information. This they proceeded to do. Early in the present year they made another visit to University College with definite proposals, and were seen by Prof. Starling and Prof. Elliot Smith, who showed them what was necessary to be done for the adequate provision of instruction and research in the fundamental sciences of anatomy, physiology, and pharmacology. It was clear to them that the most pressing need was the building of a new anatomical institute, although the medical sciences themselves naturally required the larger proportion of any proposed gift.

In April four representatives of University College and Medical School visited the United States for the purpose of further conference. These were the Provost (Sir Gregory Foster), Dr. Blacker (Dean of the Medical School), Prof. T. R. Elliott (professor of medicine), and Prof. Elliot Smith (professor of anatomy). On their return they brought back the definite offer of this extremely generous gift, and speak with the greatest appreciation of the friendliness of the manner in which they were received, the spirit in which the offer was made, and in which it was impressed upon them that it should be accepted.

Owing to the premature publication of the scheme it was necessary to call a general college meeting on Friday last, at which the Provost made a statement of its actual terms. In the words of the Rockefeller Executive Committee, they are as follows: "(1) An institute of anatomy. (2) Increase of clinical facilities. (3) Clinical laboratories planned. (4) Increased maintenance costs. (5) Closely unified administration." The Medical School will receive 835,000*l.* and the College 370,000*l.* Further details of the ways in which it is proposed to utilise the money will be duly announced. At this meeting Prof. Elliot Smith pointed out that anatomy is to be understood as including in its purview the microscopic structure of the tissues, embryology, and a study of the factors governing the development of form. It is further to be hoped that the working of the scheme will involve a much closer co-operation between the College and the medical departments, to the advantage of both.

It is perhaps advisable to direct attention to the fact that the gift is for the purpose of improving medical education and research. At the same time the hospital, as an institution for the cure of patients, will benefit indirectly, although doubtless its working expenses will be increased owing to the enlargement proposed.

W. M. BAYLISS.

The Permanent Value of University Benefactions.

AN account of the opening of the new building of the Department of Applied Statistics and Eugenics at University College, London, presented by Sir Herbert Bartlett, was given in last week's NATURE. The speech made by Prof. Karl Pearson in seconding the vote of thanks to the donor contains certain truths which have a wider application than to the immediate audience, and we therefore reproduce it