

York. Three principal axes are determined along which the various groups of stars show markedly unequal motion.

The eighth number of Volume 3 of the *Proceedings of the National Academy of Sciences* contains the following articles:

Relation of Preferential Motion and of the Spectral-Class and Magnitude Velocity Progressions to Proper Motion: C. D. Perrine, Observatorio Nacional Argentino, Córdoba.

Growth of Isolated Sporophytes of Anthoceros: Douglas Houghton Campbell, department of botany, Leland Stanford University. The young sporophyte of *Anthoceros Pearsoni*, separated from its association with the gametophyte, is capable of limited growth in length and is able to mature normal spores and elaters from the young sporogenous tissue.

The Mesa Verde Types of Pueblos: J. Walter Fewkes, Bureau of American Ethnology, Washington, D. C. A morphological study of Far View House and other types of prehistoric buildings.

A Determination of the Ratio of the Specific Heats of Hydrogen at 18° and —190° C.: Margaret C. Shields, Ryerson Physical Laboratory, University of Chicago. The value 1.4012 closely in accord with kinetic theory and different from previous determinations at 18° C. is obtained; the value 1.592 is found at —190° C.

Note on the Coefficient of Total Radiation of a Uniformly Heated Enclosure: W. W. Coblentz, Bureau of Standards, Washington, D. C. The value 5.722×10^{-12} is found by direct measurement and agrees with that calculated by Millikan on the basis of his values for h and e .

The Development of a Source for Standard Wave-Lengths and the Importance of their Fundamental Values: Charles E. St. John and Harold D. Babcock, Mount Wilson Solar Observatory, Carnegie Institution of Washington. It is necessary to examine for pole effect; the problem of wave-length determination is not one of routine but one for real investigation.

On the Presence of Albumoses in Extracts of the Posterior Lobe of the Hypophysis

Cerebri: John J. Abel and M. C. Pincoffs, Pharmacological Laboratory, Johns Hopkins University. Secondary albumoses and possibly peptones were found to be present in all the therapeutically used extracts of the posterior lobe of the hypophysis cerebri that were examined. The "Hypophysin" of the Farbwerke-Hoechst is not, as claimed for it, a solution of the isolated active substances of the pituitary gland but a mixture of albumoses with varying and unknown amounts of active and inactive constituents of the gland.

On the Rôle of the Thymus in the Production of Tetany: Eduard Uhlenhuth, Rockefeller Institute of Medical Research, New York. It would seem that thymus contains the substances which cause tetany and secretes them into the body from which they are removed by the parathyroids. Extirpation of the latter would thus cause tetany.

Evidence of Assortive Mating in a Nudibranch: W. J. Crozier, Bermuda Biological Station for Research, Agar's Island, Bermuda. Mating pairs of the nudibranch *Chromodoris zebra* are found to exhibit a rather high degree of correlation between the sizes of the two members. This is due to assortive mating, which may constitute an important influence tending to increase the numbers of larvae.

Coral Reefs of Tutuila, with Reference to the Murray-Agassiz Solution Theory: Alfred Goldsborough Mayer, Department of Marine Biology, Carnegie Institution of Washington.

National Research Council: Suggestions relating to the new National Army by the Anthropology Committee of the National Research Council; First Report of Committee on Botany; Meetings of the Executive Committee.

Notices of Biographical Memoirs.

EDWIN BIDWELL WILSON

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
CAMBRIDGE, MASS.

SPECIAL ARTICLES

A RELATION OF ATOMIC WEIGHTS TO ATOMIC NUMBERS, AND A SUGGESTED STRUCTURE OF ATOMIC NUCLEI

THE writer has plotted, for all the elements, ratios of atomic numbers to the corresponding

atomic weights against square roots of atomic weights. Although the values for successive elements vary somewhat irregularly, if averages are taken for successive groups of ten or twelve elements each it appears that there exists an approximate general linear relation of the form

$$\frac{N}{W} = 0.520 - 0.0088\sqrt{W}. \quad (1)$$

N is the atomic number, and W is the atomic weight. The average deviation in N/W from this straight line, regardless of sign, is 0.008. Hydrogen alone was not included in this average.

The relation between N/W and any other power of W , such as $W^{\frac{1}{2}}$ or $W^{\frac{2}{3}}$, is not so nearly linear. Furthermore, if values of N/W are plotted against $\sqrt{W}$ for the odd-numbered and even-numbered elements separately, it is found that a number of curious and nearly exact linear relations exist. Unless these are accidental, equation 1 must express no mere empirical relation, but an actual tendency of atoms.

If atoms have the structure called for by Rutherford's theory, equation 1 must represent a property of the atomic nucleus. If the nucleus is built up of positive and negative electrons, equation 1 can be accounted for if it has a surface shell of positive charge and a volume distribution of negative charge. The values of the coefficients in (1) seem to indicate that the negative electrons in the nucleus are packed together like solid spheres; to each negative electron on the surface of the nucleus two positive electrons are attached, on the average. (A positive electron is very much smaller, and hence much more massive, than a negative electron. This is a common assumption in electron theory.) If the number of positive electrons (hydrogen nuclei) in the nucleus is p , and if p is numerically equal to W , then n , the number of negative electrons in the nucleus, is $0.480 W + 0.0088 W^{\frac{1}{2}}$. (It was this three to two ratio of the exponents of W that suggested the assumed structure of the nucleus.) The first term in the equation just given may be supposed to equal the number of

negative electrons in the surface layer of the nucleus; then the second term is the number of negative electrons crowded inside. The latter are held together by the external positive shell; it is assumed that this shell tends to contract, perhaps under electromagnetic forces.

In very heavy atoms the number of negative electrons inside the nucleus is so large that they can not be held together by the positive contractile shell against their mutual repulsions. Hence there is an upper limit to atomic weights, and immediately below this limit atoms are unstable.

The nucleus-model described also is capable of illustrating isotopism. Those elements which have atomic weights not whole numbers may, as has been suggested by Harkins and Wilson,¹ each be a group of isotopes—in which case their atomic weights are averages. (This suggestion was first made by Soddy.) For those atomic weights at which the number of negative electrons inside the nucleus increases by unity one might expect that two stable systems could exist. Such atomic weights, as calculated by the equation for n given above, are 23, 37, 49, 59; for these values the number of negative electrons inside the nucleus is 1, 2, 3, 4, respectively. These values of W , then, should be critical values near which isotopes can exist most readily. It is at least interesting to note that, of the four atomic weights less than 60 which differ from integers by more than 0.16, the values of three are 24.32, 35.46, 58.68 (Mg, Cl, Ni), while Si = 28.3. It is known, moreover, that isotopes occur at neon, with atomic weights 20 and 22.

The atomic weights of elements heavier than nickel show no tendency to approximate to whole numbers, according to Harkins and Wilson. This is to be expected; because for those elements the number of negative electrons inside the nucleus increases more rapidly with the atomic weight, so that almost every heavy element is near a "critical" value of W .

JOHN Q. STEWART

PALMER PHYSICAL LABORATORY,
PRINCETON UNIVERSITY

¹ Harkins and Wilson, *J. Am. Chem. Soc.*, XXXVII, pp. 1383-1396, 1915.