differential thermo-electric circuit concept[5]. Assuming that these results obey equation (2) above, values of n have been calculated and are shown below for comparison with the values obtained from conductivity measurements :

Substance	Theoretical value of n	Value from conductivity measurements	Value deduced from thermo-electric measurements
Cu_2O	8	7	8·8
NiO	6	4	4·8
ZnO	6	4·3	6·1

The experimental results are not sufficiently comprehensive or accurate for a critical comparison, but it is noteworthy that in each case the value of n calculated from thermo-electric properties is in closer agreement with the theoretical than that obtained from conductivity measurements.

Experiments on various semi-conductors are being carried out and the results to date show that equation (2) is, in fact, obeyed. Details of the equations and their derivation will be published later.

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Nuclear Models

IN a recent paper[1], H. A. Wilson has proposed a spherical shell model for the nucleus of a heavy atom. In this model the nucleus is represented as an inextensible, flexible, spherical shell the shape of which is maintained by the Coulomb forces between the protons. The radius of the shell is assumed to be $R = R_0A^{1/3}$, where R_0 is a constant and A is the total number of nucleons in the nucleus, and, according to Wilson, the frequency of the nth mode of vibration of the shell is given by

$$\omega = \omega_0(n^2 + n - 2)^{1/2},$$

where $\omega_0 = eZ/2R_0^{3/2}M^{1/2}A$.

A model of this type has much to recommend it, but calculations we have recently performed indicate that it is not entirely satisfactory. To give a density of energy-levels of 0·1 V. for an excitation energy of 6,800 kV. in uranium requires that $\hbar\omega_0$ should be about 378 kV. for this nucleus. The value of $\hbar\omega_0$ for any other nucleus can then be obtained by multiplying by the appropriate factor Z/A as indicated by the definition of $\hbar\omega_0$. When the value for $A = 120$ is used to calculate the spacing of the energy levels for an excitation energy of 8,000 kV., we obtain a spacing of 0·05 V., which is definitely not in agreement with the experimental evidence. This fact cannot, however, be used as an argument against Wilson's *general* idea, but only against the extrapolation of the condition of the inextensibility of the shell to high-excitation energies.

On the other hand, calculations based on the assumption that the neutrons and protons forming a heavy nucleus are contained in the same spherical volume leads to a value $R_0 = 1{\cdot}56 \times 10^{-13}$ cm. from which the nuclear radius can be evaluated. This value is not in agreement with the value R_a of the same constant derived from the many-body theory of α-decay[2]. The discrepancy between the two values can, however, be removed by modifying the type of nuclear model used. The use of the statistical method of calculation imposes no restriction on the location of the volumes occupied by the protons and neutrons forming the nucleus, so we are at liberty to construct a model in which they occupy different regions of space.

If for simplicity we assume that the number of neutrons is equal to the number of protons, then they will occupy equal volumes. The simplest way of constructing a nuclear model in which the protons occupy a volume equal to that occupied by the neutrons but not identically situated is to consider that the neutrons form a central spherical core which is surrounded by a spherical shell of protons. The radius of the inner core is then $R_0A^{1/3}$, while the external radius of the whole nucleus corresponds to $R_aA^{1/3}$ of the α-decay theory. Since the volumes of core and shell are equal, we have immediately that $R_a^3 - R_0^3 = R_0^3$, so that $R_a = \sqrt[3]{2}\,R_0$.

Taking the value $R = 1{\cdot}56 \times 10^{-13}$ cm. given by our calculations, we then obtain $R_a = 1{\cdot}97 \times 10^{-13}$ cm., which is in good agreement with the value 2·0(5) cited by Bethe. Furthermore, taking R_0 to be the radius of a proton, we find by a simple calculation that the proton shell in heavy nuclei is only one proton thick, so that each proton in the shell is in contact with at least one neutron of the inner core.

The details of the calculations will be published shortly in the *Proceedings of the Cambridge Philosophical Society*.

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Spectrum of White Dwarfs

IN a recent paper, Blackett[1] has suggested that the Zeeman effect might be responsible for the peculiar absence of metallic lines in the spectra of most of the white dwarfs and may also contribute to the broadening of the hydrogen lines. Since this suggestion was given as one more argument in support of the theory of the magnetic field of massive rotating bodies, it may be of interest to point out that considerations of the internal constitution of white dwarfs seem to offer an alternative explanation of the peculiar features of their spectra.

Such an explanation may, in fact, be afforded by the strong separation of elements in the high gravitational field of white dwarfs. It has been shown[2] that we must expect in a white dwarf a core of heavy elements surrounded by a hydrogen layer. (In this paper I had assumed the inherent β-radiation to be forbidden (in the sense of the selection rules); but, as shown below, the results of Bethe and Critchfield are not in contradiction with astrophysical evidence.) Between them exists a mixed layer the thickness of which, proportional to the temperature and inversely proportional to the acceleration of gravity, is very small compared with the radius of the star. The decrease in concentration of heavy elements in the hydrogen layer is extremely rapid, so that the con-