model and the subscript k refers to a neutron. Let us break up the volume of the nucleus into four boxes corresponding to the four protons (neutrons) with spin $\frac{1}{2}$ $(-\frac{1}{2})$. From symmetry considerations we examine three divisions of the nuclear volume into boxes: (a) Three concentric spheres; (b) One sphere of radius a with three zones specified in the following manner:

$$0 \leqslant \theta \leqslant x, \quad x \leqslant \theta \leqslant \pi - x, \quad \pi - x \leqslant \theta \leqslant \pi$$

(where $a \le r \le \infty$, $0 \le \varphi \le 2\pi$); (c) The protons (neutrons) with spin $\frac{1}{2}$ $(-\frac{1}{2})$ are situated on the vertices of a tetrahedron. The second division corresponds to a geometrical localization of nucleons over s and p shells. The boundaries of the boxes are chosen to make ΣP_i a maximum for each division. For divisions (a), (b), and (c) the values of η are respectively 0.545, 0.724, and 0.756.

Thus the division of the volume of the nucleus into boxes by concentric spheres is the best of all those considered. The radii of the spheres are equal to 0.768R, 1.023R, and 1.316R, where $R = 3.276 \times 10^{-13}$ cm. is the radius of the nucleus, determined from the maximum slope of the nucleon density distribution curve. For a radius of 0.768R the nucleon density amounts to 88% of its maximum value, so that three boxes are located in the surface layer of the nucleus and one in the center. There is no geometrical localization of nucleons over s and p shells.

By determining the dimensions of a box we establish an upper limit for the diameter of the nucleon. The first spherical layer has the smallest transverse dimension; its thickness is 0.835×10^{-13} cm. Consequently, the radius of a nucleon cannot be greater than 4.18×10^{-14} cm. This is in good agreement with experiments on scattering of electrons by protons which indicate that the radius of a proton is $\sim 4 \times 10^{-14}$ cm (Ref. 4).

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TABULATED MASS DIFFERENCES

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RESULTS of high-precision mass spectrometer measurements of atomic masses of stable isotopes from iron to zinc are given in the work of Quisenberry, Scolman and Nier[1] with calculations of atomic masses of the radioactive isotopes. The atomic masses of the radioactive isotopes were calculated from the atomic masses of the stable isotopes with the use of β decay energies from King's tables[2] and reaction energies from the tables of Van Patter and Whaling.[3] A check of these calculations carried out by the author has led to the finding that King's tables are not sufficiently complete and has made possible calculation of the atomic masses of Mn^{55}, Mn^{56} and Fe^{55} with great accuracy and in better agreement with other experimental data. In King's tables, the value 3.65 ± 0.03 Mev given for the total energy of the $Mn^{56} \rightarrow Fe^{56}$ β transition is derived as a weighted mean from the data of three works.[5,6,8] The author knows of seven works in which are published measurements of the limit of the β spectrum and the energy of the γ quanta emitted on β decay of Mn^{56} (they are listed in the table). The weighted mean of all of these values yields 3.710 ± 0.011 Mev for the total energy of the β decay of Mn^{56}. Using this value, one can calculate the mass of Fe^{55} from the mass of Fe^{56} by way of $Fe^{56} \rightarrow Mn^{56} \rightarrow Mn^{55} \rightarrow Fe^{55}$. From the mass difference $Fe^{55} - Fe^{54}$, the binding energy of the neutron in Fe^{55} is calculated from mass spectrometric data; this turns out to be 9.296 ± 0.014 Mev. According to the measurements by Kinsey and Bartholomew[11] for the reaction $Fe^{54}(n, \gamma)\ Fe^{55}$, this neutron binding energy comes to 9.298 ± 0.007 Mev. The discrepancy comes to merely 12 ± 16 Kev. If one uses the energy of the β decay of Mn^{56} from King's table, the same discrepancy, as shown in Ref. 1 becomes much worse — 60 ± 30 Kev. Calculation of the atomic masses of isotopes of manganese and iron in different ways, with the use of improved values of the energy of the β decay of Mn^{56}, allows one to replace the masses given in the work of Quisenberry et al[1] by the following more reliable weighted mean values: Mn^{55} = 54.955512 ± 8, Mn^{56} = 55.956700 ± 8, Fe^{55} = 54.955761 ± 8.

At the present time the experimental data on hand is very extensive. To calculate good values of atomic masses it is necessary to have as much of the data as possible, to compare and estimate their true accuracy, and then to select all the reliable values for the actual calculation. Incomplete use of all reliable experimental data, as seen from the example cited, often leads to questionable values of mass differences.

Correction to King's Table

Decay	Decay Data					Weighted mean value of the total energy of the decay	
	Form	Mev	Error	Method	Reference	Mev	Error
$Mn^{56} \rightarrow Fe$	β^-	2.88	1	M.s.	[4]	3.710	11
		2.86	5	M.s.	[5]		
		2.81	3*	M.s.	[6]		
		2.82	8	Scin.	[7]		
	γ	0.866	20*	M.s.	[8]		
		0.845	15	M.s.	[5]		
		0.822	8*	M.s.	[6]		
		0.845	10*	Scin.	[9]		
		0.845	10*	Scin.	[10]		

Remark. The errors are presented in units of the last significant figure of the energy. An asterisk next to the value for the error denotes that its value was determined by the compiler of the table, either because the experimenter did not quote it in the cited work, or because in the compiler's opinion the error is undervalued. The abbreviations for the measurement method are: M.s. — magnetic spectrometer, Scin. — scintillation recorder.

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CERTAIN SOLUTIONS OF THE EQUATIONS OF PLASMA HYDRODYNAMICS

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IN the present communication we shall consider certain exact solutions of the hydrodynamic equations of cold plasma in the presence of an external magnetic field, and also in its absence. For the sake of simplicity we shall regard the ions as being at rest, but this restriction is not a fundamental one and may be easily removed.