

Thus the number of species is 10 for either zero or three pairs of cementing electrons, and eight (possibly seven for one pair) for one, two, or four pairs. This agrees with the writer's early idea that the zero level should be a long one, and with Latimer's idea that the level for three pairs of cementing electrons should also be long. While later discoveries may change these limits, they will probably not destroy the validity of the general relations.

It may be noted that Latimer⁹ makes no attempt to explain the most fundamental relation which concerns nuclear stability, the pairing of electrons in the nucleus. Also Dirac's principle of superposition, mentioned by Rodebush,¹⁰ has not been developed to the extent necessary to explain this phenomenon. It is not improbable that the two electrons in an alpha particle move through the whole volume of the particle, but the distribution of electron density is entirely unknown. It is not intended to imply that the electron pairing cannot later be treated in terms of an overlapping of the eigenfunctions of the single electrons.

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THE STRUCTURE OF THE α -PARTICLE

Sir:

In the March number of THIS JOURNAL, W. M. Latimer has written an article in which he refers to a suggestion of mine. Inasmuch as one might infer therefrom that I considered the idea of the tetrahedral form of α -particle to be original with me, may I state that this was not the case. What I did suggest and discuss with Professor Latimer and others was the orientation of the spins of the proton, as used by Latimer, in which the spin of each proton was supposed to point out from the center of the tetrahedron. This was some time ago, and Professor Latimer writes me that our discussion was only recalled to him by our correspondence after this article was in manuscript form.

In view of this paper of Latimer's and recent discussions of nuclear spin [Bartlett, *Phys. Rev.*, **37**, 327 (1931); Gibbs and Kruger, *ibid.*, **37**, 656 (1931)], a word as to my reason for making this suggestion may not be out of place. I wished to have the resultant spin for one, two or three protons the same (and the same as that of the electron, equal to $1/2$ unit), and the spin for four protons equal to zero. This is a natural result of the tetrahedral structure though requiring some "distortion" of the angle (if such language has any meaning) between two protons in the case of two. This would explain the anomalous spin in the case of nitrogen (3 α -particles, 2 extra protons, 1 extra electron, resultant spin

⁹ Latimer, THIS JOURNAL, **53**, 987 (1931).

¹⁰ Rodebush, *ibid.*, **53**, 1611 (1931).

2/2 units) and, in fact, accounts for the spin in all the cases considered by Bartlett. However, these cases will also fit into a scheme in which the electrons have no spin, and the proton spins behave like ordinary electron spins (Bartlett, *loc. cit.*). Both proposals will meet with difficulties in the case of Al (Gibbs and Kruger, *loc. cit.*). I think we must simply admit that we do not know how the spins in nuclei are produced. In the meantime, speculations regarding nuclear structure, such as Latimer's, which are based on other data, are of interest.

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THE PREPARATION OF COPPER-CHROMIUM OXIDE CATALYSTS FOR HYDROGENATION

Sir:

The new and very efficient catalyst for the hydrogenation of various organic compounds in the liquid phase [Adkins, Connor and Folkers, *THIS JOURNAL*, **53**, 1091, 1095 (1931)] referred to as "copper chromite" suffers under the disadvantage that in the hydrogenation of certain compounds (ethyl phenylacetate to phenylethyl alcohol, for example), there occurs reduction of the catalyst to a red inactive compound. This undesirable feature is not present in a modified catalyst containing barium, for example, which was prepared by replacing 10% of the copper nitrate with a molecularly equivalent amount of barium nitrate using 750 ml. of water at 70° per mole of nitrate. The preparation of a copper-chromium catalyst as originally described by us was based upon the method patented by Lazier for obtaining catalysts from certain chromates. Recently it has been found in this Laboratory that an equally if not more efficient copper-chromium catalyst may be prepared by a more convenient and simple method which is as follows. Seventy-one grams of ammonium carbonate monohydrate in 400 ml. of water was added to a solution containing 50 g. of copper nitrate trihydrate, 5.4 g. of barium nitrate and 77 g. of chromium nitrate ($\text{Cr}_2(\text{NO}_3)_6 \cdot 15\text{H}_2\text{O}$) in 575 ml. of water. After thorough mixing of the reactants, the precipitate was filtered with suction on a Büchner funnel, and washed twice with 50-ml. portions of water. The solid was dried overnight at 100–110°, ground to a powder and heated to approximately 230° in order to expel ammonia, carbon dioxide, etc. The catalyst was then used as previously described.

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