A more detailed account of the application of the statistical method based on the assumption that, in a first approximation, the interaction among the particles can be described by some field of forces, will be given in another place.

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January 24, 1935.

[1] In a previous note we have considered the problem regarding the statistics of positive and negative electrons: Phil. Mag. [7] **17**, 910 (1934).

[2] The following remarks can also be applied to the hypothetic "neutrinos" and negative protons.

[3] Which we applied to the electrons in our preceding note, reference 1.

A New Method for Calculating Relative Multiplet Strengths in a Transition Array

The relative strengths of multiplets in a transition array such as $p^2\cdot p - p^2\cdot d$, where the jumping electron does not belong to a shell of equivalent electrons, may be calculated by the simple Kronig formulae.[1] When the jumping electron belongs to a shell of three or more equivalent electrons, as in the array $p^3 - p^2 d$, the relative multiplet strengths may be calculated by the method of Condon and Ufford,[2] which is based on the principle of spectroscopic stability. When more than one term of a kind occurs in a given configuration, however, their method gives only the sum of the strengths of the multiplets arising from all transitions between these terms and a term (or set of like terms) in the second configuration, and not the strengths of the individual multiplets. This apparent indeterminacy arises from the assumption that it is impossible to fix the ionic parentage for each term of the given configuration of equivalent electrons. Bacher and Goudsmit[3] have shown that the difficulty is purely formal, and that the parentage of any term in such a configuration may be expressed as a linear combination of all the terms of the ion. The coefficients may be found by quantum-mechanical methods. Thus, the parentages of the terms ^4S, ^2D and ^2P of p^3 are divided as follows among the terms ^3P, ^1D and ^1S of p^2: (^3P), $(1/2\,^3P + 1/2\,^1D)$ and $(1/2\,^3P + 5/18\,^1D + 2/9\,^1S)$. Accordingly, the relative multiplet strengths for the permitted transitions of $p^3 - p^2\cdot d$ are the same as for the corresponding transitions of $p^2\cdot p - p^2\cdot d$, except for the factors 1/2, 5/18, etc., which must be introduced to take account of the fractional parentage of the term in question. It has already been noted that the strengths of $p^2\cdot p - p^2\cdot d$ may be calculated by the simple Kronig rules. Table I contains the multiplet strengths for the transition $p^3 - p^2 d$. The numbers in parentheses are the strengths given by Kronig's formulae for the corresponding multiplets of $p^2\cdot p - p^2\cdot d$. The parent terms are also given in parentheses. The missing multiplets are those forbidden by one or more of the ordinary selection rules. The resultant strengths may be compared with those computed by Condon and Ufford for the same transition array.

TABLE I.

p^3 \ p^2d	(^3P)				(^1D)				(^1S)
	^4P	^2F	^2D	^2P	^2F	^2D	^2P	^2S	^2D
$(^3P)\ ^4S$	(240) 240								
$1/2\ (^3P)\ ^2D$		(504) 252	(90) 45	(6) 3					
$1/2\ (^3P)\ ^2P$			(270) 135	(90) 45					
$1/2\ (^1D)\ ^2D$					(336) 168	(210) 105	(54) 27		
$5/18\ (^1D)\ ^2P$						(126) 35	(162) 45	(72) 20	
$2/9\ (^1S)\ ^2P$									(360) 80

Tables for the cases of astrophysical importance will be given in the complete paper, which will be sent to the *Astrophysical Journal.*

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February 18, 1935.

[1] cf., review by Shortley, Proc. Nat. Acad. Sci. **20**, 591 (1934).

[2] Condon and Ufford, Phys. Rev. **44**, 740 (1933).

[3] Bacher and Goudsmit, Phys. Rev. **46**, 948 (1934).

The Action of Neutrons on Heavy Water

We have observed a large decrease in the radioactivity of a target activated by neutrons when heavy water is interposed between the target and neutron source. The water, weighing 46 g was contained in a Pyrex glass tube. It was prepared by Dr. H. L. Johnston and since it had been loaned for another purpose we were not at liberty to transfer it to a more suitable vessel. The neutron source consisted of 125 millicuries of radon in a 0.5 cc bulb containing powdered beryllium. This bulb was in turn surrounded by 20 g of powdered beryllium to utilize the production of neutrons by gamma-rays. The tube of water was placed close to the source and inclined at an angle to the target to increase the path of the neutrons through the water. This average path was about 5 cm. The target was a silver cylinder, 1 mm thick, placed around a screen-wall tube counter and inside the outer brass wall, 2 mm thick, of the counter.

In order to compare the effect with H^1 and H^2, measurements were made with a similar Pyrex glass tube containing the same quantity of ordinary water, and also with the empty container. The summary of the various activations under these conditions is given. Each value is the average count per minute above the normal background for the first 5 minutes, starting one-half minute after the source was removed.