QUANTUM MECHANICS.

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THE concept of the atom, which considers the electrons moving in orbits restricted by certain quantum rules, has been, and still is, of extreme importance for the description of atomic properties. Many spectroscopic experiences and various other properties can be expressed in a very simple way with the help of this model.

The discovery and analysis of atomic properties, such as the Compton and photoelectric effects which did not fit into this orbital picture, were not however the only reasons which necessitated the development of the new Mechanics. A close study of the description of spectroscopic laws with the help of the atomic model reveals many unsatisfactory deductions, ad hoc hypotheses and unnecessary complications. The introduction of "half" quantum numbers, the replacement of the square of some quantum number, say j^2, by $j(j + 1)$, the existence of orbits with an angular momentum which has to be taken equal to zero, are some examples of this.

The new Quantum Mechanics, though allowing no longer a naïve picture for the atom, has made the great accomplishment of providing us with a completely consistent description of the atomic properties, giving at once the right results wherever the calculation has been possible. It is obvious that such a new theory changes considerably our conceptions of atoms and electrons, though it has been shown at the same time that the orbital picture is a very good approximation to the truth in most cases and the Quantum Mechanics corroborates even some of its results. For instance, it has been very surprising that the old theory gave such excellent results for the spectroscopic properties of alkali atoms, if one replaces the inner electron shell merely by a spherically symmetric charge distribution. This approximation has been completely justified by the Quantum Mechanics.

The introduction of the Theory of Groups into the Quantum Mechanics by Professor Weyl has thrown light upon a special class of atomic properties, namely those connected with symmetry. For instance, the selection rule for complicated spectra, the Laporte rule, which is so important for spectroscopy, has been shown by the methods of Weyl to be closely connected with the fundamentals of the Quantum Mechanics, whereas it did not find its right place in the older conceptions.

The success of this development gives hope that very soon some properties of spectra which still lack a rigorous explanation, may be described with the help of the Quantum Mechanics. Such problems of special interest for spectroscopy are, among others, the interaction between two spins, the interaction between the core of electrons and the magnetic properties of the nucleus. A rigorous solution of these problems will throw light on the laws of multiplet structure and on the properties of hyperfine structure.