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ATOMS AND ISOMORPHISM

OUR knowledge of the nature of atoms has recently been enlarged in a remarkable way with many important results, some of which were quite unforeseen.

Atoms were formerly known only by their weights and chemical properties. They are now believed to consist of a nucleus and one or more electrons, which together occupy a measurable portion of space. Formerly the properties of atoms were held to be related to the atomic weights. I shall try to show that one of the properties of atoms depends upon their sizes rather than their weights.

The measurement of the sizes of atoms is one of the important results of recent studies of crystals by the new method with X-rays. W. H. and W. L. Bragg[1] reflected X-rays from crystal faces and found that the angle at which reflection became evident bore a simple relation to the wave-length of the X-rays used and to the distance between adjacent layers of atoms in the crystal. The validity of the equation: $\lambda = 2d \sin \alpha$ is easily demonstrated by means of Fig. 1, if it be remembered that the intensity of reflection from a single layer of atoms is extremely small, and the reflected ray only becomes appreciable in case reflections from many parallel planes of atoms are in phase and therefore reenforce each other.

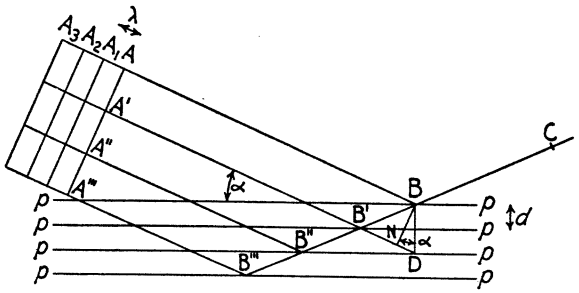

FIG. 1. Reflection of X-rays from a crystal space lattice (after Bragg).

Accordingly, the distance (d) between adjacent planes of atoms is equal to the wave-length (λ) of the X-rays divided by twice the sine of the angle of incidence (α). The wave-lengths of X-rays from various sources are now quite accurately known. Therefore it is only necessary to measure the angle of incidence at which reflection occurs in order to be able to calculate the distance between adjacent planes of atoms in any crystal.

[1] "X-Rays and Crystal Structure."