

X-Rays Reveal Arrangement of Atoms

Physics

Called Most Important Tool of Physics

BECAUSE X-rays do not bend when they hit a solid object, but either pass straight through or stop dead, they have become one of the most important of the tools of modern physics, laying bare the secrets of crystals and showing how atoms are arranged in molecules.

The usefulness of these invisible radiations was discussed in a radio talk by Sir William H. Bragg, director of the Royal Institution of Great Britain and one of the world's leading physicists. He was honored a few days ago by the presentation of the Franklin Medal of the Franklin Institute in Philadelphia. The talk was given over the Columbia Broadcasting System, under the auspices of Science Service.

Radio waves, light waves and the waves of X-rays, Sir William reminded his hearers, are all members of the same family, so far as their fundamental nature is concerned. But radio waves will turn and bend and go around obstacles, while light and X-ray waves will not deviate from a straight line.

"Light waves would be of no use if they behaved like that," he continued. "If they did we should swim in a sea of light but it would be much the same in all directions. Whichever way we looked we should be receiving light from all the surrounding objects: we should have to exercise care even to sort out whether a thing was in front of us



Sir William Bragg

or behind. We must have light that turns corners as little as possible. Even in radio transmission when a so-called "beam" is wanted—a ray which will keep more or less straight without spreading—short waves of twenty or thirty meters only are employed. Now small details can only be kept distinct when the rays of light from them keep very straight. For this reason there is a limit to the smallness of things that may be seen by the aid of ordinary light; not even with the aid of the microscope can that limit be overstepped. In the same way it might be possible to detect the presence of a mountain by its effect on radio transmission; but radio could not be used to find a house or a tree.

"But the X-rays enable us to see, if I may use the word, what light

cannot show us. Of course, we have to replace our eyes by specially made instruments. And when we use the X-rays we find ourselves in a new world which is always about us, which has to do with the structures of ourselves and all our surroundings, and with the way in which those structures are fitted for their work; this new world has hitherto been hidden from us.

"First of all, we are struck with the constant tendency in Nature to arrange in order the atoms of which all things are made. The carbon atoms which make up the diamond are arranged in a beautifully simple pattern, one of the most regular of all the patterns we find in crystals; and no doubt we have here the reason why the diamond is so hard. When it is rubbed against other substances in which the forces that tie the atoms together are less strongly and systematically combined, it is the atoms of the second substance that must shift, while the diamond remains unchanged.

"With the aid of the X-rays we can peer down into the pattern of the ice crystal, so fine in detail as to be far beyond the power of light to examine: and we see the atoms of oxygen and hydrogen arranging themselves to make six-sided figures which, when multiplied enormously, make the crystals of snow and ice with which we are familiar."

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Statistics Aid Study of Insanity

Psychiatry

THE real nature of insanity is at last being probed with twentieth century mathematical precision. Discovery of eight fundamental factors in mental diseases is reported by Prof. Thomas V. Moore, psychiatrist of the Catholic University of America, who has combined his knowledge of mankind's mental failure with a skill in handling involved mathematical procedures.

In treating physical diseases, doctors long ago realized that a local pain or strange feeling meant some specific physical abnormality, Prof. Moore explained, in describing the progress of his elaborate research. From centuries of studying living patients and from autopsies, doctors

now know the symptoms that point to hundreds of bodily diseases.

But the patient who is troubled with delusions of his own grandeur or who has fallen into a state of hopeless apathy may have no physical diseased condition that can be traced. And so, psychiatry has been slow to sort out the symptoms that fit together to make pictures of the different mental diseases. Doctors of mental disease talk in terms so vague that it is as if a physician should be satisfied to conclude simply that his patient had heart trouble.

To measure and chart the symptoms pointing to fundamental mental disorders, Prof. Moore has re-

sorted to exact statistical procedures. He has determined the existence of 41 different symptoms, and eight syndromes or fundamental factors. As an example of one of the fundamental factors underlying mental illness, he mentioned defect of intellectual power. Another is constitutional hereditary depression, which attacks the controlling mechanism of emotional life but leaves the thinking process untouched.

The investigation is practically the first attempt to apply to mental diseases the statistical procedures so widely made use of by psychologists in studying normal people.

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