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AN APPARATUS FOR THE STUDY OF X-RAY SATELLITES IN THE REGION OF 5 A°

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(Abstract)

The X-ray satellites, or non-diagram lines are lines in the x-ray spectra which are not given by a simple combination of energy values as are the

diagram lines. They are of low intensity and usually accompany a diagram line on its short wave-length side.

G. Wentzel (1, 2, 3) proposed a theory of single electron transitions in multiple ionized atoms to explain the production of satellites. Relative intensity considerations (4) and measurements of exciting potentials (5) would not support Wentzel's theory.

In view of difficulties of other attempts to explain the production of x-ray satellites F. K. Richtmyer (4) offered an alternative suggestion of two electron transitions occurring simultaneously. He supposed one transition to give rise to an x-ray diagram line and the other to give a line in the optical spectra, and the energies of the two combining to produce a single frequency, namely that of an x-ray satellite. G. B. Deodhar (6) gives an explanation of some experimental data on satellites in regard to Richtmyer's suggestion.

Satellites of the diagram lines L $Alpha_1$, and L $Beta_1$ have been observed for elements 28 (Ni) to 49 (In) and their wave-lengths determined. These satellites are more intense and numerous for elements 37 (Rb) to 46 (Pd). For atomic numbers above 46 the satellites become faint and diffuse and for 50 (Sn) are hardly measurable. This upper limit corresponds roughly to the completion of the fifth Period of Bohr's periodic table.

An attempt was made to study experimentally the satellites of the L $Alpha_1$ group in the region of the upper limit, by using long exposures and a spectrometer arrangement giving a high dispersion. The spectrometer was a single crystal type. The circular scale was graduated only in degrees and hence the arrangement could be used only for relative measurements. The slit was placed after the crystal, in fact was mounted on the front of the camera. To reduce absorption in the air the camera was arranged to be evacuated. It was made of brass tubing three inches in diameter and about six feet in length. In one end was a small rectangular window to admit x-rays.

Cellophane was used as windows on the x-ray tube and also on the camera. The thickness of the cellophane used was about .025 mm. To reach the photographic plate the x-rays needed to pass through two cellophane windows, 6 cm. of air, and a black paper plate cover. The total absorption for x-rays in this region, about 4.2 A°, would reduce the intensity to about one-tenth of the original intensity.

None of the plates taken, either for 47(Ag) or 48(Cd), showed any of the satellites satisfactorily. Apparently the plates were somewhat affected by x-rays scattered from the slit and the cellophane window which together with the reduction of intensity by absorption caused the satellites to be indistinguishable.

The conclusion is that this spectrometer arrangement is not suitable for the study of x-ray satellites in the region of 4 to 5 A°, because of excessive absorption and scattering.

1. Annalen Der Physik. 66: 437 (1921).
2. Annalen der Physik. 73: 647 (1924).
3. Zeit. Physik. 31: 445 (1925).
4. Richtmyer, F. K., Jour. Frank. Inst. 208: 325 (1929).
5. Backlin, E., Zeit. Physik. 27: 30 (1924).
6. Proc. Roy. Soc. 131: 476 (1931).