Further work is in progress, and it is hoped to publish fuller details later. I wish to express my thanks to Dr P. J. G. de Vos for his help with the experimental work, and to Prof. C. E. Tilley for providing the material. I also wish to thank Sir Lawrence Bragg for his interest in the work.

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Note on the structure of uranium.

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The structure of the low-temperature, or alpha, phase of uranium has been studied by Wilson (1933) and by Jacob & Warren (1937). In both investigations, the powder technique was used. Wilson reports a monoclinic cell with the following constants

$$a=2{\cdot}829,\quad b=4{\cdot}887,\quad c=3{\cdot}308\,\text{A.},\quad \beta=63^\circ\,26'\,(116^\circ\,34').$$

Jacob & Warren observed additional lines and deduced an orthorhombic cell with

$$a=2{\cdot}852,\quad b=5{\cdot}865,\quad c=4{\cdot}945\,\text{A.}$$

The space group is D_{2h}^{17}–*Cmcm*. Atoms are in the $4(c)$ position, and satisfactory intensity agreement was found with the y parameter equal to $0{\cdot}105\pm0{\cdot}005$.

Because of the uncertainties inherent in the interpretation of powder photographs of low symmetry, it was felt advisable to confirm the structure using single crystals. Rotation and Weissenberg photographs are consistent with the cell and space group of Jacob & Warren. Intensities are in substantial agreement with those calculated from the suggested structure. No refinement of the parameter is possible because of the high absorption. As a typical example, calculation gives

$$002 \gg 006 > 004,$$

whereas it is observed that

$$006 \ggg 002 > 004.$$

The apparent reversal is due to the fact that, for copper radiation, 006 is a high-theta reflection and is relatively unaffected by absorption.

It is of interest to note that the cell deduced by Wilson can be considered as contained in that of Jacob & Warren. The axial relations can be expressed as follows

$$-a_{\text{mono.}}=a_{\text{ortho.}},\quad b_{\text{mono.}}=c_{\text{ortho.}},\quad c_{\text{mono.}}=\tfrac{1}{2}(a_{\text{ortho.}}+b_{\text{ortho.}}).$$

The monoclinic angle, β, is that between the a axis and the $a+b$ direction.

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Reflexion method for projecting crystal-structure models.

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Parallel-light devices (see, for example, Low & Waldram, 1949) are in use in several laboratories for obtaining projections of wire crystal-structure models and for correlating models and two-dimensional Fourier syntheses. A sheet of plate glass is almost as satisfactory for the first purpose, and can be used for the second, though less conveniently. Its simplicity may, however, recommend it. Relatively large and robust models may be used; the high cost of large parabolic reflectors restricts the size of those used with parallel-light devices.

The point of projection is obtained by moving the eye until the atom and its reflexion coincide. It may be recorded in various ways, depending on the purpose for which it is wanted: (1) the point of projection may be marked on the glass with a suitable pencil; (2) its Cartesian co-ordinates may be read off on a sheet of graph paper placed beneath the glass; (3) its fractional co-ordinates may be read off on a scale drawing of the unit cell with its edges divided into tenths or twentieths. The accuracy obtained (0·005–0·01 of the cell edge) is sufficient for many purposes. For the first method it is convenient to place a sheet of black paper beneath the glass; the reflexion of the model is then easily seen with ordinary lighting. For the other two methods, and for the correlation of the model with trial Fourier syntheses placed beneath the glass, the model should be illuminated from the side, the lamp being shaded so that the paper beneath the glass is not too bright.

We have used the method only with single projections. There seems no reason, however, why it should not be used for two or three simultaneously, suitable stands being used to support vertical or inclined glass sheets. A lamp mounted in a cocoa tin pointing roughly along the cell diagonal would probably suffice to illuminate the model without throwing too much light on the glass sheets.

Reference

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