procedure of Howells, Phillips and Rogers[4] did not give a conclusive result which would enable a choice between the two space groups to be made. The density of the crystals is $1 \cdot 455 \pm 0 \cdot 001$ gm./ml. and the number of formula units $Ni(C_5H_7O_2)_2$ in the unit cell is 12 (calculated $11 \cdot 96 \pm 0 \cdot 07$).

Examination of the three-dimensional Patterson function and, in particular, of Patterson–Harker sections, showed that there are three nickel atoms in the asymmetric unit, the space group being $P2_1ab$. The co-ordinates of these three nickels are given in Table 1; the three atoms are very nearly collinear and the distances between adjacent atoms are: $Ni_1 - Ni_2$, 2·72 A., and $Ni_2 - Ni_3$, 2·88 A.

Table 1. CO-ORDINATES AS FRACTIONS OF THE AXIAL LENGTHS

Atom	x	y	z
Ni_1	0·092	0·036	0·256
Ni_2	0·000	0·120	0·125
Ni_3	−0·098	0·208	−0·017

It is considered that, at the stage to which this work has been taken, the difference between these two values is not significant. The proximity of the nickel atoms implies either (*a*) an interaction between neighbouring nickels, or (*b*) a bridging of neighbouring nickels by other atoms. In either case the crystal must contain large molecules, each three times as big as hitherto supposed, namely, $Ni_3(C_5H_7O_2)_6$. The presence of these trinuclear molecules is shown plainly in the electron density projection on (001), $\rho(xy0)$, reproduced in Fig. 1. Direct and 'trial and error' methods of determining the positions of the other atoms have failed to lead to a unique solution. Many possible molecular models can be ruled out, but with trinuclear molecules the possibility of octahedral co-ordination of the nickel atoms must be taken into account; it is not simply a choice between tetrahedral and square-planar co-ordination.

It is apparent that further investigation of this compound using other physical techniques is essential before one can decide between the various possible structures with any confidence. With this object in view, further work is proceeding in collaboration with Prof. R. S. Nyholm. In particular, the magnetic susceptibility is being studied over a range of temperature, the molecular weight is being determined in various solvents and infra-red studies are to be carried out.

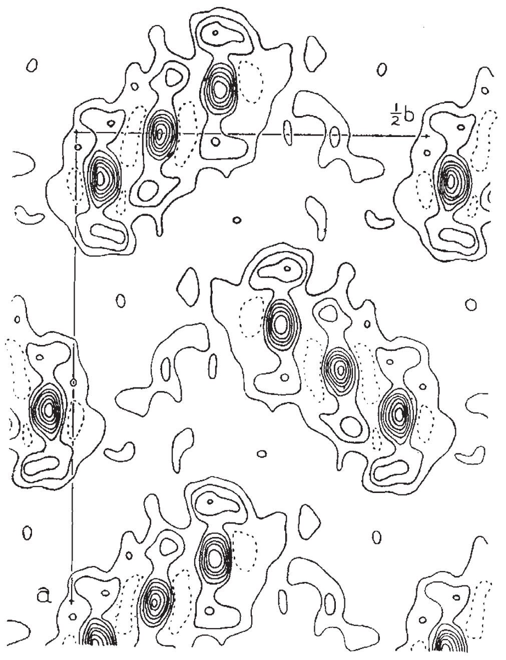

Fig. 1. Electron-density projection on (001). Contour interval arbitrary, some contours around the nickel atoms being omitted for clarity

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[1] See, for example, Godycki, L. E., and Rundle, R. E., *Acta Cryst.*, **6**, 487 (1953). Cox, E. G., Wardlaw, W., and Webster, K. C., *J. Chem. Soc.*, 1475 (1935).

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The Arrow of Time

IT is widely believed that all irreversible mechanical processes involve an increase of entropy, and that 'classical' (that is, non-statistical) mechanics, of continuous media as well as of particles, can describe physical processes only in so far as they are reversible in time[1]. This means that a film taken of a classical process should be reversible, in the sense that, if put into a projector with the last picture first, it should again yield a possible classical process.

This is a myth, however, as a trivial counter-example will show. Suppose a film is taken of a large surface of water initially at rest into which a stone is dropped. The reversed film will show contracting circular waves of increasing amplitude. Moreover, immediately behind the highest wave crest, a circular region of undisturbed water will close in towards the centre. This cannot be regarded as a possible classical process. (It would demand a vast number of distant coherent generators of waves the co-ordination of which, to be explicable, would have to be shown, in the film, as originating from one centre. This, however, raises precisely the same difficulty again, if we try to reverse the amended film.)

Thus irreversible classical processes exist. (On the other hand, in statistical mechanics all processes are, in principle, reversible, even if the reversion is highly improbable.) Although the arrow of time is not implied by the fundamental equations, it nevertheless characterizes most solutions. For example, in applying Maxwell's theory, the initial conditions determine whether we choose to work with retarded or with advanced potentials, and the resulting situation is, in general, irreversible.

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[1] See, for example, Max Born, "Natural Philosophy of Cause and Chance", especially pp. 25f. (1949).