plate material taken with other telescopes appears desirable. One of the reasons why the thin line may have escaped previous observations is the fact that most large reflectors have their secondary mirror supports in an east–west, north south direction so that the diffraction cross resulting from long exposures would hide the thin line. (Notable exceptions: the Lick 120-in. and McDonald 82-in. reflectors the secondary supports of which are at 45° angles to the meridian.)

While it should be re-emphasized that the interpretation of the present data is tentative only, it is unlikely that the observations can be attributed to instrumental effects or guiding errors for the following reasons.

(1) No diffraction spikes are seen on any of the exposures. (2) The thin line lies exactly in the plane of the rings, about 2·5° to the horizontal. Guiding errors are usually in right ascension. (3) Background stars do not show any guiding errors or extensions. (4) The thin line is not likely to be caused by adjacency effects in the emulsion between closely spaced images of satellites. On at least one night when four bright satellites were west of the planet and two were widely spaced in the east, the thin line showed up very well in the east. (5) To avoid internal reflexions, no filters were used. (6) The thin line observations were made when the Sun was above and the Earth below the plane of the rings.

I thank Dr. N. E. Wagman for making the telescope available, Dr. T. M. Donahue for helpful discussions, and the Westinghouse Research and Development Center for the use of the Jarrel–Ash microdensitometer. The work was partly supported by the U.S. National Science Foundation.

W. A. Feibelman

Department of Physics and Allegheny Observatory,
University of Pittsburgh,
Pennsylvania.

Received March 4, 1967.

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PLANETARY SCIENCE

Sporadic *E* in Middle Latitudes—a Reply

My communication[1] suggested that sporadic *E* layers are accompanied by, not formed by, discontinuities in the vertical motion of the neutral gas. The horizontal motion of the neutral gas also plays an important part in the hypothesis I outlined. The vertical drift velocity of ionization, as given by equation (10)[1], is

$$w = a_x(u_x - u_{0x}) + a_y(u_y - u_{0y}) + a_z u_z$$

The coefficients a_x, a_y, which are proportional to the horizontal component of the magnetic field, undergo abrupt changes at a discontinuity of the kind contemplated in my communication. The increments of a_x and a_y, as well as that of u_z, contribute to the increment of w across a layer of discontinuity. There is no obvious reason why the last contribution should be dominant, except at high geomagnetic latitudes. Thus the observations cited by Whitehead[2,3] seem to support my hypothesis.

David Layzer

Harvard College Observatory,
Harvard University,
Cambridge, Massachusetts.

Received March 28, 1967.

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THE SOLID STATE

Crystal Structure of $Na_2Si_3O_7$: a New Type of Silicate Sheet

The preparation and characterization of sodium trisilicate have been reported by Williamson and Glasser[1], who determined the pseudo unit cell (based on the strong reflexions) to be orthorhombic, $a = 20{\cdot}6$ Å, $b = 6{\cdot}50$ Å, $c = 4{\cdot}90$ Å. Additional weak but sharp reflexions have, however, been observed which lie nearly but not exactly midway between reciprocal lattice points in the b^* direction, as illustrated in Fig. 1; the displacement from the mid-points corresponds to approximately $b^*/17$. These extra reflexions are not attributable to twinning, and indicate that this is an example of an order–disorder structure. In the present work they have been ignored and the structure has been solved as far as possible with respect to the strong reflexions only.

The possible space groups are $C2cm$, $Cmcm$ and $Cmc2_1$; only in $Cmc2_1$ can the silicon–oxygen tetrahedra be accommodated in a reasonable manner, and accordingly this space group was chosen. The cell contents are $Na_8Si_{12}O_{28}$. Three-dimensional data were measured for a small, untwinned crystal on a Hilger and Watts linear diffractometer with molybdenum Kα radiation. Because of the small size of the crystal, many of the reflexions were unobserved.

Harker–Kasper inequalities and sign relationships were used to solve the projection on (001). Thirty-seven signs were determined in terms of two sign symbols, and the initial R value for the correct combination of signs was 48 per cent. A series of Fourier and difference syntheses reduced this to 30 per cent and a sequence of least squares refinements led to a final R index of 10·4 per cent for fifty-eight non-zero reflexions, using an overall temperature factor of 2·4 Å^2.

The projection of the structure on (001) is illustrated in Fig. 2 (i), and is seen to show a striking resemblance to the projections of the structures of Na_2SiO_3 (refs. 2 and 4) and of α-$Na_2Si_2O_5$ (ref. 3) (Fig. 3). It appears from this that the structure consists of metasilicate chains (A—A, B—B) running parallel to c, and condensed to form $(Si_3O_7)^{2-}$ sheets (no example of which has previously been found). A single chain, viewed along a, is drawn in Fig. 2 (ii). Every oxygen atom involved in the central chain A—A is shared by two tetrahedra; in the B—B chain only the atom O(3) is unshared.

Attempts were next made to assign z-co-ordinates to the atoms and account for the three-dimensional data. The sodium atom was not varied from height $z = 0$, and the atoms O(1) and O(3) were assigned z-co-ordinates of

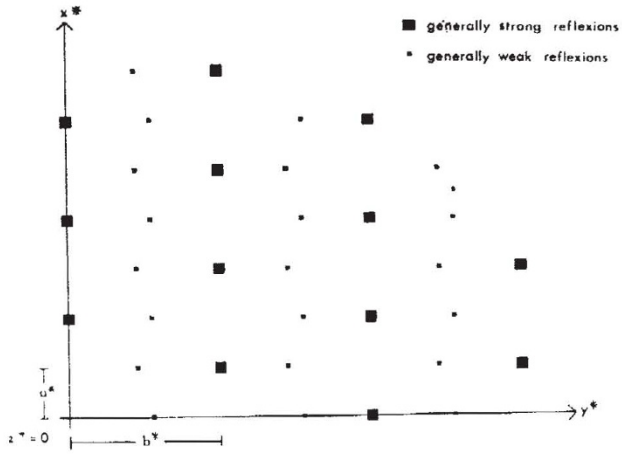

Fig. 1. Part of the reciprocal lattice of $Na_2Si_3O_7$ showing the positions of the additional intensity maxima. Upper layers are essentially the same.