and this prompts speculation that transducer outputs are quantized in 32 levels before transmission. The fact that other values cluster around 84 per cent (or level 16) supports such speculation. Read-out as a five-bit binary code for storage and data processing is therefore a possibility.

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[1] *New China News Agency* (in English) (1915 UT, April 25, 1970).

LETTERS TO THE EDITOR

PHYSICAL SCIENCES

Telemetry from the First Chinese Artificial Earth Satellite

THE first Chinese artificial Earth satellite was launched at approximately 1330 UT on April 24, 1970. The announcement of the launch, giving a transmission frequency of 20·009 MHz, was made in Peking at 1232 UT on April 25. First signals were received at Kettering Grammar School at 1402 UT, towards the end of the twelfth orbit of the Earth.

As announced later in Peking, the signals consist of a 1 min cycle of alternate music and telemetry[1]. The first 40 s are devoted to a repetition of the music of "Tungfanghung"—"The East is Red" (Fig. 1)—followed by an interval of 5 s. Then follows 10 s of telemetry and, after a further interval of 5 s, the complete sequence is repeated.

The telemetry consists of audio tones which seem to be quantized in steps of 13·6 Hz. The first tone has the same frequency as the highest musical tone. The duration of the first tone is twice that of succeeding tones and its frequency is 100 times the minimum difference between tones, so it is considered to serve as a calibration point nominally equal to 100 per cent. Then follow twenty tones of equal duration, terminated by several rapid tones.

Values of the initial tone and twenty channels, expressed as a percentage of the maximum observed frequency, are given for revolutions 24 and 99 in Fig. 2. To date, no frequency below 68 per cent has been observed. Seven of the channels had this minimum value on revolution 99

Fig. 1. "Tungfanghung."

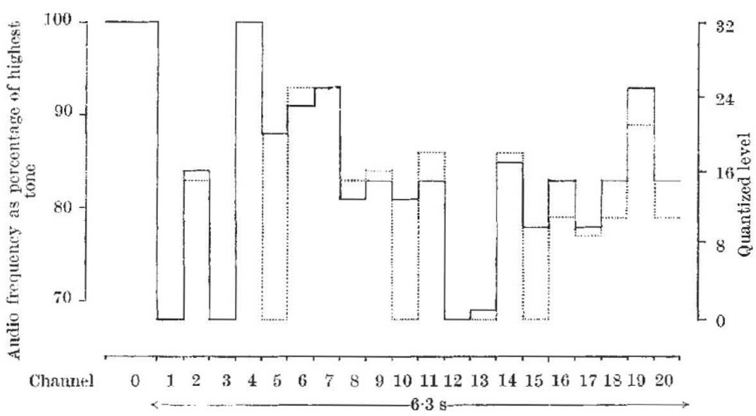

Fig. 2. Telemetry from 1970—34 A on revolution 24 (——), April 26, 1970, and revolution 99 (...), May 2, 1970.

Is the Diffuse Interstellar Absorption Band at 4430 Å caused by Trivalent Iron?

ALTHOUGH the broad diffuse interstellar absorption bands have been known for more than 30 years, they still defy identification. It has been suggested that the bands may be caused by electronic transitions in impurity ions in grains[1]. Here I show that the wavelength, asymmetry and half-width of the 4430 Å band, in particular, are compatible with absorption bands marking the $^6A_1(S) \rightarrow {}^4A_1{}^4E(G)$ transitions in Fe^{3+} in some terrestrial silicates. The absorption spectra of Fe^{3+} in octahedral sites in some garnets are used for comparison, because these spectra are now reasonably well understood. Because Fe^{3+} is a $3d^5$ ion, however, the d–d spectra are similar for both octahedral and tetrahedral complexes.

Fig. 1 shows portions of the absorption spectra of the natural garnets and radite[2], $Ca_3Fe_2{}^{3+}Si_3O_{12}$, and schorlomite[3], a high-Ti garnet corresponding to an andradite but with approximately 25 per cent of the tetrahedral Si^{4+} and 10 per cent of the octahedral Fe^{3+} ions replaced by Al^{3+} and Ti^{4+} ions[4]. Each oxygen is common to two eight-cornered Ca^{2+} polyhedra, one Fe^{3+} octahedron and one Si^{4+} tetrahedron[5]. In schorlomite, each Fe^{3+} ion has an average of 1·5 Al^{3+} or Ti^{4+} ions in the next-nearest-neighbour tetrahedral sites. The principal bands at 4400 Å mark the $^6A_1(S) \rightarrow {}^4A_1{}^4E(G)$ transitions in Fe^{3+}; they are relatively sharp for transition-metal d–d bands because the transitions are field-independent[2]. The oscillator strengths are $3·5 \times 10^{-6}$ for andradite and 6×10^{-5} for schorlomite. Substitution of the tetrahedral Si^{4+} ions by the larger, less covalent Al^{3+} or Ti^{4+} ions destroys the inversion symmetry at adjacent octahedral Fe^{3+} sites by distorting the oxygen octahedra and modifying the charge distribution within these octahedra[3]. Accordingly, in schorlomite, the Fe^{3+} transitions may borrow intensity from charge-transfer transitions, such as $O^{2-}2p \rightarrow Fe^{3+}3d$, through crystal field mixing of odd-parity charge-transfer states with even-parity d states. Replacement of Si^{4+} ions by Al^{3+} and Ti^{4+} ions also has the effect of broadening the Fe^{3+} bands; the half-widths of the 4400 Å bands in andradite and schorlomite are 100 Å and 260 Å respectively, compared with a half-width of 150–200 Å for the 4430 Å band in spectra of supernova SN–NGC–2713[6-8].

The $^4A_1(G)$ and $^4E(G)$ levels of Fe^{3+} are not exactly degenerate and in well resolved spectra two component bands are observed (Fig. 1). In less well resolved spectra a shoulder is observed on one of the wings of the 4400 Å band. The image tube observations of Brück and Nandy[9] show that the 4430 Å interstellar band can be highly asymmetric, the longer wavelength side being the steeper. This indicates the pre-