FINE STRUCTURE IN TYPE IV SOLAR RADIO BURSTS

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Abstract (*Solar Phys.*). The fine structure in solar type IV radio bursts was studied using the 169 MHz Nançay radioheliograph and the 60 channel radiospectrograph at Utrecht (160–320 MHz). The observed fine structure includes pulsating structure, zebra patterns (parallel drifting bands) and intermediate drift bursts. All are considered as modulation of high frequency radiation by low frequency oscillations or as the result of up conversion of low frequency oscillations to higher frequencies (Rosenberg, 1973).

Definite proof is presented that the pulsating structure is produced by a source which is imbedded in the continuum source and which is considerably smaller than the continuum source (Caroubalos *et al.*, 1973).

The zebra patterns can be understood as due to the coupling of electron Bernstein waves and upper hybrid waves. These waves become unstable if a hot electron cloud is trapped inside a magnetic flux tube filled with cooler coronal plasma (Chiuderi *et al.*, 1974). A source size of 1000 km and an energy density in the plasma waves and Bernstein waves equal to 10^{-3} of the thermal coronal energy density is compatible with the observations. It is concluded that stationary type IV radiation is not synchrotron radiation but magnetoplasma radiation strongly dependent upon the magnetic field (Chiuderi *et al.*, 1973).

References

Caroubalos, C., Pick, M., Rosenberg, H., and Slottje, C.: 1973, *Solar Phys.* **30**, 473.
Chiuderi, C., Giachetti, R., and Rosenberg, H.: 1973, *Solar Phys.* **33**, 225.
Chiuderi, C., Giachetti, R., and Rosenberg, H.: 1974, to be published.
Rosenberg, H.: 1973, Thesis, Utrecht.

DISCUSSION

Wild: Perhaps an alternative and simpler explanation of the Zebra pattern on dynamic spectra would be to postulate a propagation effect in which the radiation reaches the observer along two well-defined paths, causing an interference pattern. A similar bi-prism phenomenon is observed on the dynamic spectrum of radio-star scintillations, though perhaps in this case the 'bi-prism' would be in the solar atmosphere. One would only need a path-length difference of, e.g., 10 m to explain a frequency separation between adjacent stripes of 30 MHz.

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Gordon Newkirk, Jr. (ed.), Coronal Disturbances, 291–292.

Sy: (1) If an instability is involved, you would expect different intensities in the harmonics. (2) You assume the Bernstein waves to be isotropic which is doubtful.

Rosenberg: (1) Intensities are observed to be comparable in the laboratory. Harmonics are thought to feed each other nonlinearly. (2) We used an isotropic distribution for simplicity, but only a small portion of it is important for coalescence.