A POSSIBLE GENERATING MECHANISM FOR INTERMEDIATE DRIFT BURSTS

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Intermediate drift bursts (1) of fiberbursts can be seen on dynamic radiospectra of the NERA-spectrograph in type IV-like continua in the range 200 - 320 MHz. An individual fiber consists of an emission ridge, typically 1.5 MHz wide, with an adjoining absorption edge at the low frequency side of the same width. The drift rate in the considered frequency band generally lies in the range from -2 to -10 MHz s\(^{-1}\), occasionally showing a positive drift. (see figure).

As the generating mechanism of this phenomenon we propose nonlinear coupling in the source region between radiation and passing wave packets of the whistles-type travelling parallel to the magnetic field.

Because of the unsettled nature of the associated continua two possibilities exist.

First the radiation may be synchrotron radiation from relativistic electrons, escaping predominantly in the extraordinary mode at a level above the local plasma frequency. A passing whistler (with frequency \(\omega_h\)) can couple nonlinearly at
March 6, 1972. The structure of the fibers is clearly visible on the sensitive channels in the middle. (Lower part: normal channels, upper part: circular polarization.)
its instantaneous position to the transverse radiation (with frequency \( t \)) with small group velocity (e.g. near the corresponding reflection levels). During the coupling \( t + \omega h \rightarrow t' \), the original synchrotron radiation is upconverted in frequency, giving rise to the observed frequency profile.

Secondly, the continuum radiation may be due to scattering of Cerenkov plasma radiation (\( \gamma \)) on particles or ion acoustic waves (p). The frequency of the scattered transverse wave is essentially the frequency of the plasma wave. If a whistler packet is present the plasma waves can couple with the whistler (\( \gamma + \omega h \rightarrow t \)), also giving rise to the observed frequency dependence.*

In both cases the frequency separation of the emission and absorption ridges in a fiber corresponds to the frequency of the whistler. The last attains its maximum group velocity around one third of the electron gyrofrequency (2). If we take this value as the characteristic frequency of the whistler, the magnetic field strength in the source region is approximately 2 Gauss.

Whistlers can propagate in the form of discrete wave

*) Detailed calculations of the coupling coefficients are in progress.
packets, solitons, with velocities between 21 to 31 times the Alfvén speed, depending upon their amplitudes (3).

The measured drift rate of the fibers, -2 to -10 MHz s⁻¹, corresponds to 4500 km s⁻¹. in an enhanced coronal model (10x Newkirk). Indeed this agrees with the soliton speed for a field strength of 2 Gauss and a density of 10⁹ cm⁻³, 4 - 6. 10³ km s⁻¹.

We did not explain how the whistlers are generated. Multiple evidence exists that they can be excited by an anisotropic high velocity particle distribution with preferred velocities perpendicular to the magnetic field (4, 5), e.g. in the mirror points. Alternatively they can be excited by MHD-disturbances.

References: