TEORSCATTER

are used to scatter and reflect radio signals, and the nature of their make up suggests that the condition for optimum reflection will not last for very long, this can be witnessed by the very rapid make up and disappearance of a 'shooting star' (meteor). In some the ionisation density is very low and scattering of the signal takes place rather than reflection. These are known as underdense trails and because of the low electron density signals pass through the trail and the total received energy is the sum of the individual reflections. However due to the rapid change in phase angles caused by multiple individual reflections bursts from underdense trails are very short. It is this condition which produces the familiar 'ping' with signals audible for only a fraction of a second. This of course serves no useful purpose other than to assure you that someone is transmitting on the specified frequency — hopefully your sked partner! Other trails produce high levels of ionisation and are known as overdense. With this type of meteor trail the high levels of ionisation cause total relection of the wave giving much longer bursts of information which can sometimes last for 90s and on rare occasions 2-3 minutes. Strongest reflections will occur if the meteor trail electron density exceeds the value for total reflection from an ionised gas. This requires the trail to exceed 10^{14} electrons per metre of length.

SIGNAL LEVEL FLUCTUATIONS

Received signals reflected from meteor trails are often subject to considerable fluctions in strength. There are two main reasons for this, both of which are due to more than one reflection being received at the antenna, sometimes in phase, and adding to the signal and at other times in anti-phase and cancelling.

The first are rapid fluctuations directly proportional to the frequency used. These have been measured by professional pulse methods and found to correspond to a fluctuation of approximately 22ms at 144MHz. It is caused by a series of maximum and minimums which occur during the making up of the meteor trail, and is best explained with the aid of a simple diagram. (seee **Fig. 1**).

As the meteor travels along the axis T.T1 insufficient scatter is produced before point AZ is reached. Reflections between ZA and ZA1 will travel the return distance from the observer between 2R and 2(R + /2) but waves scattered between AB and A1B1 will travel return distances between 2(R + /2) and 2(R + 1). Thus if the reflections from ZA ZA1 are positive in amplitude those in AB and A1B1 will be in anti-phase cancel. Those in BC and B1C1 are in phase with ZA and ZA1 and so add to the received signal strength. This rise and fall in signal strength is shown graphically in **Fig. 2**.

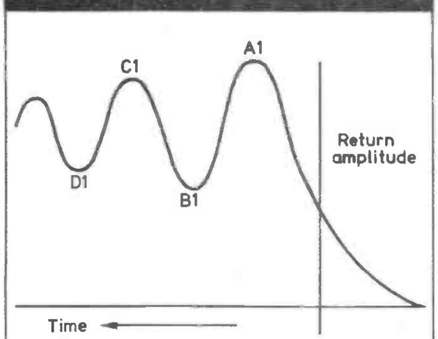

FIG. 2. Return signal amplitude plotted against time

When the trail is complete the signal will level off and then slowly decay as the ionisation is dispersed in the upper atmosphere by high altitude winds. The second reason in the simplest case, is believed to be caused by distortion of the ionised trail due to severe turbulence encountered in the upper atmosphere. It is quite common when receiving a long burst from distant m-s stations to find periods of several seconds when no signal is present, or at a very low level. Although this is not always the case it may be attributed to those reasons given above.

SIGNAL STRENGTH AND DURATION

When considering scattered signals from underdense meteor trails the duration is proportional to the square of the wavelength. In other words a 1s burst on 2m will only have a duration of 0.11s on 70cms.

The received energy is proportional to the third power of the wavelength which corresponds to a 27:1 reduction on 70cms compared with 2m. A signal 15dB above noise on 2m will only be 1dB on 70cms. (14dB reduction).

For overdense trails where most of the incident wave is reflected the duration is still proportional to the square of wavelength but the received engergy is directly proportional to the wavelength. In real terms this means that a burst of 10s duration, 10dB above noise on 2m would be 1.1s long and 5.5dB over noise on 70cms.

On 4m the values would be increased to 42s duration and 16dB over noise compared with those on 2m.

These figures indicate why 70cms is a much more difficult band to work using this mode of propagation.

It must be said that some dedicated 70cms operators have had successful QSO's on this band but compared with 2m the combination of reduced received energy and signal duration make the completion of QSO's very difficult for all but the best equipped stations.

A certain amount of work is being done by some operators working cross band 4m/2m. In this situation the 4m listening station has the added advantage of the improvements offered by the lower frequency. 4m would most certainly be an excellent band for the meteor scatter enthusiast but unfortunately cannot be used to full advantage because it is denied to most operators in Europe.

EXPECTED RANGE

What distance can I expect to work using meteor scatter? This is a fre-