quent question and one which depends considerably on the conditions prevailing at the time. Generally it can be said the ranges expected are very similar to that obtained when working single hop sporadic E, normally between 600 and 2000km, although during levels of high meteor activity ranges of 3000km are possible.

Meteor scatter is normally a weak signal form of communication, particularly when stations are placed towards the limits of range. When attempting schedules with stations at ranges in excess of 1800km signal strengths can often be very low — only a few dB above the noise floor of the receiver with long periods of no signals at all. It is under these circumstances that the utmost patience is required as a burst of information may come along which is sufficient to complete a QSO when hope is running out. Shorter range stations between 1000-1500km can often provide regular, strong signals above S9 if using some of the major showers with correct timing. This is where most people start meteor scatter operating and develop an interest in this most fascinating form of VHF propogation.

DOPPLER FREQUENCY SHIFT

Any signal, audio or radio frequency which is radiated by, or reflected from a moving object will be subject to Doppler shift.

Reflections from meteor trails are no exception to this rule and are often affected to some extent by this phenomenon. The amount of frequency shift can be calculated if two factors are known.

1. The velocity of the meteor trail
2. The frequency of RF energy.

$$FD = V/C \times f$$

Where FD = unknown doppler shift in Hz

V = Velocity of meteor in earth's atmosphere m/sec

C = Velocity of propagation — 300×10^6 m/sec

f = Transmitted frequency in Hz.

Different meteor showers have a wide range of velocities when entering the earth's atmosphere.

For example, the April Lyrids are 50km/second.

Therefore FD =

$$\frac{50 \times 10^3 \times 144 \times 10^6}{300 \times 10^6} = 24\text{kHz}$$

The maximum velocity of a meteor entering the atmosphere from within the solar system is 72km/sec. This limit is made up of two components and is the sum of the earth's velocity around the sun (30km/s) and the escape velocity from the solar system (42km/s). This value of 72km/s is attained by the November Leonids shower and gives a theoretical maximum Doppler shift of 34.5khz These figures are theoretical maxima and assume the reflecting medium to be moving at this speed.

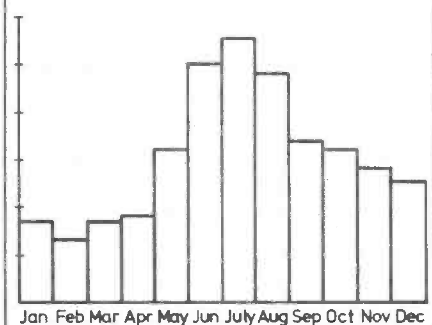

FIG. 3. Diagram showing the variation of sporadic meteors throughout the year.

This of course, is not the case in practice because it is only the meteor head which is moving at this velocity. The trail of ionisation produced by the meteor is stationary except for relatively small atmospheric disturbances, and as this is the reflecting medium Doppler shift should no be evident.

However in some instances Doppler shift can be heard and although personal observations seem to indicate that the bursts are all very short, this may not necessarily be the case, as often the Doppler shift moves the received signal completely across the passband of the receiver and the true duration and the amount of shift are never discovered. It is possible that this phenomenon is due to reflections taking place from the ionisastion surrounding the meteor head which may also have a trajectory far from ideal for the path being worked.

SPORADIC METEORS

Sporadic meteors, as the name implies, have a random distribution over the sky with non-defined orbits. They account for the majority of particles that enter the earth's atmosphere although meteor showers with well defined orbits and high concentrations provide much improved propagation for short periods only.

Sporadic meteors can be used by the ms operator with considerable success throughout the year although certain times of the day, and months of the year give a definite improvement in communications efficiency.

ANNUAL VARIATIONS

There are certain months of the year which provide a much higher yield of sporadic meteors. A peak in activity occurs during June, July and August with minimum activity occuring in February and March. A diagram outlining these annual variations is shown in **Fig. 3**.

DIURNAL VARIATIONS

Owing to the earth's motion, certain parts of the day produce higher rates of sporadic meteors.

As the earth rotates on its axis, some parts are in sunlight and others in darkness. During the early morning around 06.00 the observer's part of the earth is forward on its journey around the sun and tends to sweep up the meteoric particles in its path whereas at sunset the opposite occurs as the earth is acting as a shield to incoming particles and only those with sufficient velocity to overcome that of the earth's motion will enter the atmosphere. Any meteors approaching the earth towards sunset will need to exceed the forward velocity of 30km/s whereas at 06.00 optimum conditions exist and the velocities are additive. **Fig. 4** shows this in the form of a daigram which illustrates the relative motions and times.

Although sporadic meteor scatter can be used at any time of the day throughout the year best results should be obtained during the early mornings of the summer.

METEOR SHOWERS

At certain times every year, the earth, on its path around the sun,