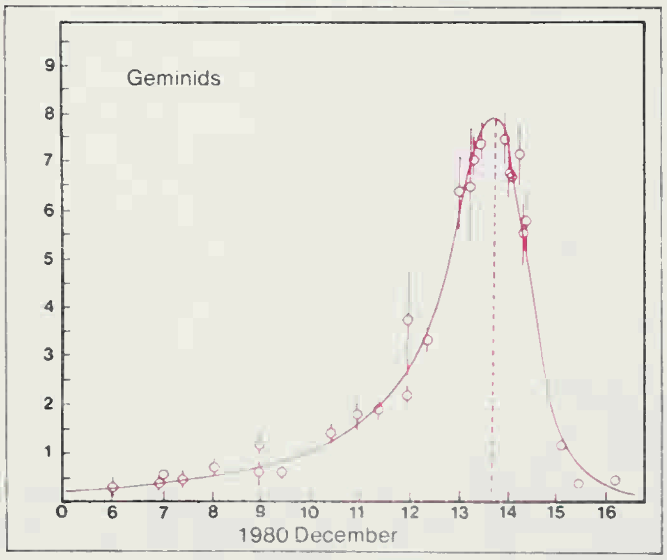
Meteor Watching

The visual observation of meteors is exciting work and provides an excellent introduction to observational astronomy because little equipment is required, other than a suitable atlas or set of star charts. Under good conditions a keen-eyed observer can expect to see about eight sporadic meteors per hour on average. On nights when showers are active the rate may be very much higher, although none of the major showers can be expected to rise much over 100 per hour under normal conditions. The spectacular displays such as those of the Leonids in 1799, 1833, 1866 and 1966, with many thousands of meteors per hour, are very much the exception. The rate which one can normally expect from the Leonids is not much greater than that for sporadics. The clumps of meteoroids which give rise to high rates are frequently very compact, so that even with the regular showers the peak frequency may only be seen over a small area of the Earth. Various other factors will affect the number of meteors seen, the most important being interference from the Moon, the altitude of the radiant, the clarity of the atmosphere and the time of night – more meteors are seen after midnight when the Earth's rotation is carrying the observer 'into' the stream. It is also best for the observer to watch an area of the sky about 45° away from the radiant.

A single observer can obtain very interesting and useful records, but obviously it is not possible to watch the whole sky at one time, so small groups of persons frequently observe from one site, each observer covering a portion of the sky, with perhaps one member recording details called out by the observers. This form of meteor watch is frequently used when a shower is close to maximum. The methods adopted and the information recorded vary, depending upon whether the observer is alone or in a group, and whether the meteor rate is low or high. Basically, however, records are made of the time at which meteors are seen, their magnitudes, paths – particularly start and end points – whether they seem to belong to a shower or appear to be sporadic, and any special features such as persistent trails. (The latter can persist for some considerable time after a meteor, and recording its position, either visually or photographically, can give important information about motion in the upper atmosphere.)



It is best for watches to last for a set period – say 30 or 60 minutes – but the beginning and end times must in any case be recorded fully.

Although it is of advantage to know the position of the radiants, these do alter slowly from day to day due to the Earth's motion relative to the orbit of the meteoroids. However, the identity of individual meteors can usually be determined by plotting their paths on star charts. (Only one special map projection – known as the gnomonic – shows paths as straight lines, but provided that the start and end points are correctly identified, accurate tracks may be derived from any chart using nothing more complicated than a scientific calculator.) The detailed determination of radiants from visual observations is difficult and has now largely been superseded by other means. However, during showers the recording of meteor magnitudes and of the numbers seen allows very important information about the distribution and sizes of the meteoroids within the stream to be deduced.

Many meteor observers supplement their visual observations with photographic records and even simple undriven camera mounts can be used for time exposures. However, photography will only ever record the brightest meteors. As with visual observing it is most effective if a single camera is pointed about 45° from the radiant. During a time exposure, the starting and finishing times of which must be recorded, the observer should, if possible, also watch the same area of the sky, recording the details of any meteors as usual. Any meteors recorded on the film will then be fully documented. More advanced amateurs use a battery of cameras, or special mirrors or fish-eye lenses to record the whole sky. Rotating shutters may be fitted to either single or multiple-camera arrangements, in order to break the trails at fixed intervals, thus providing a means of determining the velocity of any object.

Co-operative photographic projects are well worthwhile, the simplest technique being to place two observers some distance apart – perhaps 50 km or more – to photograph the same volume of sky. The paths of any meteors photographed by the two cameras can then be determined exactly, and the heights derived by triangulation processes. National organizations frequently arrange for special coverage on particular nights, asking all observers to direct one camera towards one of a number of points, usually 70km above specific positions on the ground. (In a small country, such as the United Kingdom, only three such points may be needed.)

Similar techniques are used by the fireball patrols which regularly operate cameras, sometimes quite automatically, on every clear night. Unlike ordinary meteor photography, however, this is only suitable for very dedicated observers who are prepared not only to expose the films, but also to develop and check them as quickly as possible. This is especially important when there has been a bright fireball which may have resulted in a meteorite reaching the surface of the Earth. Here photographs are needed to determine the most probable impact point so that a search may be mounted as soon as possible.

A daytime fireball is a very important event and should be recorded as fully as possible, giving the altitude and azimuth of the ends of the track – or those parts which were seen – as well as the usual

The plot of meteor numbers during the course of the Gemenid meteor shower, observed over several nights in 1980 December (B.A.A. data).