

thesis and claimed it to be more convenient than that of Ellison *et al.*⁷ Their hypothesis is that the inclination of the interplanetary magnetic field is caused by the anticipated streaming of the ionized particles roughly perpendicular to the galactic plane, the so-called galactic wind.

In light of the above hypothesis, if we assume a source of charged particles or ionizing radiation in galactic or interstellar space, our findings can be partly explained. During the two equinoxes the sun's diurnal path coincides with the celestial equator and the earth's geographic equator; the earth-sun distance also remains same but positions of the sun in the galactic space are not identical. On vernal equinox, the sun occupies its position in the Aries while on autumn equinox it is in the Libra. Thus, any source of ionization situated outside the solar system will evidently give different values of electron density and hence f_oF_2 , for all locations of ionospheric observatories during equinoxes, even when all other characteristic parameters of F2-region remain identical. However, the nature of global distribution of Δf is yet to be explained. From the mode of global distribution it appears that the geomagnetic field plays an important role in controlling charged particles responsible for giving non-zero values to Δf .

In support of the hypothesis of the existence of a source of ionizing radiation outside the solar system it is interesting to recall a news item released from Space Control Centre at Houston on 25 July 1975, which runs as follows: "A powerful source of ultra-violet radiation outside the solar system was discovered on board the U S Apollo spacecraft almost accidentally as the Apollo made its 109th orbit round the earth on 22 July. It is the first time that such a source, whose intensity lies between 50 and 1000 Å, has been detected outside the solar system. Prof. C. S. Bowyer who devised the instrument declined to say anything more than this."

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Nocturnal E-region during Meteor Showers

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The effects of Geminid meteor shower of 1972 on nocturnal E-region are studied from If amplitude records. The studies on the peak activity day indicate an enhancement of both ionization and irregularities during the latter part of the night. Also, good correlations are observed between the amplitude attenuation and radio meteor count, and increase in fading rate and visual meteor count. The results indicate that the increase of ionization is the earlier effect and the formation of irregularities is the latter effect.

Although it is now well established that the main sources of nocturnal E-region ionization are scattered Lyman- α and soft particles,^{1,2} meteors are also shown to be prominent ionizing sources particularly during shower periods. This is evident from the pronounced effects observed on the propagation characteristics of vlf and lf waves by several workers.³⁻⁷ In this communication, If amplitude records during a Geminid shower are studied so as to understand the changes in the nocturnal E-region during shower times at one of the low latitude stations.

The sky wave amplitude of 292 kHz signals, transmitted from Madras (13°0'N, 80°2'E) and recorded at Waltair (17°8'N, 83°3'E), are studied during the latter part of the night of 14 Dec. 1972, the peak activity day of Geminid meteors. Geminids, with a declination of +32° is one of the intense showers,⁸ active during 7-15 Dec. of every year. The peak activity of the shower is during 13-14 Dec., and its radiant transit time is at 0205 hrs LT, with a visual meteor rate of 50 per hour.

Fig. 1 shows the sky wave If amplitude records of 4 Dec. 1972, a typical non-shower day, and of 14 Dec. 1972, the peak activity day of Geminids. The records shown during 00-07 hrs LT clearly show the distinctive features between the non-shower and the shower days. The local time (LT) referred here cor-

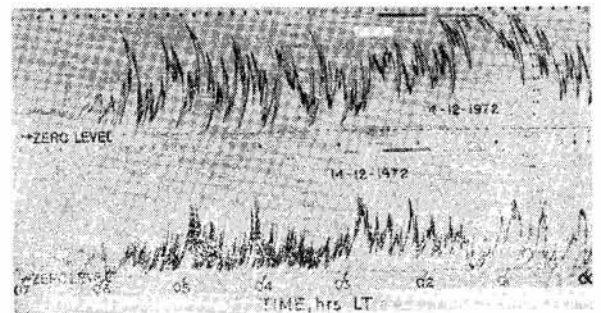


Fig. 1—Amplitude records at 292 kHz for non-shower day of 4 Dec., and peak activity day of the Geminid shower of 14 Dec. 1972

responds to Waltair, as the LT at the reflection point is a little different. The amplitude is highly attenuated during the latter part of the shower night associated with a large increase in the fading frequency. A clear temporal variation of the signal attenuation is brought in Fig. 2, where the normalized percentage of the attenuation is plotted against local time, which is calculated using ten non-shower day values of that month. The radio meteor count of the same shower of 1958 observed at Jodrell Bank⁹ is also plotted in the same figure. Both the curves show a good correlation indicating that there is an increase of ionization during the peak activity date of the shower which resulted in the attenuation of the signal. The peak of radio meteor count coincided well with the peak of amplitude attenuation.

Fig. 3 shows the percentage increase in the fading rate, calculated in the same manner as for amplitude attenuation, plotted against local time. Also the average visual meteor count observed by Rama Rao¹⁰ at Waltair, for the showers of 1962-64, is plotted in the same figure. Both the curves show high correlation, with simultaneous peaking at 0300 hrs.

Fig. 1 shows the high attenuation of the signal which can be inferred as due to the enhancement of ionization produced by shower meteors. This is evident from the Fig. 2 also where the attenuation of the signal closely follows the radio meteor count. The increase in the fading rate in a similar way is due to

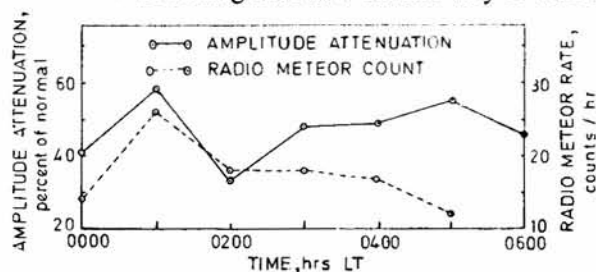


Fig. 2—Amplitude attenuation of the If signal and the radio meteor count plotted against local time, for the peak activity day of the Geminid shower

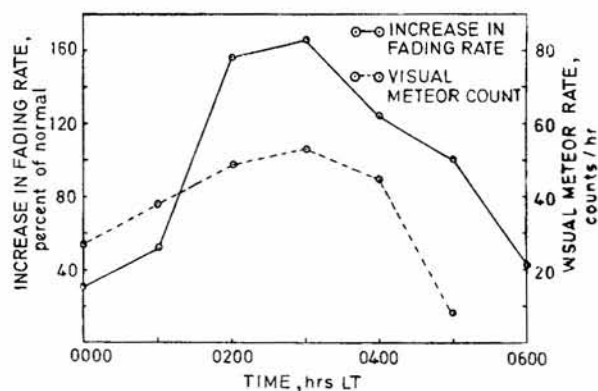


Fig. 3—Increase in fading rate and visual meteor count plotted against local time for the peak activity day of the Geminid shower

the production of large size irregularities. This inference is also evident from Fig. 3. The visual meteor rate closely follows the increased fading rate but not amplitude attenuation. This indicates that the attenuation of the signal and the increase of fading rate are the two different effects produced by the shower meteors. It is quite likely that visual meteors are produced at the latter part of the shower when the ambient ionization is already at a higher level giving rise to the overdense trails which might manifest as the visual meteors, whereas the increase of ionization is due to all meteors, however small they might be, as shown by the increase in the radio meteor count. Narcisi¹¹ has also observed formation of such large size irregularities in the estimation of positive ion concentrations during a Leonid shower.

The study conclusively shows that, during the peak activity day of the Geminid shower, the increase of ionization and the production of large size irregularities are the two effects produced at the base of the E-region where the If signal is reflected. Also, the good correlations between the signal attenuation and the radio meteor count, and increase in fading rate and the visual meteor rate, indicate that the above two effects are distinct and are produced in succession due to the shower meteors.

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Threshold Height & Equatorial Spread F

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About 300 events of disappearance and subsequent reappearance of spread F at three equatorial stations, Singapore, Bangkok and Ibadan have been examined for the sunspot minimum and maximum years. No systematic changes in the layer height are observed to be associated with these events, showing that no threshold height exists for the spread F irregularities to sustain.

Hitherto, it is known that the equatorial spread F is a height-controlled phenomenon, especially at the