# LETTERS TO THE EDITOR

## RADIOPHYSICS

### Use of 'Local Mean Auroral Time' for Very-low-frequency Emissions

IT has been shown by Allcock[1] and Pope[2] that the diurnal occurrence of very-low-frequency emissions depends on geomagnetic latitude up to about 60°, with the maximum occurrence, measured in local time, increasing linearly with latitude. At higher latitudes, a band of noise (the 'low emission band'), centred typically about 750 c/s and a few hundred c/s wide, is observed[3] which does not appear to continue the pattern of lower latitude emissions[4]. However, a consistent picture is obtained if the time of peak occurrence is measured in a new co-ordinate system, apparently related to auroral occurrence and called 'local mean auroral time'.

Vegard[5] defined a system of geomagnetic time, a discussion of which is given by Chamberlain[6]. In this system, geomagnetic time is defined in terms of geomagnetic longitude. A parallel development may be used to define 'auroral time'. A location is chosen at approximately the centre of the southern auroral zone[7] and this location and the antipodal point are called austral-auroral poles. (Because the centres of the northern and southern auroral zones are not antipodal, a different pair of points is required for the northern auroral zone, these being designated the boreal-auroral poles.) Given such a pair of poles, the co-ordinates of any given location may be expressed in auroral latitude and auroral longitude, with the meridian of zero longitude defined as passing through the geographic poles. Auroral time is then found from the angle between the meridian of auroral longitude passing through the station and the one passing through the Sun, each fifteen degrees representing one auroral hour of time difference from auroral noon. The difference between local mean solar time (commonly called simply local time) and auroral time is then, like geomagnetic time, a function of location, time of day and season. To obviate this difficulty, we define local mean auroral time so that the difference between local (mean solar) time and local mean auroral time is constant.

For any location on a meridian of auroral longitude, local mean auroral time is defined as equal to local mean solar time at the intersection of this meridian and the geographic equator. The seasonal variation of auroral time is thus eliminated by using the mean Sun position (for which the sub-solar point is always on the equator) and the diurnal variation by defining the duration of a mean auroral hour to be constant. Since the auroral pole is located at a high geographic latitude, a good approximation to the difference between mean auroral time and mean solar time is given by the angle between the direction of the auroral pole (along a great circle path) and the corresponding geographic pole (north or south), each 15 degrees representing 1 h. Although at the geographic pole local time is undefined, mean auroral noon occurs when this pole is directly between the auroral pole and the Sun, this being local (mean solar) midnight at the auroral pole. Use of local mean auroral time gives a consistent diurnal occurrence pattern for very-low-frequency emissions.

Along the west coast of Greenland, emissions were recorded at a series of locations[4], all approximately on the same auroral meridian. None of the lower latitude types of emissions was heard and the time of peak occurrence of the low band appeared constant, regardless of latitude. At a series of locations in Antarctica, no such consistency was observed when the peak occurrence was measured in local time. However, the difference between the measured local time and that given by the Greenland data corresponded approximately at each location to the angle between the direction of the auroral pole and geographic south. Hence, if the occurrence is measured, not in local mean solar time, but in local mean auroral time, much better consistency is found among the Antarctic stations (including observations at the south geographic pole), and agreement with the Arctic results. Since the emission peak is a couple of hours wide, no great increase in error is introduced by using approximate mean auroral time rather than exact auroral time. The latter has several interesting features which will be discussed elsewhere.

The time of peak occurrence for emissions below 60° auroral latitude increases approximately linearly with latitude while the higher latitude low band peak is approximately independent of auroral latitude. The overall effect is similar to a spiral caused by positive particle precipitation. Further measurements and refined analysis may determine whether there is a continuous variation in peak occurrence or whether the lower or higher latitude phenomena are essentially independent.

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NEIL BRICE
EIGIL UNGSTRUP

Radioscience Laboratory,
Stanford University,
Stanford, California.

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## PHYSICS

### Refractometry in the Far Infra-red using a Two-beam Interferometer

A MICHELSON two-beam interferometer can be used for refractive-index determination by measuring the shift of the achromatic fringe when a specimen of known thickness is placed in one arm of the interferometer. Such a measurement using a broad spectrum and 'white-light' fringes gives only a single index value and that cannot be related to a definite wave-length. Monochromatic radiation cannot be used because of the impossibility of identifying a given fringe after displacement. It appeared plausible, however, that a spectrum of refractive index could be obtained by making observations of intensity over a range of path-difference and taking the Fourier transform of the two-beam interferogram, the method being an extension of that used for obtaining infra-red power-spectra[1]. This has been realized in the far infra-red region, where the method has been used to determine the refractive-index spectrum of crystalline quartz over the wave-length range 500–180μ (20–56 $cm^{-1}$). No values have been previously reported over much of this range.

The convergent-beam interferometer made specially for this trial is shown in Fig. 1. For convenience it was