Several theories have been propounded for the micropulsations on the level of magnetic activity, the occurrence of Pi2 micropulsations being established feature of nighttime Pi2 micropulsations. Several theories have been propounded for the generation of Pi2 micropulsations. Saito and Matsushita suggested that Pi2 peak occurrence time may be closely related to deflection angle of the magnetotail axis with respect to the sun-earth line, which is conditioned by the solar wind. Smith calculated the solar wind streaming angle variation of the solar wind proton pressure, which determines the occurrence of Pi2, for both high and low Kp (magnetic planetary index) and showed that it is 188° during low Kp and 165° during high Kp, measured positive eastward from the sun-earth line.

To infer the dependence of the occurrence of Pi2 micropulsations on the level of magnetic activity, the 3 hr Kp index has been assigned to all the events observed and variation of the Pi2 pulsation occurrence with Kp index is shown in Fig. 1(b). It is interesting to note that the Pi2 occurrence shows positive correlation with Kp index from 0° to 2 and negative correlation with Kp index from 2 to 5. A consideration of the above result in the light of earlier work indicates a latitudinal dependence of the occurrence of Pi micropulsations in relation to the level of magnetic activity. To elaborate, Kannangara and Fernando reported a positive correlation between the occurrence of Pi2 micropulsations and Kp index for Colombo (geogr. lat : 6°54'N) and Istanbul (geogr. lat : 41°03' N), respectively. On the other hand, Sarma and Smith reported the dependence of Pi2 micropulsations occurrence on Kp index to be of a composite nature for Hyderabad (geogr. lat : 17° 25'N), Memambetsu (geogr. lat : 53° 54'N) and Wingst (geogr. lat : 53° 45' N) stations, respectively. A comprehensive analysis of Pi2 micropulsations at a number of stations covering a wide latitude range for a specific period will throw more light on this characteristic of Pi2 micropulsations.

References

A New Method for Estimation of the Neutral Temperature in the Upper Atmosphere by Night Airglow Measurements

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The ratio of intensity of one of the rotational lines in P branch to the total intensity of the R branch of a rotational vibrational band is shown to give the temperature of the emission region. In the OH (7-2) band, intensity of (i) P3 (3) line, \( \lambda = 6922.8 \text{ Å} \) and (ii) Total R branch, \( \lambda = 6832 \text{ Å} \) is measured with the help of a photometric filter photometer with two narrow band filters. A third filter at 7115 Å allows background measurements. Ratio of intensities of P3 (3) to total R branch is computed and compared with that calculated theoretically. The comparison gives the temperature. Preliminary results are presented.

The OH rotational vibrational band system is a doublet system \( ^2\pi - ^2\sigma \). Each band has P, Q, R branches. \(^2\pi\) state is split into two substates \( ^2\pi_{3/2} \) and \( ^2\pi_{1/2} \) which give rise to \( P_3 \), \( Q_3 \), \( R_3 \) and \( P_5 \), \( Q_5 \), \( R_5 \) lines. Because of spin doubling, \( ^2\pi_{3/2} \) state lies higher than the \( ^2\pi_{1/2} \) states. Rotational lines in its \( P_5 \), \( Q_5 \), \( R_5 \) branches are weaker than those in the lower more populated state. Consequently there is an alteration of intensity between \( P_3 \) and \( P_5 \) lines in the band as shown in Fig. 1.

As the excited molecules undergo a large number of collisions ~200) with the ambient molecules before radiative deactivation, the thermal equilibrium is assumed. Then the intensities of rotational lines within the same band are given by

\[ I = C \exp \left[-\frac{F(J)}{kT}\right] \]

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where $I$ is intensity of a line, $S_J$ its line strength, $J$ its upper rotational quantum number, $T$ the rotational temperature, $C$ an arbitrary constant and $F(J)$ the term value which can be approximated as

$$F(J) = B_J (J+1)$$

... (2)

where $B_J$ is the effective rotational constant.

The primary reaction responsible for vibrationally excited OH molecule is given as

$$\text{H} + \text{O}_2 \rightarrow \text{OH}^* + \text{O}_2 + 3.30 \text{ eV}$$

... (3)

The excitation energy in the ground ($^2\Pi$) state of OH is 3.23 eV; therefore only bands originating from ($\nu' < 9$) could be observed. This fulfills the energy requirements for excitation up to 9th vibrational level.

The conventional methods use the measured intensities of the rotational lines of the well resolved P branch of a band for evaluating the temperature. The measured intensities can be utilised in two ways for computation of temperatures.

(i) $I-J$ Curve Method

In this method the intensities $I$ of different rotational lines are plotted against the rotational quantum number $J$. Theoretical intensities computed from Eq. (1) for different values of parameter $T$ are plotted on the same graph; the constant $C$ being adjusted to make experimental and theoretical intensities coincide for specified quantum numbers. Then the temperature curve obtained by observations is matched with one of the theoretical curves.

(ii) In ($I/S_J$) vs $E$ Method

Here ln ($I/S_J$) is plotted against energy $E(J) = F(J) \hbar c$. It should give a straight line if thermal equilibrium exists. The temperature is computed from the slope of the straight line. Another way is to compare total intensities of $P$, $Q$, $R$ branches within the band.

(iii) New Method

The estimation of temperature from the ratio of the intensity of a single line of one of the branches of the OH band to total intensity of the other branch of the same band is yet another method which is described in this communication.

Fig. 1—Rotational vibrational spectrum of OH (7-2) Band

Fig. 2—Spectral transmittance curves of the three filters (The rotational structure of OH (7-2) band and their relative intensities are shown).
For computation of the temperature at the altitude from where OH radiation is emitted, we have chosen OH (7-2) band of which the P branch is well resolved and Q and R branches are well separated from the P branch. Also the band is not contaminated by any other radiation.

To measure the intensity in two parts of the OH (7-2) band at two fixed wavelengths \( P_1 \) (3) line (\( \lambda = 6922.8 \text{ Å} \)) of the P branch and total R branch (\( \lambda = 6832 \text{ Å} \)) of this band are chosen.

The intensity of rotational lines of OH (7-2) band in P, Q, R branches are calculated by using Eq. (1) for different temperatures (50 to 3000°K) at an interval of 10°K. Then the ratio of \( P_1 \) (3) to \( \Sigma R \) is calculated for different temperatures. A value of the ratio corresponds to a single temperature.

The intensities of \( P_1 \) (3) line and total R branch of the OH (7-2) band are measured at Mt. Abu (geogr. lat., 24°6′N, long., 72°7′E) with the help of photoelectric filter photometer with two filters (a) one centred at 6926 Å, H. W. 10 Å and (b) the other at 6832 Å, H. W. 32-5 Å. A third filter measures background radiation where there is no airglow radiation, except the continuum. This filter is centred at 7120 Å, H. W. 44 Å. The transmission curves of these filters along with the relative intensities of different lines of OH (7-2) band are shown in Fig. 2. The filters (a) and (b) also pass background radiation in addition to 6922.8 Å and 6832 Å emissions. Two more filters (6300 Å and 6080 Å) also are included in this photometer.

The five filters are symmetrically mounted on a circular disc which can be rotated with a synchronous motor. Each filter in turn stays for 1.5 min on the objective lens which is imaged by a Fabry lens on the cathode of photomultiplier and intensity of transmitted radiation is measured. The zero level when there is no radiation incident on the photomultiplier is also recorded. In 12.5 min one complete set of intensities through the five filters and corresponding zero levels are recorded on the chart record. These observations are converted into absolute intensity units Rayleighs, with a standard C14 fluorescent source.

The observations for the two filters are corrected for the background radiation by properly subtracting observations obtained with (7120 Å), background filter. The ratio of \( P_1 \) (3) to \( \Sigma R \) is calculated and is compared with the ratio calculated theoretically. Hence, the temperature can be determined.

The temperature computed from the nights distributed over few months of the year 1973-74 are presented. The average value of temperature for one lunation and for few nights are shown in Fig. 3 and 4 respectively.

References

**Frequency of the Received Wave from a Geostationary Satellite**

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This communication deals with the calculations of shift in frequency received on earth from a geostationary satellite, caused by relative motion between earth and satellite and the gravitational field of the earth. It is found that total shift is of the order of \( \Delta f_{\text{sat}} = 5.5 \times 10^{-10} \) which needs experimental verification.

* This work was done by the author when he was at the Department of Electrical Engineering, Tohoku University, Sendai, Japan during March 1973-March 1974.