

LETTERS TO THE EDITOR

ROTATIONAL ANALYSIS OF A-X₁ SYSTEM OF PbCl MOLECULE

SPECTRUM of PbCl molecule has been studied by various workers (Popou and Neuijmin⁴, Rochester⁶, Morgan¹ Wieland and Newburg^{7,8}, Rao and Rao⁵). Rotational analysis of A-X₁ system has been done by Rao and Rao⁵ at low resolution. They were able to pick up single P and R branch lines only and case c (1/2 - 1/2) transition has been assigned to it. However in a recent study of spectrum of PbF molecule in this laboratory for the corresponding transition some additional branches have been observed which suggest the possibility of a ²Σ⁻²Π transition for this system (Philip Mathew *et al.*²). Since PbCl is analogous to PbF, we expect a ²Σ⁻²Π transition for A-X₁ system of PbCl molecule also. In order to confirm the nature of transition involved, a reinvestigation of A-X₁ system of PbCl molecule has been done.

The spectrum of PbCl molecule has been excited in a high frequency discharge (15 MHz). 1,1 and 2,1 bands of A-X₁ system were photographed in the fifth order of a two metre plane grating spectrograph at a reciprocal dispersion of 0.9 Å/mm. Bands in the A-X₁ system are degraded to longer wavelength side. Bands show well resolved P₁, Q₁ and R₁ branches. Satellite branch lines were weak in intensity; as such sufficient number of such lines were not picked up. The structure of bands was found to be similar to those of A-X₁ system of PbF molecule. Analysis has been carried out by the method suggested by Youngner and Winans³. Analysis of 1,1 and 2,1 bands of A-X₁ system reveals that the amount of Λ-doubling for the lower state and spin-splitting for the upper state are negligibly small and hence it was not possible to calculate it at the resolution and dispersion obtained in the spectrograms.

TABLE I

Rotational constants of PbCl molecule obtained from the present analysis

State	B ₀ cm ⁻¹	10 ⁷ × D ₀ cm ⁻¹	r ⁰ Å
A- ² Σ	0.21550	3.1	1.6118
X ₁ - ² Π _{1/2}	0.23825	1.5	1.5329

Results obtained from the present analysis are given in Table I. For a ²Σ⁻²Π_{1/2} transition according to

selection rules ΔJ = 0 ± 1 and + → -, three main branches, viz., P₁, Q₁, R₁ and three satellite branches, viz., P₂₁, Q₂₁, R₂₁ are possible. Additional Q branch observed in the present analysis supports the fact that the transition is a typical a ²Σ⁻²Π_{1/2} transition similar to that of PbF molecule (Philip Mathew *et al.*²) and not case c (1/2 - 1/2) as reported by Rao and Rao⁵.

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ESTIMATES OF TRACKING ERRORS FOR LOW ORBITING SATELLITES

KNOWLEDGE of the ionization distribution in the ionosphere is important for the accurate tracking of the satellites. The time delay produced by the ionosphere is directly proportional to the total electron content along the path from the satellite to the tracking station and is given by the relation

$$\Delta T_p = \frac{1.34 \times 10^8}{f^2} \text{TEC} \quad (1a)$$

where *f* is the frequency of the radiowave in MHz, T_p is in nanoseconds and TEC is in units of 10⁸ el./m² column.

The range error Δ*r* is given by

$$\Delta r = C \Delta T_p \quad (1b)$$

where C is the velocity of light.

Range rate errors are proportional to the time derivative of TEC. The angular refraction, errors to a first approximation, can be related to the TEC. The TEC measurements are therefore used for tracking errors.

For the Indian zone, a numerical model to represent the total electron content for different seasons and for different sunspot epochs was constructed from the TEC data obtained from the Faraday rotation measurements from the orbiting satellite Explorer BE-B (1000 km polar orbit) and reported by Klobuchar, *et al.*¹. This would give corrections for satellites at altitudes of 1000 km or greater, since the contributions from above 1000 km in the total electron content is not much. Faraday rotation measurements at a chain of stations in India during the ATS-6 phase II (October 1975 to July 1976) provided TEC data with very good time resolution and a numerical model for low latitude TEC was constructed by Sethia *et al.*².

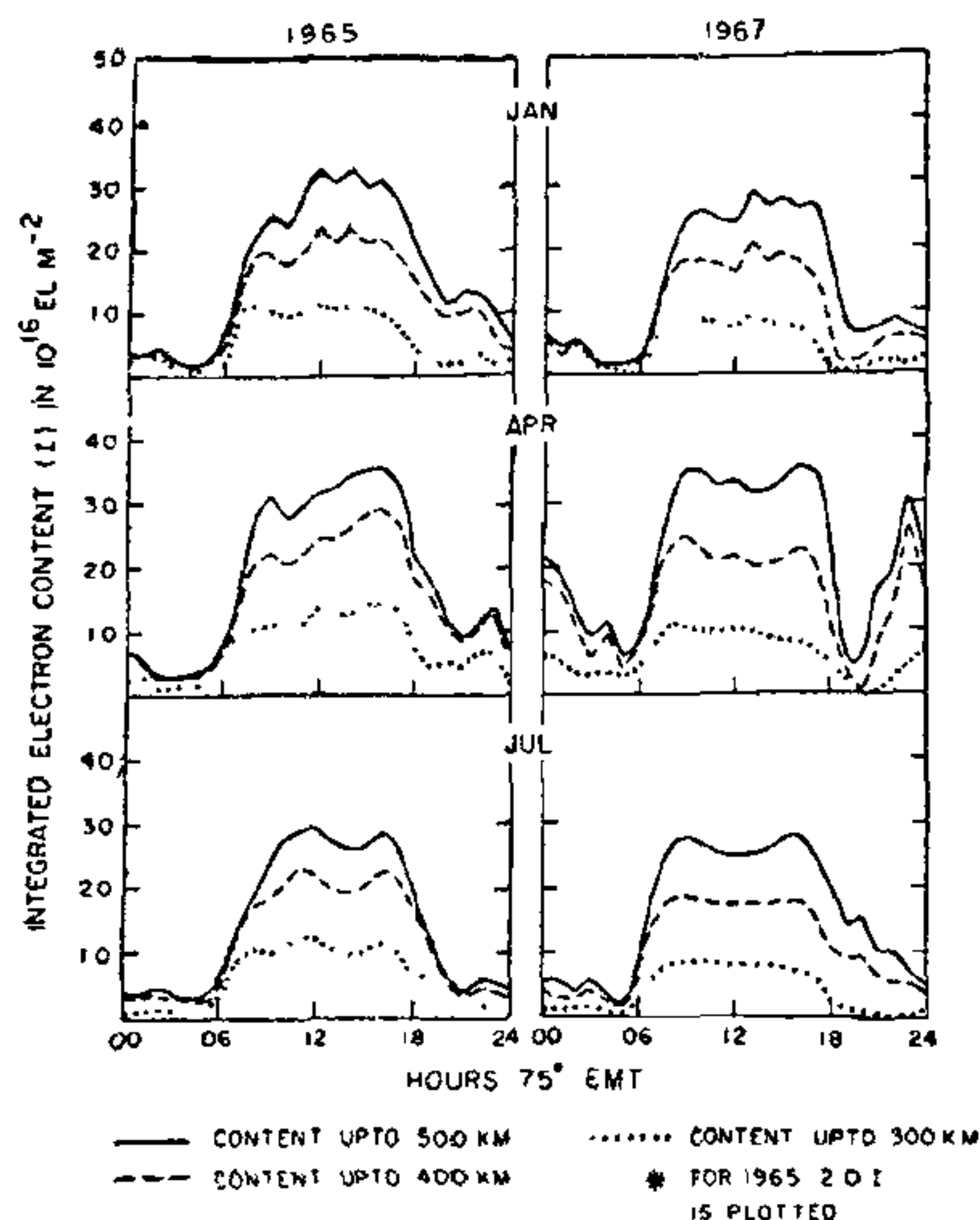


FIG. 1. Integrated electron content over Thumba using bottomside ionosonde data.

However, for low orbiting satellites like the satellite for earth observation (SEO) these models would not be of much use. One requires information about the total electron content for lower orbiting heights and for this, an attempt has been made to integrate the electron density profiles derived from ionograms obtained at Thumba (dip 0.6 deg. S). The ionization profiles above the height of maximum ionization ($h_m F_2$) are extrapolated by assuming an exponential decrease. Mean N-h profile on quiet days of the three representative months of January, April and July have been

obtained both for a low sunspot year 1965 (mean R_s value of 15) and for a medium sunspot year 1967 (mean R_s value of 96). Integrations upto 300 km, 400 km and 500 km have been performed and the daily variations of the total electron content are shown in Fig. 1. The values for the year 1965 are half the values plotted. These values can be used to evaluate the time delay and hence the range error introduced by the ionization according to equations 1a and 1b for equatorial latitudes.

Thanks are due to Mrs. S. Desai for computational help.

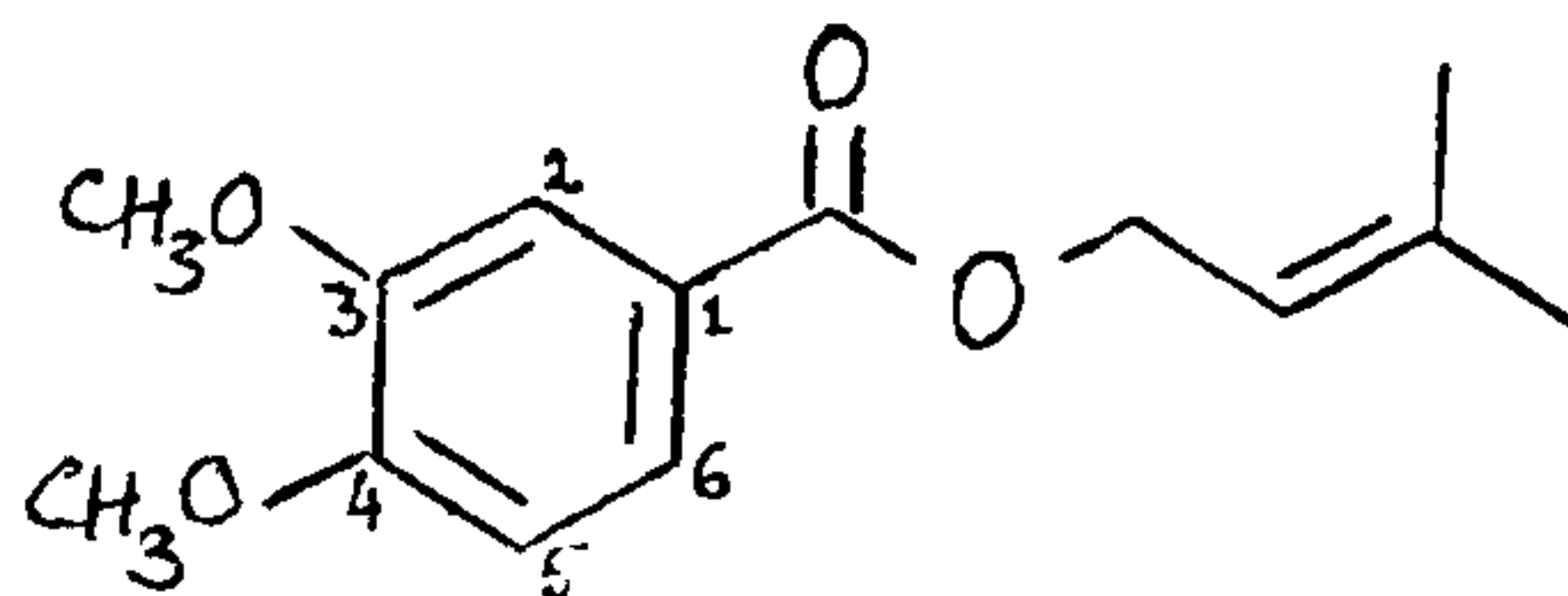
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SYNTHESIS OF TRICHOCOLEIN

RECENTLY a new aromatic ester, Trichocolein, has been isolated from the liverwort, *Trichocolea tomentella*, by Asakawa *et al.*¹. They have assigned the structure as prenyl veratrate (I), based on spectroscopic studies. We now report the synthesis of I starting from vanillin. Vanillin on methylation with dimethyl sulphate, potassium carbonate and acetone for 6 hours (reflux) gave a product, which on hydrolysis with alcoholic potash for 30 min (reflux) gave veratraldehyde. The latter on oxidation with potassium permanganate afforded veratric acid. Veratric acid on esterification with prenyl bromide, potassium carbonate and acetone for two hours gave prenyl veratrate (I).



B.p. 180° (Found C, 66.8; H, 6.9; $C_{14}H_{18}O_4$ requires C, 67.2; H, 7.2)

UV λ_{max}^{MeOH} 217, 259 and 290 nm,

IR ν_{max}^{KBr} 1715, 1596, 1498, 1270 and 760 cm^{-1} .

NMR ($CDCl_3$): δ 1.75 (s, 6H, $2CH_3$), 3.85, 3.95 (2s, 6H, $2OCH_3$), 4.8-4.95 [d, J = 8Hz, 2H, $-CH_2-CH=C(CH_3)_2$], 5.4-5.8 (m, 1H, $-O-CH_2-CH=C<$), 7.05 (d, 1H, J = 9Hz, C_5-H) 7.85 (d, 2H, J = 9Hz, $C_2, 6-H$).