



# NEWSLETTER

No. 119

April 1971

## THE POLAR AURORA - PART IV

(Did you suppose yourself, reader, free from further auroral onslaught; alas for human hopes; I now offer details even unto the fourth part).

The brightness of aurorae can vary from below the visual threshold to that which can produce an illumination on the ground comparable to full moonlight. The brightness index shown in the fourth column (Part 3) of the classification table is a visual estimate of the order of magnitude of intensity of the aurora in its region of maximum intensity. To help the judgement of brightness by observers, auroral forms are rated in brightness and assigned an International Brightness Coefficient as follows:

- for IBC I aurora is comparable to Milky Way
- for IBC II aurora is comparable to thin moonlit cirrus
- for IBC III aurora is comparable to moonlit cumulus clouds
- for IBC IV aurora is comparable to full moonlight

At brightness indices I-III, aurorae are below the threshold of colour perception and the eye responds only to  $\lambda$  5577 radiation which as stated previously is close to the maximum retinal sensitivity. However, small differences in retinal response will mean that estimates of brightness index vary among different observers even for a given spectral composition of the emission and the difficulty of consistent estimation is increased by the great variations that do occur in the auroral spectrum. In spite of these difficulties a useful degree of consistency of estimation is attained among practised observers.

Compared to many other luminous phenomena in the sky, a strong aurora is fairly well up the 'league table':

SOURCE	FLUX (ERG-CM <sup>-2</sup> SEC <sup>-1</sup> )
Sun	1.4 x 10 <sup>6</sup>
Full Moon	3000 x 10 <sup>-3</sup>
Aurora (IBC IV)	1000 x 10 <sup>-3</sup>
OH (infrared)	19 x 10 <sup>-3</sup>
Airglow (visible)	16 x 10 <sup>-3</sup>
Lyman-a	10 x 10 <sup>-3</sup>
Cosmic rays	3.8 x 10 <sup>-3</sup>
Total starlight	1.8 x 10 <sup>-3</sup>
Celestial sources (1230-1350A)	0.1 x 10 <sup>-3</sup>

With the advent of photo-electric devices and the requirement of even more accurate and meaningful photometric measurements of the aurora, there was a need by the early fifties for a well defined unit for the photometry of the aurora (and airglow), preferably one in which its interpretation in terms of physical processes should be convenient.

Therefore it was proposed by Hunten, Roach and Chamberlain in 1956 that photometric measurements of the aurora (and airglow) be reported in terms of the unit of the "rayleigh" where:

$$1R = 10^6 \text{ photons/cm}^2 \text{ column, sec.}$$

The unit is named after the fourth Lord Rayleigh (whose father was the molecular scattering man) who in 1930 made the first absolute measurement of the intensity of the night airglow by visual photometry. Reading his exemplary account of this measurement is a journey back into another, more leisurely scientific world. One reads:

"It was at first contemplated to standardise such a source by bolometric methods, but the more this was considered the more difficult did it appear, especially since my laboratory had been destroyed by fire (March 6, 1930) and I had to work, if at all, in extemporised quarters".

The IBC, now fixed to photons of  $\lambda$  5577 is defined in terms of rayleighs as follows:

intensity (of $\lambda$ 5577) $< 10^{-1}$ kR				corresponds to IBC 0 subvisual		
				or Brightness Index		
"	"	"	1	"	"	" 1 milky way
"	"	"	10	"	"	" 2 moonlit cirrus
"	"	"	$10^2$	"	"	" 3 moonlit cumulus
"	"	"	$10^3$	"	"	" 4 full moonlight

For observers, an aurora which is subjectively estimated to be of the same brightness as a  $\lambda$  5577 emission of intensity  $10^{N-1}$  kR, by means of the comparisons in the right hand column, is ascribed a brightness index N. Index 0 is used to designate instrumentally detected aurorae.

The rayleigh is of course not tied to any particular wavelength. While  $\lambda$  5577 is a convenient wavelength to standardize the IBC on from the human eye point of view, photometric brightness measurements of the aurora are usually quoted in terms of whichever wavelength is theoretically more indicative of the physical processes being studied.

Auroral form	$\phi$ (4278) (kilorayleighs)	Estimated length of column (km)	P (4278)* ( $10^4 \text{ cm}^{-3} \text{ sec}^{-1}$ )
Faint arc	4	10	6.4
Weak pulsating surfaces	2	10	0.2
Medium rays	6-12	1	6-12
Medium arcs	15-32	10	1.5-3.2
Strong rays	32	1	32
Strong arcs	67	10	6.7
Lower border of strong drapery	90	5	18
Very bright display in rapid movement	150	10	15
Band in rapid movement (strongest aurora measured)	200	10	20

\*The full photon emission rate in the  $N_2$  + First Negative system, P (1st Neg.), is 6.5 times P (4278).

The above table, prepared by Omholt in 1954, is of great use in getting a 'feel' for auroral brightness.

Despite all these aids to aurora spotting I have not actually got round to describing the thing - would you believe next time?

SPORTS AND SOCIAL CLUB NEWS

Dr. Horner is now Chairman of the S.R.C. Sports and Social Association.

SPECIAL ANNOUNCEMENT!!

The bar committee would like to announce that in the near future a questionnaire will be circulated to all members of the station concerning the bar and its facilities. Some suggestions for improvements have already been discussed by the committee and these will be put to you for your opinions.

We ask for the co-operation of all members of the staff in this matter as we feel that the bar should be run to provide you with what you want, or as close as we can get to it.

Please, before you receive this questionnaire visit the bars and try to form an opinion, if you do not already have one; then when we ask you in the questionnaire you will be able to give us a clear indication of your wishes.

On behalf of the committee, I should like to thank you for your co-operation in advance.

D. M. Kelley

STATION NEWS

Mr. Lane, Dr. Quigley and Messrs. M. Hall, E. Golton and Z. Warhaft have recently been to Skiekampen in Norway to attend the NATO Advanced Studies Institute meeting dealing with statistical methods and instrumentation in radio meteorology.

Dr. Quigley has also been to Canada for discussions with staff of the National Research Council about the use of the Algonquin Park aerial and the Chilbolton aerial in long base-line interferometry experiments at 10.7 GHz.

STAFF NEWS

Congratulations to:

Jim Burge and Dorothy Lavery who were married at Newcastle on March 26th.  
Pat Dadds and Les Scammell who were married at Virginia Water on April 24th.  
Mike Lawden on his engagement to Miss Yvonne Wilkes of Knowle, Staffs.  
Henry Rishbeth on his proceeding to Sc.D. of the University of Cambridge.

Congratulations to:

P. S. C. Allies	now	Craftsman I
Z. C. Kutylowski	"	" "
C. Mc.Farlane	"	" "
P. H. Miller	"	" "
W. N. Rees	"	" "
E. R. J. Tucker	"	" "

Welcome to:

W. A. Etheridge	S.S.A. Local Recruit Falkland Islands
Mrs. J. C. Palfreyman	Typist II P/T
D. J. Finch	Exec.O. Transferred from L.O. for duty at A.R.U. Culham on RSRS complement
Mrs. V. M. Cory	Cleaner P/T
Mrs. D. E. Butler	Cleaner P/T

Resignations

Mrs. M. King	S.A.
C. J. Payne	A.E.O.
D. F. Bampton	Tech. III

Other Changes

G. E. Mackrell	E.O. seconded to U.C.L. for approx. 2 yrs. (still on RSRS complement)
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E.S.R.O.

D. W. Hardy	A.E.O. arrived U.K. from Falkland Islands on mid-tour leave
E. P. Ward	T.T.O. II Left U.K. 23.3.71, arrived F.Is.
P. R. Button	A.E.O. " " " " "

To the Hon. Sec. of ? C/o the Editor

Dear Sir

I wish to claim the prize for guessing your sport, reference last months Newsletter.

I deduced by pure logic that you are a part-time barman who plays bridge. The reasons for my choice being the fact that you put several loaded words into your paragraph. These being, table (bridge) and shaky (part-time barman).

Yours

Even in China

Curtain Raiser

P.S. Next season is always yet to come.

(The Editor, too, must accept credit or collective guilt for last months mystery sports report).

SPORTS AND SOCIAL CLUB NEWS

MOTOR CLUB

The Motor Club stocks of oil have been replenished recently. In the 20/50 grade 1 pint cans are 12p, 1 gallon cans 85p and a 5 gallon drum is £3.20. Also available are some Sterling and Superb grades. Due to bulk buying these prices are advantageous compared with CSMA standard prices, and also with other proprietary brands such as Shell, Duckham's, purchased retail.

P. Muzlish  
Hon. Secretary

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NEWS OF FORMER STAFF

Congratulations to Mike and Mary Colbourne on the birth of their daughter Victoria Rose on 31 March.

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PAYLOV?

LETTER TO THE OUTSTATIONS

Dear Colleagues

Over at least the past twelve months of what is, I am sure, diligent reading of each and every scientific periodical even remotely related to our art, you may well have seen references to the 'citation index'. No reference this to deeds of valour beyond the call of duty or whatever; rather it smacks somewhat of social small-talk, for the size of the index number is a function of the number of people who take your name in vain by reference to your publications. Whether the reference 'Bloggs, 1952' is, linked with such phrases as 'seminal', 'definitive', 'masterly', etc. or 'ill-conceived', 'premature', 'superficial', doesn't seem to matter, the thing is to get a mention. This means that one's work finds itself in unfamiliar company on occasion and a non-discriminating reprint collector such as a machine or a girl assistant with more important matters on her mind will beg for a copy of your latest gem, be it what it may.

How else comes it that a seemingly harmless historical note perpetrated by me some time ago has brought forth demands from the National Institute for Research in Dairying; Medical Research Foundation Inc. (of Minneapolis), I nearly wrote (whom God preserve), or the School of Public Health of that venerable foundation the University of Louvain. Is it something I said or just something to do with keeping the environment clean and free from paper pollution such as that practiced by,

Yours sincerely,  
The Editor

APRIL 1971

List of Reprints

- D. L. Croom                      Slough Solar Radio Observatory  
R. J. Powell  
and L. J. Harris                Solar Physics 1970, 14, 238-244
- J. A. Lane                        Some results of lidar probing of the troposphere  
G. E. Ashwell  
and A. Dagnall                 Atmospheric Environment 1971, 5, 49-54
- D. L. Croom                      19 Gigahertz (1.58 Centimeter) Solar Radio Bursts as  
Indication of Proton Events  
Journal of Geophysical Research, Space Physics  
Dec. 1970, Vol. 75 No. 34 6940-6949
- H. Rishbeth                      Maps of the vertical F-layer drifts caused by horizontal  
and D. M. Kelley               winds at mid-latitudes  
J.A.T.P. 1971, 33, 539-545