

**COMMISSION 21 : THE LIGHT OF THE NIGHT SKY
LUMIERE DU CIEL NOCTURNE**

Report of the meetings 25, 26, 27 and 31 July 1991

President A.C. LEVASSEUR-REGOURD Vice-President M.S. HANNER

**26 July 1991
Business session**

The President opened the meeting at 9:00 by welcoming the participants ; twelve Commission members were present.

I. Activities during the past triennium

Commission 21 has sponsored two major scientific meetings :

IAU Symposium 139, The galactic and extragalactic background radiation, Heidelberg, June 1989, S. BOWYER and C. LEINERT eds., Kluwer Academic Publishers, 1990.

IAU Colloquium 126, Origin and evolution of interplanetary dust, Kyoto, August 1990, A.C. LEVASSEUR-REGOURD and H. HASEGAWA eds., Kluwer Academic Publishers, 1991.

The triennial report for the IAU transactions has been prepared ; reprints were distributed to the Commission members. Four scientific sessions have been organized for the IAU General Assembly, with a total of fifteen presentations. Extended abstracts were distributed to the participants and mailed to the Commission members.

A letter poll on the emphasis for Commission 21 was analyzed by S. BOWYER. The results are that the Commission emphasis should be equally divided around the studies of zodiacal light, diffuse galactic light and extragalactic light, with airglow as an additional significant topic. These foreground and background sources of radiation are necessarily observed together ; all of these sources need to be understood in order to separate the contribution from anyone component accurately. In recent years, space measurements from rockets, satellites, and space probes have been emphasized and the wavelength coverage has been extended to include both the ultraviolet and the infrared.

II. Officers and Membership

The following officers, proposed by the Organizing Committee, were elected :

President	Martha S. HANNER (USA)
Vice-President	Michael G. HAUSER (USA)
Organizing Committee	S. BOWYER (USA), R. DUMONT (France), Yu. I. GALPERIN (Russia), S.S. HONG (S. Korea), J. HOUCK (USA), Ph. LAMY (France), Ch. LEINERT (Germany), A.Ch. LEVASSEUR-REGOURD (France), T. MUKAI (Japan).

The roster of Commission 21 members was reviewed. After some discussion, it was agreed that the President will send a letter to all the Commission members, requesting an indication of continued interest with, three months thereafter, a follow-up letter to those who have not replied. Those not responding either to this second letter will be dropped from the Commission membership. A new consultants list was also approved.

III. IAU Resolutions and Working Groups

The following resolutions have been approved.

The resolution (with commissions 4, 7, 9, 15, 16, 20, 22) related to the importance of expanding and sustaining scientific programmes for the discovery, continued surveillance and in-depth physical and theoretical study of potentially hazardous Natural Near-Earth Objects was approved. B.A.S. GUSTAFSON and A.C. LEVASSEUR-REGOURD were appointed to represent Commission 21 in the Joint Working Group on NEO's.

The resolution (with Commission 15, 20, 22 and 51) related to the prevention of pollution of the interplanetary space environment was approved, after some discussion and the proposal of a revised version.

M.S. HANNER was appointed to represent Commission 21 in the light pollution working group (with Commission 50).

A resolution regarding surface brightness units, in agreement with IAU recommendation, was approved (see last paragraph).

25 July 1991

Scientific session 1 on the extragalactic and galactic components of the light of the night sky

M.G. HAUSER, Chair

The two comprehensive talks in this session provided an up-to-date view of current knowledge about diffuse cosmic radiations in the infrared (R. SILVERBERG) and the far and extreme ultraviolet (S. BOWYER) spectral domains. Some similarities in the status of the observations at these wavelengths were apparent : the observed sky brightness is dominated by sources within the Galaxy and, though many mechanisms for generating extragalactic backgrounds have been suggested, unambiguous detection of such backgrounds has yet to occur. New data in both fields promise a much clearer picture by the time of the next General Assembly.

26 July 1991

Scientific session 2 on the atmospheric component of the light of the night sky and adverse impact on observations

A.C. LEVASSEUR-REGOURD, Chair

In order to understand the observed brightness distribution of the atmospheric diffuse light, a solution to the problem of the radiative transfer in an anisotropically scattering spherical atmosphere was proposed by S.M. KWON, S.S. HONG and Y.S. PARK, using a ray tracing technique and different values of the asymmetry factor in the Henyey-Greenstein function.

The importance of irregular space and time density variations, mainly due to atmospheric turbulence in the nightglow, was stressed by H. TEITELBAUM. A review of the observed variations was presented, with emphasis on the green and red oxygen lines and the hydroxyl Meinel bands.

A report on the airglow regular observation programme at Tokyo national astronomical observatory was presented by H. TANABE. The observations have been carried out on a regular basis from 1957 to 1990.

An interpretation of the different O₂ emissions in the airglow was presented by M.J. LOPEZ-GONZALEZ, J.J. LOPEZ-MORENO, and R. RODRIGO. The photochemical scheme for the OH emissions was also presented, and information on the density of atomic hydrogen and ozone was inferred from simultaneous measurements of these emissions.

The session concluded with a presentation by D.L. CRAWFORD on the increasing adverse environmental impacts on astronomy and on some of the steps being taken to solve this growing problem.

26 July 1991

**Scientific session 3 on the interplanetary component
of the light of the night sky (zodiacal light)**

M.S. HANNER, Chair

The IRAS sky background survey was described by J.M. VRTILEK. The zodiacal emission, for $60^\circ < \epsilon < 120^\circ$ in four bandpasses as a function of time is contained in the zodiacal observation history file, available on magnetic tape. The main features of these observations were described.

The recent sky survey by the DIRBE instrument on board COBE was described by R. SILVERBERG. The absolutely calibrated fluxes, from 1 to 200 μm , and for $64^\circ < \epsilon < 124^\circ$ will provide a very reliable data base for the zodiacal emission.

A model of the zodiacal emission based on a dynamical model for the interplanetary dust cloud, was presented by B.A.S. GUSTAFSON, R.H. ZERULL, E. CORBACH and K. SCHULTZ, as well as scattering measurements performed at the Ruhr University microwave scattering laboratory, shortly before it was closed down.

The session concluded with a discussion by R.K. SOBERMAN of jetting cosmoids as a possible explanation for the Pioneer 10 experimental data and as a major source of the zodiacal light. These are fluffy aggregates of volatile material which are impulsively disrupted by solar heating.

30 July 1991

**Scientific session 4 on the interplanetary component
of the light of the night sky, continued**

H. TANABE, Chair

This last session started with a presentation by A.C. LEVASSEUR-REGOURD, J.B. RENARD and R. DUMONT of the results obtained on local optical properties of the zodiacal dust, with emphasis on the variations of the average dust properties (albedo, polarization) with location, both with radial distance in the symmetry plane and with elevation perpendicular to it. The results obtained out of the symmetry plane suggest that the cloud is a complex mixture of grains of different origins.

The status of zodiacal light and zodiacal emission studies was reviewed by M.S. HANNER. Some of the still unanswered questions were pointed out, e.g. infrared

emission at small elongations or above 50 μm , physical changes that occur with heliocentric distance or with distance to the symmetry plane, near the Sun dust distribution, and sublimation processes.

Studies about exact electromagnetic scattering by aggregates of spherical particles were presented by K. LUMME and K. MUJINONEN, with emphasis on the coherent backscattering mechanism and the reversal of polarization at small phase angles, that play an important role in the opposition effect and negative polarization of atmosphereless Solar System bodies and the zodiacal cloud.

The session concluded with a presentation by H. TANABE of some images of the July 1991 solar eclipse and with a presentation by C. CESARSKY of the Infrared Space Observatory (ISO) to be launched in 1993, with special emphasis on the zodiacal emission observational possibilities.

27 July 1991

Workshop on standard tables and units

S. BOWYER, Chair

The session was devoted to a discussion of units to be used for diffuse radiation. A wide variety of units were discussed at length. A strong endorsement was made by Commission 21 that the IAU recommendation on SI units is followed.

The advantages of alternative units for subsections of the electromagnetic spectrum were acknowledged and it was agreed that if alternate units were employed for specialized papers, the authors should provide a conversion to SI units in these papers, taking into account the particular difficulties of converting S_{10} and other magnitude based units to SI units.

The following resolution of Commission 21 regarding surface brightness units was formulated and approved.

In accord with IAU recommendation, Commission 21 recommends the use of SI units for surface brightness, either $\text{W m}^{-2} \text{sr}^{-1} \text{Hz}^{-1}$ or $\text{W m}^{-2} \text{sr}^{-1} \text{m}^{-1}$. We recommend against the future use of S_{10} units and other magnitude based fundamental units. We strongly recommend that, if other units are used, the conversion to SI units be clearly stated.