1.1.19 VISIBLE AND UV PHOTOMETRY OF THE GEGENSCHEIN AND THE MILKY WAY

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The French astronomical satellite D2B is to be launched on September 1975. The spin axis is constantly oriented towards the sun with an accuracy of ± 30 arc min. The ERC experiment (field recognition) will provide images in three spectral intervals of a region centered at the anti-sun point and having a diameter of 10°. The scanning of this region is realized by a combination of the spin motion of the satellite and internal electronic scanning. This experiment includes a catadioptric objective (optimized Kern telescope) with a field of 3° x 6° and an image dissector which analyses the image.

This experiment will achieve a mapping of the Gegenschein and of local regions of the Milky Way with a resolution of 40' x 40' in three spectral bands centered at 2800, 3600 and 4200 Å.

The "Laboratoire d'Astronomie Spatiale (L.A.S.)" is participating in the research programme of the scientific satellite D2B to be launched next september. L.A.S. is in charge of three experiments placed on board the satellite. Their purpose is the extended sources study and the photometry of hot stars.

The E.A.S. and E.L.Z. (antisolar and zodiacal light experiments) are spectrophotometers whose objective operates for wavelengths between 70 nm and 340 nm. The E.R.C. (field recognition experiment) is a photometer with very large bands, sensitive in three wavelengths from 220 nm to 650 nm. The E.R.C. should give back a photometric image with weak resolution of the antisolar zone. The identification of stars in the stard field will provide, once processed, a precise indication of the satellite's altitude.

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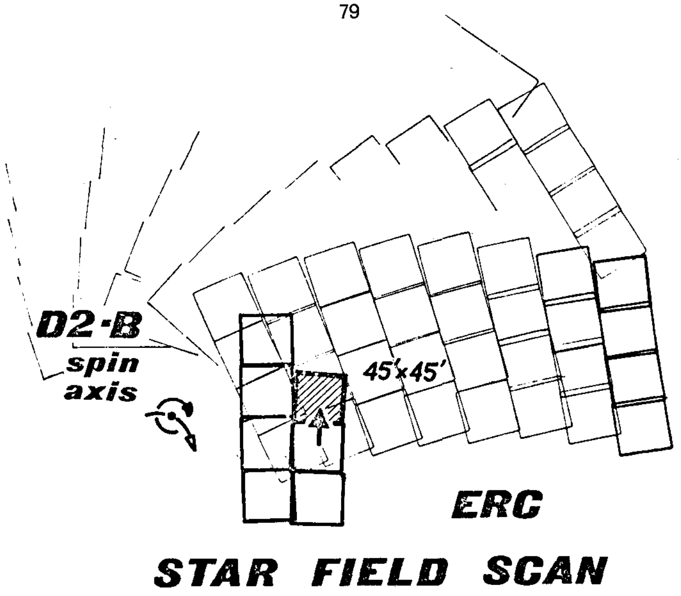

fig. 1

The E.R.C. whose optical axis is shifted 3,5° with respect to the satellite's spin axis, will constantly explore an area of the sky, 20 degrees in diameter, around the antisolar point, while the satellite is constantly pointed in this direction. Thus the actual rotation of the satellite will give us is a E.R.C. photometric measurements of the antisolar point during the satellite's duration, as well as the variations of the sky background with relation to its position on the ecliptic. Cruvellier and Maucherat (1), (2) give a detailed description of the satellite and of the other experiments. Here we will describe the E.R.C.

The E.R.C. is a bi-dimensional photometer with a space resolution of 45' x 45' and an overall field of view of 6° x 3° (rectangular). The rectangle's principal axis is in the same plane as the spin axis. As already stated, as the satellite turns, the E.R.C. explores an area of the sky that is crown-shaped around the spin axis. This axis has a residual movement of precession caused by parasite couples and a slight excess of transverse cinetic energy that makes this exploration practically uniform.

The E.R.C. is made up of an objective and a bidimensional photometric detector, the objective calculated by Detaille (3) is 90° bent, because of crowding. Its optical diagram is that of a perfected Kern telescope. It has three mirrors and three diopters. A parabolic mirror with a Schmidt blade in the entrance pupil forms the image in the centre of the field. A spherical mirror transports the image to the detector's photocathode, with the help of a 45° plane mirror and a field lens that takes up the image at the photocathode's curb. In a ± 3,5° field the image spot is less than 80 μm (for 90% of the energy), in the spectral region 220 μm to 660 μm.

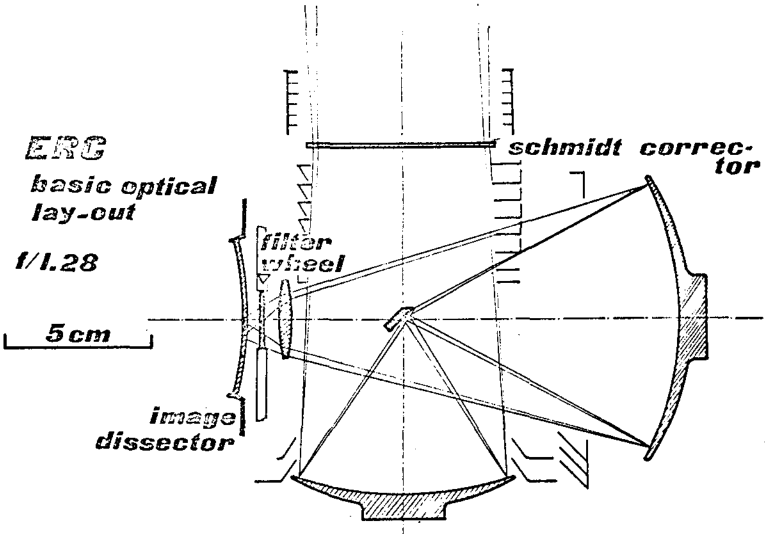

Figure 2

Two low pass filters reduce this band pass to 290 nm and 390 nm respectively, while the third leaves it uncharged. Thus 3 band passes are obtained, two of which are obtained by subtraction of the characteristics given in the adjoining figure.

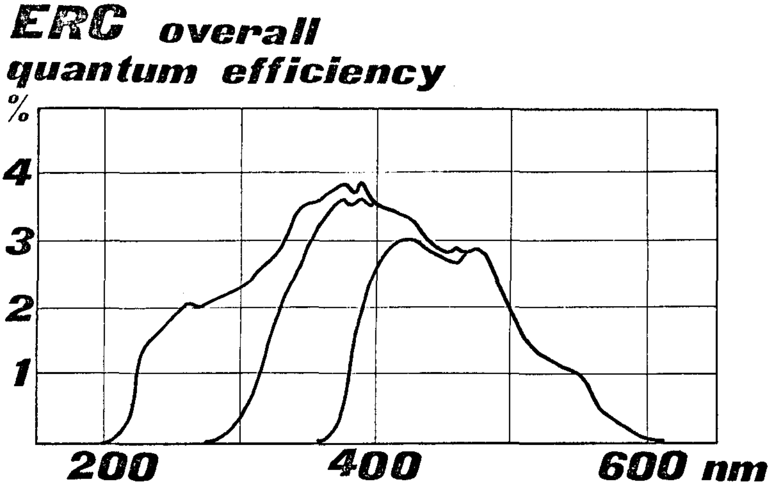

Figure 3

The detector used is an E.M.R. 459 image dissector with a square slit, 1 mm x 1 mm, for exploration of an 8 x 4 mm^2 field. The principle characteristics of this detector are high quantum efficiency (> 20%), a 5% photocathode uniformity and a negligible dark current (1 count/second).

The field is thus decomposed into 32 elementary adjacent zones making up 4 lines and 8 columns. The analog electronics commands gradual exploration, column by column, in the opposite direction to that of the satellite's rolling and at 0,5 sec per elementary zone (since the satellite's rotation speed is 1 revolution/4 minutes, the apparatus scans 16 fields per revolution). Thus the apparatus scanning, the satellite's rotation and the displacement of its spin axis according to the antisolar point and along the year allow us to explore a zone of ± 10° on either side of the ecliptic.

The E.R.C.'s flight models were calibrate at L.A.S. and at the Foux d'Allos Observatory (2600m). The stability of their geometric and photometric characteristics are regularly checked. The calibrations done at the laboratory included:

- Electronic centering and measurement of geometric characteristics,
- Measurements of band passes,
- Uniformity of the field,
- Rate of diffusion of parasitic light,
- Checks for long-range stability.

Measurements of the sky at Foux d'Allos Observatory (2600 m) included:

- Photometric sensitivity,
- Dynamic simulations.

The expected flux, according to the results obtained, is indicated in the adjoining table.

E. R. C. COUNTS PER $S_{10}(V)$

Channel		I	II	III
Spectral Type	A0	79	106	125
	F0	65	86	98
	G5	45	57	61

Counting period : 0.5 sec.

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For a sky background with a G5V spectral type and $S_{10}(V) = 100$ intensity, the average number of impulses counted per 0.5 sec will be 4700, 5700 and 6100 for channels I, II and III respectively.

At the present time, the programmes for altitude restitution are complete, and we are preparing the programmes for photometric restitution. The latter must include:

- Qualification of light measurements,
- Centralization of measurements in a data base,
- Summary processing allowing the obtention of results within a brief time period (1 day),
- More evolved processing working on 15 days measurements periods.

For the processing, the following are needed:

- Detection of possible variations of the Gegenschein UV flux,
- One must provide a Gegenschein and an ecliptic mapping in three band passes (I-II, II-III and III).

References:

(1) Maucherat, M., Cruvellier,P. 1976, Presentation of Zodiacal Light Instrument aboard the D2B french astronomical satellite , this volume.

(2) Cruvellier,P., Maucherat,M., Maucherat,J. Le satellite D2B. Colloque d'Aussois du 24-28 avril 1972. Editions de l'IAP. Paris.

(3) Detaille,M., Saisse,M. Les télescopes de Schmidt anastigmates. 5ème Journées d'Optique Spatiale. Marseille 1975. Edition du CNES. Paris.

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