ABSOLUTE STELLAR PHOTOMETRY IN THE REGION 1200–3000 Å

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1. General

Since 1962 the Space Research Division of the Royal Observatory Edinburgh have been planning and launching a number of rocket experiments aimed at observing the absolute stellar fluxes of early-type stars in the region 1000 Å–3000 Å. Although some earlier attempts were unsuccessful due to rocket failures, good photometric data have been obtained from four successful flights in 1967 and 1968, and it is the purpose of this short report to indicate the nature of the data rather than give a complete scientific analysis.

Because of the non-availability of stabilised rockets it was necessary to use the roll and precessional motion of the rocket to scan the telescope axes across the sky, the scan rate being optimized by means of a single axis gas jet system operating around the roll axis.

In addition to the ultraviolet photometers, a number of stellar photometers sensitive in the region 2500 Å–5000 Å was also flown in order to facilitate the determination of the rocket attitude, each photometer having a one degree field of view.

2. Stellar Observations in the Region 1200 Å–2000 Å

The photometer for this region consisted of an $F/3$, Cassegrain telescope of aperture 23 cm. The mirrors were aluminized and given a protective coating of magnesium fluoride, typical reflectances being of the order of 85% at 1216 Å. The light from the primary mirror was imaged on to the photo-cathode of an Ascop 542G photomultiplier by means of a lithium fluoride Fabry lens and the field of view defined by means of a circular diaphragm ($1\frac{1}{2}°$ diameter) in the focal plane. The waveband was 250 Å wide and centred on 1600 Å. The detector was operated with the cathode at -3000 V with respect to the rocket body potential and the output from the anode measured by means of a dual range solid state d.c. electrometer operating in the range 3×10^{-10} A–3×10^{-7} A.

Each photometer was calibrated in an absolute manner using microwave excited gas discharges as well as xenon and low pressure mercury lamps. The exact procedure will be described elsewhere.

Approximately 120 observations of identified stars of spectral types between O8 and A2 down to a limiting magnitude of 6.5 were obtained in a flight in December 1968.

Houziaux and Butler (eds.), Ultraviolet Stellar Spectra and Ground-Based Observations, 135–137.

3. Stellar Observations in the Region 2000 Å–3000 Å

In this wavelength region the stellar photometer consisted of two parallel identical Newtonian telescopes of aperture 18 cm × 8 cm and field of view 1° also mounted perpendicular to the thrust axis of the rocket.

The light from the telescopes was imaged on to the photo-cathodes of two solar blind photomultipliers by means of quartz Fabry lenses. Again the detectors were operated at a high negative cathode potential and the output measured by d.c. electrometers.

The wavelength isolation in the May 1967 flight was achieved by means of interference filters of passband 250 Å, centred on 2150 Å and 2550 Å. In two later flights in 1968, this isolation was achieved by selectively reflecting surfaces, with an increase in efficiency of the order of 4. The absolute calibration was achieved by means of a d.c. discharge of the Hinteregger type as well as by low pressure mercury lamps.

Preliminary analysis of some thirty observations from the May 1967 flights indicates good agreement with the other observational data available and is in agreement with stellar models exhibiting no blanketing, such as proposed by Mihalas (1965). The photometers of the 1968 flight produced some 150–200 stellar observations which are at present under reduction.

4. Sky Background Observations in the Region 1300 Å–5000 Å

In addition to the stellar photometry experiments, a separate experiment was flown in 1968, aimed at obtaining sky background measurements in the region 1650 Å–3200 Å. The photometer optical system consisted of a combination of a 6.5 cm objective lens and a 2.5 cm Fabry lens, both made of quartz. Periodically inserted filters at the focal plane of the photometer isolated the following wavelength regions: 1650 Å–3200 Å, 2500 Å–3200 Å, and 2800 Å–3200 Å. Eleven sky scans were achieved in a period of 400 sec of flight above a height of 110 km.

Measurements of the sky background were also obtained from the stellar attitude sensors in the region 1650 Å–5000 Å and from the stellar photometer sensitive in the region 1300 Å–2000 Å. The data are in process of being analysed.

5. Comment

Although the first European results are now beginning to appear, there is still considerable difficulty in intercomparing observations made by different experimental groups. It is a matter of extreme urgency that a system of cross calibrations between European and, of course, American instruments be established if the maximum use of the data is to be achieved. Such a system at its simplest could consist of the exchange of a suitably calibrated source (or detector) at reasonable intervals between the various scientific groups.

Reference

Mihalas, D.: 1965, *Astrophys. J. Suppl. Ser.* **9**, 321.

Discussion

Carruthers: We have an interlaboratory calibration comparison program going on in the Washington area in which we pass around from one laboratory to another, a nitric oxide ion chamber with magnesium fluoride window, which each lab calibrates at 1216 Å by its own technique, and we compare the results.

I would be interested in getting together with anyone interested in interlaboratory calibration comparisons, so that we could come up with a set of standard detectors for various wavelength ranges for passing around among laboratories.

Campbell: I am very glad that there has been an immediate response to my plea for an inter-comparison of ultraviolet standards between co-workers in the field of ultraviolet astronomy. This is particularly important in order to compare the European absolute photometry with that of the U.S.A. groups. We would be very interested in joining the U.S.A. calibartion network with a particular view to comparing measurements in the region 1600 Å–2500 Å. As a preliminary step however the transfer of your nitric oxide chamber to interested European experimenters could be of great value and should be undertaken as soon as possible. May I mention in passing that I have already mentioned a similar procedure to Dr. Boldt who intends to inter-compare various European calibrations procedures with a view to selecting the best system of standardization.