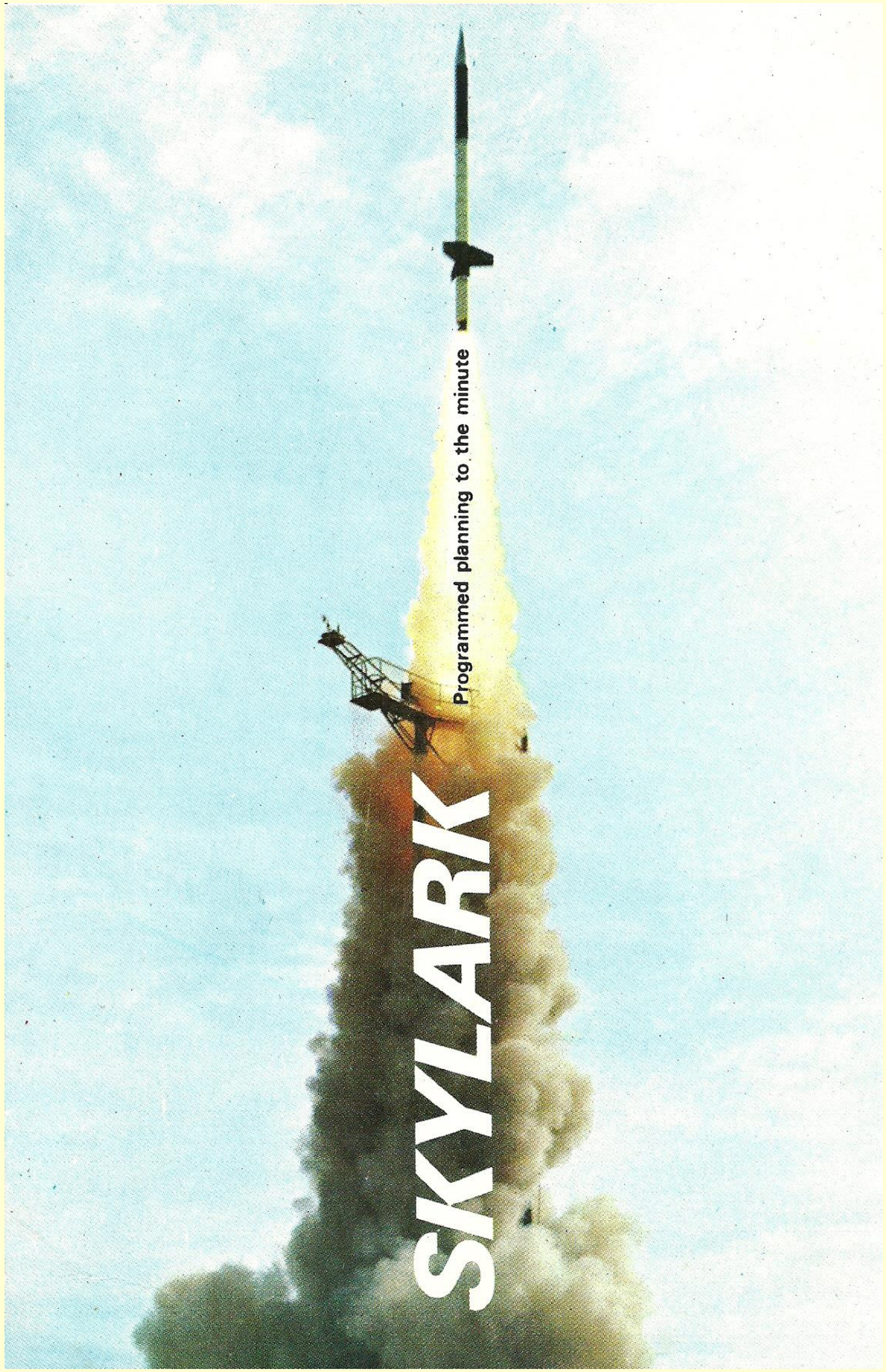


The ROE Skylark Programme

John Davies and Clive Davenhall,
Presented by Clive Davenhall

RAS Discussion Meeting 14
February 2025.

Introduction

- During the 1960s the ROE developed and flew instruments for UV astronomy on Skylark sounding rockets,
  - and useful results were obtained.

- This programme was initiated and led by Dr Hugh Butler, a Principal Scientific Officer at the Observatory.

- Other people involved included: Jim Campbell, Colin Humphries, George Sudbury, Neil Bennett (and Ray Wolstencroft).

- The instruments were mostly sky-scanning photometers and spectrophotometers,
  - but also included an objective prism Schmidt camera with a 20° FOV.

- Instruments were developed under both the ESRO and UK programmes.

- Launches were made from Woomera (UK) and Sardinia (ESRO).

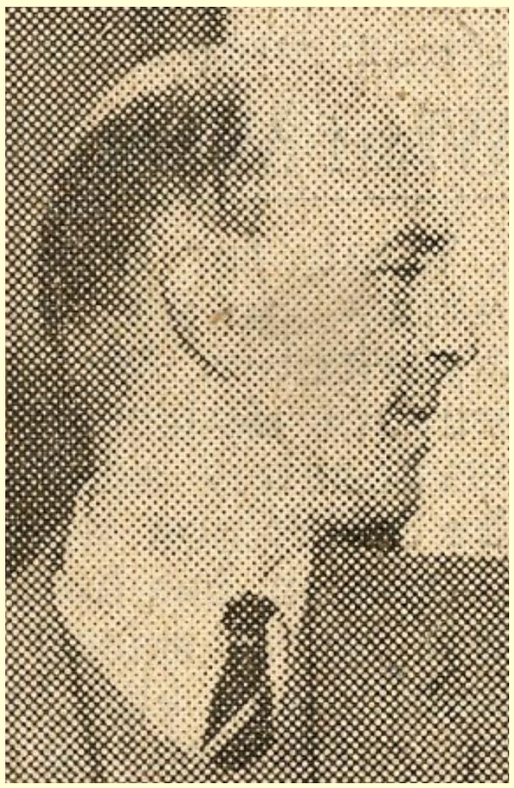
Beginnings

H.A. Brück, Proceedings of Observatories: Royal Observatory, Edinburgh, MNRAS, ***119***, *p356*.

heliographs at Observatories in climates more favourable to observation of solar activity than that of Edinburgh, it has been decided to discontinue spectro-

Other work.—In the first part of the year some time was spent by Dr Butler, Mr Ramsden, and other members of the staff on the observation or attempted observation of artificial satellites. In the case of Dr Butler this led to studies of the possible use of " Skylark " rockets for astronomical observations.

Dr Reddish has been engaged in further discussions of the rate of formation of stars (*The Observatory*, **78**, 198, 1958) and of the luminosity function of M67 (*The Observatory*, **78**, 255, 1958). He has also attempted a preliminary analysis



Dr Hugh Butler (1916-1978).

THE POSSIBILITIES OF MAKING ASTRONOMICAL OBSERVATIONS FROM BRITISH ROCKETS

by

H. E. Butler

To be read at the R.A.S. on March 13, 1959.

It is 12 years since the first ultra-violet spectrum of the Sun was obtained in the U.S. from a captured V2 rocket (see e.g. E. Durand, J. J. Oberly and R. Tousey, Ap. J. 109, 1, 1949). That spectrum was the first observation of a new branch of astronomy just as much as Jansky's first observation of Cosmic Noise in 1931 was the beginning of Radio Astronomy. In fact there is a very close parallel between Radio Astronomy and Rocket Astronomy, perhaps the most interesting difference being that radio astronomy was completely unexpected while the chance to use more or less conventional instruments from outside the Earth's atmosphere has been eagerly anticipated by observational astronomers for half a century or more.

Script of talk given by Hugh Butler to the RAS on 13 March 1959.

Instruments Developed

R62 2 Channel Photometer with 250 Angstrom filters centered at 2200 and 2500A

R63 Stellar scanning UV Spectrophotometer 1500-3000A, resolution 100A

R65 A&B. 2 Channel Photometers with 250A filters centered at 2200 and 2500 As using pulse counting (R65A) and CD (R65B) outputs

R65/2 Cassegrain telescope plus Grating Spectrophotometer

R10 340cm*2 single Photometer, 1300-2000A

R120 Single channel photometer, sky brightness in 1650-3200, 2400-3200 and 2650-3200A

R121A 2 channel UV photometer

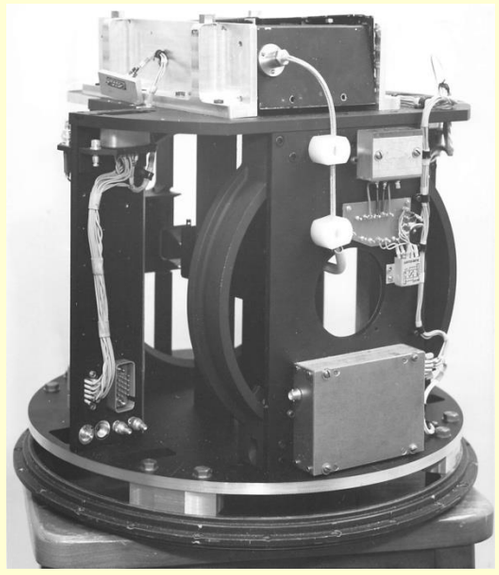
R121B Cassegrain telescope photometer

ROE-D Diffuse UV background sky scanner with photomultiplier (FOV 21x8 degrees)

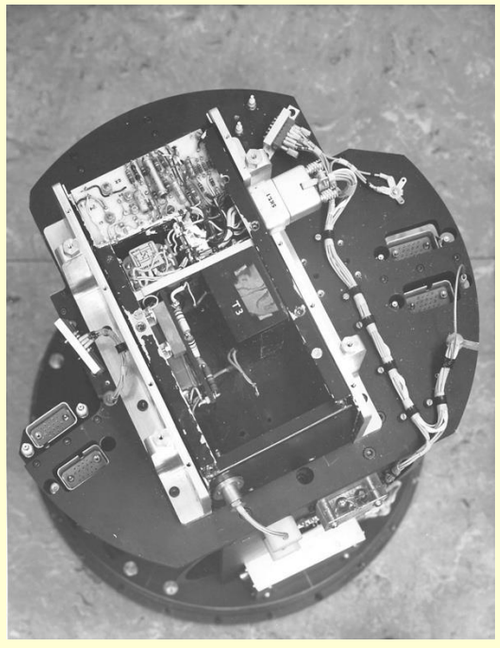
ROE-C UV Schmidt Camera with 9 plates changeable in flight (FOV 20 degrees)

R instruments developed for ESRO,
ROE instruments developed under the 'British Programme Experiment'.

Colin Humphries with instrument stack and nosecone.



R63 Stellar scanning UV spectrophotometer.



Top view of R63 spectrophotometer.

Flights

Mission	Experiment	Launch Site	Date	Maximum Altitude	Notes
SL140	ROE-D	Woomera	17 March 1965	19 km	Launch Failure
SL141	ROE-D	Woomera	25 March 1965	174 km	Partial Success. Flight Spare at ROE
S05/1	R62 + R63	Sardinia	11 August 1965	215 km	R62 Instrument cover failed to eject. No decent attitude solution for R63
S11/1	R65/1	Sardinia	26 Nov 1966	3 km	Launch failure. 2nd stage did not fire.
S11/2	R65/2	Sardinia	22 May 1967	194 km	Stellar fluxes at 2200 and 2600A. Astrophys & SS 9 pp 128-145
S05/2	R62 + R63	Sardinia	26 May 1967	239 km	Stellar Fluxes/spectra from 1450-3200A Astrophys & SS 9 pp 128-145
S47/1	R120 + R121A/B	Sardinia	7 October 1968	208 km	Diffuse UV sky brightness. 1450-3200A. Stellar fluxes 2200 and 2600A. R120 success, R121 failure (excess roll rate).
S27/1	R100 +R65A & B	Sardinia	3 December 1968	198 km	Diffuse UV sky brightness. 1450-3200A. Stellar fluxes 2150 and 2550 A. Success
SL401	ROE-C + ROE-K photometer	Woomera	19 March 1970	181 km	Telescope did not fully evacuate. No results published.
SL402	ROE-C + ROE-K photometer				Cancelled.
S47/2	R100	Woomera	30 September 1970	201 km	Diffuse UV sky brightness. 1450-3200A. Stellar fluxes 2200 and 2600A. Success

Results Obtained

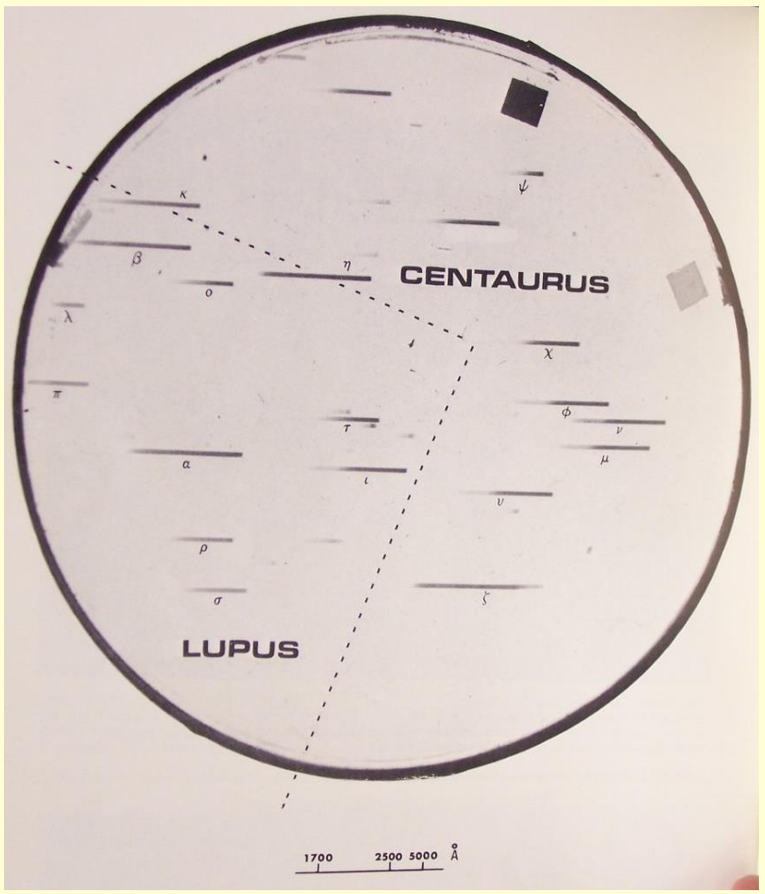
- Scientifically useful results were obtained,
  - which complemented the optical spectrophotometry and studies of hot stars which were long-term programmes at the ROE.

- A number of papers were published,
  - both astronomical and technical.

- At least 2 PhDs were awarded:
  - Sudbury (Edinburgh) and Campbell (St Andrews).

- Where there was overlap with other instruments (eg. OAO-2) there was agreement.

Telemetry from Flight S27/1 (Sardinia, 3 December 1968). Trace A is from a photometer (band around 1500Å) and Trace B from a spectrophometer (range 1500-3000Å).



Objective Prism spectra obtained during Flight SL401 (Woomera, 13 March 1970).

Legacy: Surviving Instruments

Recovered ROE-K photometer.

Engineering model for Schmidt Camera to be flown on cancelled Flight SL402; identical to the camera on Flight SL401.

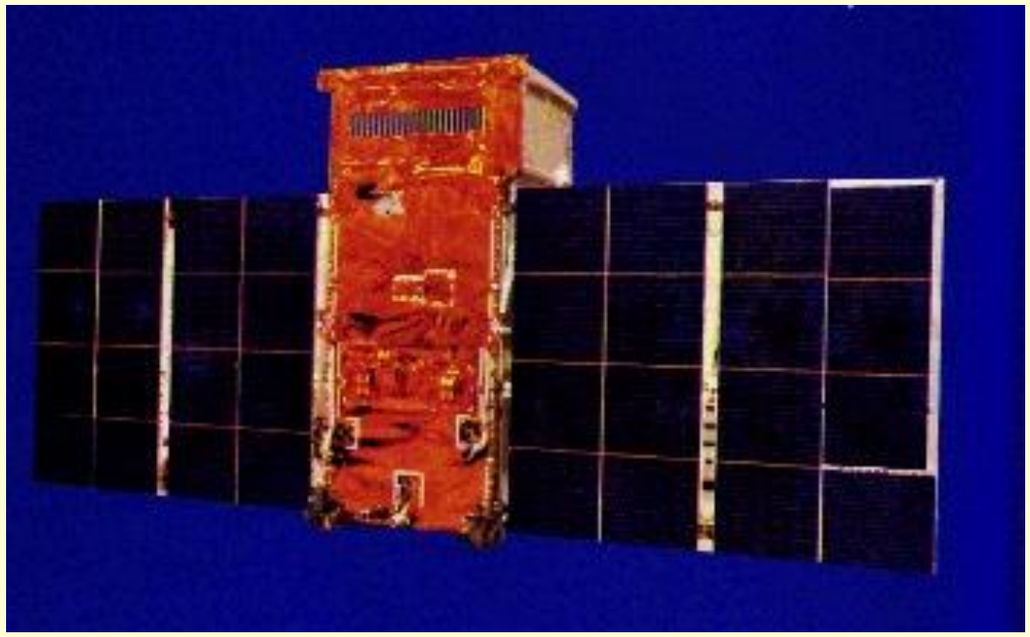
Flight SL401 from Woomera, 13 March 1970.

Impact and Lasting Significance

- The first foray into space astronomy at ROE.

- An important contribution to the development of UV astronomy,
  - particularly during the second half of the programme the S2/68 instrument was developed jointly with the *Institut d'Astrophysique* of Liege to fly on TD1-A,
  - and *indirectly* IUE.

- Laid the ground work for subsequent space instrumentation built at ROE and latterly the ATC:
  - TD-1A (S2/68), ISO (ISOCAM), HERSCHEL, JWST (MIRI), LISA (in development).



TD1-A

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