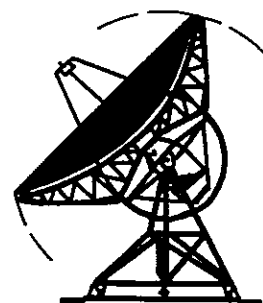


PROTO STAR

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NEWSLETTER of the James Clerk Maxwell Telescope

Number 8, September 1989



Kulia I Ka Nu'u



The chart recorder is the real object of this group's interest, not the camera. The recorder is attached to the experimental SIS 245 GHz receiver and indicates a double sideband noise temperature of 100 K. Dr Les Little (first right in the photograph) reports in this newsletter on the significance of this figure and on the performance of the receiver at the telescope. The other members of the commissioning team, photographed in the instrument preparation room adjacent to the telescope, were (l to r) Carol Bergeron (HIA), Charles Cunningham (UKC), Steve Davies (UKC) and Doug Wade (HIA).

FOREWORD

New PATT form

Attached to this issue of Protostar is the new form that is to be used, with immediate effect, for applications to PATT for JCMT time.

Award to Dr R.E. Hills

Congratulations to Richard Hills on the award of the Jackson-Gwilt Medal of the Royal Astronomical Society in recognition of his major contribution to the James Clerk Maxwell Telescope project. The citation accurately assesses that contribution with the comment "... without Richard Hills there would probably not be a JCMT."

Alex McLachlan
Editor

DEPARTURE OF ADRIAN WEBSTER FROM THE JACH

The current Head of the JCMT Science Group, Adrian Webster, has decided not to renew his tour of duty in the Joint Astronomy Centre at Hilo. He will be returning to ROE in late September. His position at the JAC is to be filled by Richard Wade from ROE who will be arriving in Hawaii sometime in late October.

I would like to take this opportunity, on behalf of the Hilo Branch of the JCMT Staff, to thank Adrian for his efforts over the last three years. It has not been an easy task to build up the JCMT into an operational and partly organised (!) observatory. There has been, and remains, tremendous pressure from outside parties pushing both the telescope and the staff into modes of operation for which they are not yet prepared. Despite all this trauma, it is clear that the JCMT is a first-class telescope and probably the most efficient and sensitive operating submillimetre observatory in the world.

The present state of the JCMT could not have been attained without a dedicated person behind the helm steering the remainder of the staff through the initial three years of training, commissioning, rebuilding, learning, etc. This work has really put the skills and knowledge of the staff to test. Many of the duties that Adrian undertook were separate and invisible from the day-to-day operation of the observatory. He dealt with most of the detailed political, administrative and financial matters in such a way that left the rest of us free to concentrate our attention towards the job of getting the antenna and instrumentation operating.

Thank you very much Adrian and Good Luck with your new position at ROE. We will undoubtedly see you now and again either at ROE or when one of your attempts to get PATT awarded observing time succeeds!

Aloha

Graeme Watt

RECENT RESULTS FROM THE JCMT

1. A spectral line survey of Orion A

The 257–273 GHz region of the spectrum from the core of Orion A has been observed by Glenn J. White and Jane Greaves (QMC Physics) using the JCMT. The observations were carried out over 3 nights in October 1988, using Receiver A (upper) and AOSD. The double-sideband (DSB) spectra were later separated into upper and lower sidebands (USB and LSB) using a new sideband deconvolution program written as part of Jane Greaves' PhD research. A very high density of spectral lines was found, with ~ 150 distinct features in the 16 GHz range, including about 5 U-lines and about 20 previously known species and their isotopic variants. Surprising discoveries include strong lines which coincide with expected frequencies of the radicals C_4H and $SiCC$. The latter has previously only been observed in the evolved star IRC+10216, and the presence of this unstable, highly-reactive species in a region of dense gas was previously unsuspected. The current understanding of silicon chemistry may need to be revised. Further analysis of the spectral and dynamic information in this survey is in progress. A follow-up program to determine the origin of the radicals will be carried out shortly. The deconvolved spectrum (i.e. equivalent to a single sideband spectrum), is shown in Figure 1.

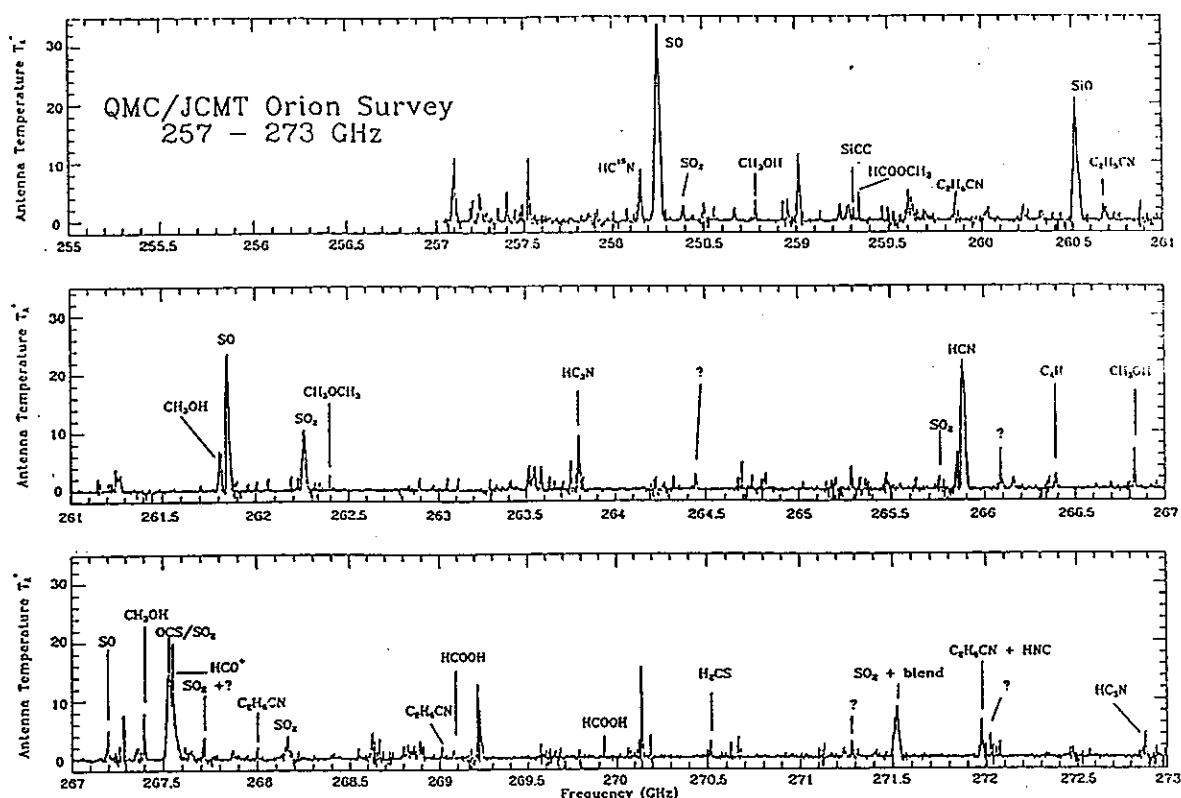


Figure 1.

The spectra were obtained by integrating for typically 10-15 minutes total per frequency setting. The noise across each passband varied considerably, and the effects of rising noise at one end of AOSD can be clearly seen at some places (for example, 272.45-272.55 GHz). At each of the settings (separated by 475 MHz), two spectra were obtained, with their lsr velocities varied by 20 MHz. This means that upper and lower sideband lines move in opposite directions in the observed double sideband spectrum, and are displaced on the sky by double the IF frequency (2×3.94 GHz), allowing the deconvolution program to extract the two sidebands separately. This program performs in a very stable way except for just a few cases (which are very overcrowded areas). An example of this deconvolution program in action is shown in Figure 2, the upper box showing the observed double sideband spectrum, and the two lower boxes the separated sideband spectra.

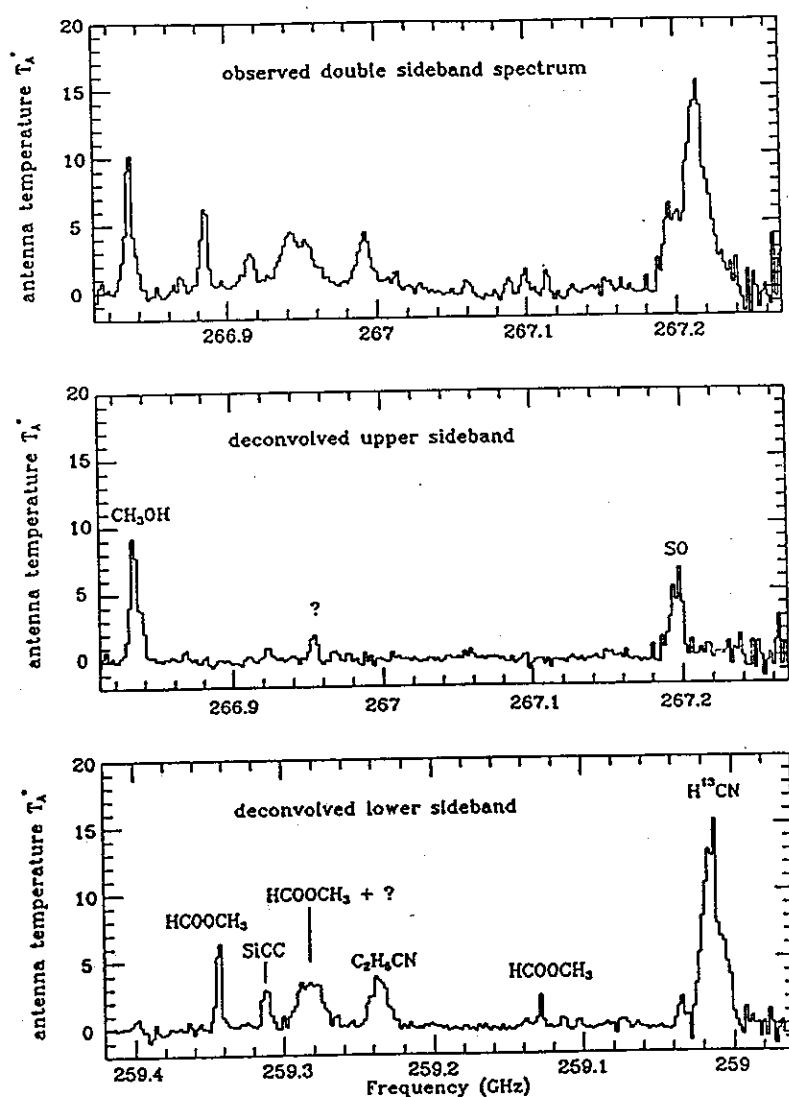
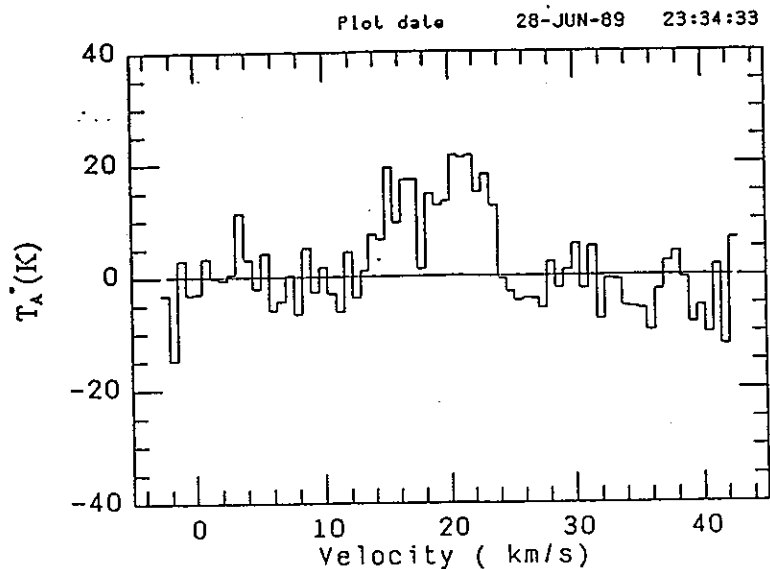


Figure 2

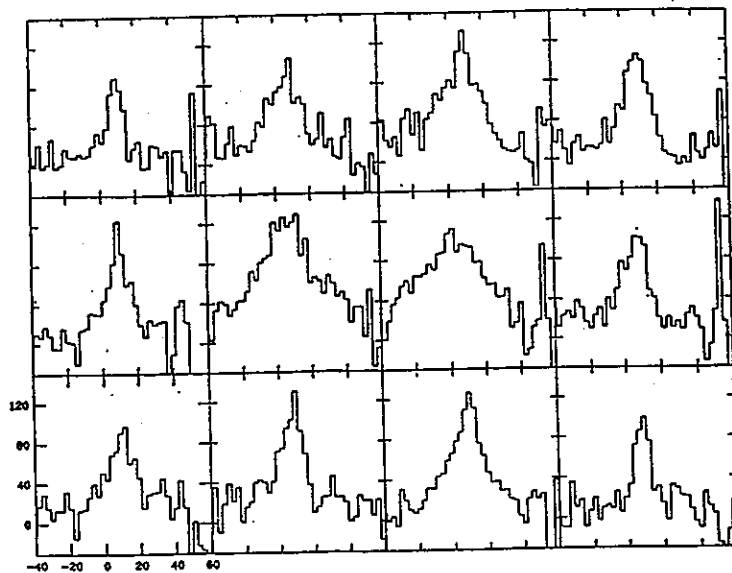
Glenn J. White
Queen Mary College
University of London

2. First results from Receiver C



Scan 590 11:08:31 23-JUN-89 0590.001_A m17_sw

1. A high resolution CO $J=4-3$ spectrum of M17SW. The spectrum has 70 channels each of width 1MHz (0.7 km/s), and required a total observing time of 20-minutes.



2. A 4x3 map of OMCI in the $J=4-3$ line of CO. The spatial sampling is 15-arcsec. Spectra are calibrated in terms of TA^* . The entire map took about 45 minutes to complete. Although the pointing was relatively uncertain at this time it can be seen that the broad "plateau" component of the spectrum totally dominates the spike in the central positions.

omcl CO 4-3

Map centre RA 5 32 47.00,

Dec. - 5 24 22.98

Rachael Padman
MRAO

COMMISSIONING OF JCMT RECEIVER 'C'

Receiver 'C' is the result of a collaboration between the astrophysics group of the Physics Department, Queen Mary College London, and the radioastronomy group in the Cavendish Laboratory, Cambridge. It is a dual polarization InSb 'hot-electron bolometer mixer' receiver intended to cover a limited frequency range around the lines of two very important coolants - the $J=4-3$ rotational transition of CO, at 461 GHz, and the $^3P_1 - ^3P_0$ fine structure transition of neutral carbon at 492 GHz. While the CO 4-3 line is interesting in itself, marking as it does some sort of boundary between the traditional lower-frequency "molecular cloud" lines and the higher excitation "cloud core" $J=6-5$ and $7-6$ lines now accessible to RxG, the real prize is the neutral carbon line. This line has previously only been observed from the KAO with a 90-cm telescope, yet is absolutely fundamental to studies of the chemistry, energetics and dynamics of molecular clouds. At 492 GHz the JCMT has a diffraction limited beam of only 7-arcseconds, and with a (realistically achievable) surface accuracy of 35-microns would have a Ruze efficiency of nearly 60%.

Since most readers are unlikely to be familiar with the operation of this type of mixer, I'm going to digress here to a brief technical introduction, before going on to describe the results of the commissioning run proper.

InSb mixers were the first detectors to be used for high resolution astronomical spectroscopy in the submillimetre waveband, and even now give very competitive noise performance. The local oscillator and signal incident on the bulk semiconductor give an "instantaneous power" (if you will forgive the apparent contradiction in terms here!) which has components varying at the sum and difference frequencies of LO and signal. An appropriately doped InSb lattice contains an electron gas, whose temperature can vary relatively rapidly with a time constant of about 0.1 microseconds. In a mixer, this electron gas responds to the difference frequency component of the total power, and modulates the resistance of the detector at the same frequency; if a constant current is applied to the detector the resulting changes in voltage can be amplified to form the signal we eventually detect.

InSb bolometer-mixers are thus true heterodyne detectors, although the i.f. bandwidth is so low (the passband extends from about 50 kHz to something like 1-2 MHz, depending on the material) that they bear little resemblance to heterodyne receivers based on Schottky diodes or SIS mixers. A major advantage is that they require much less LO power than do diode mixers - of the order of microwatts at the detector compared to milliwatts for a diode (but nanowatts for an SIS mixer). They do however need to be operated at very low temperatures; 1.5K, which can be obtained by operating with liquid ^4He at reduced pressure, is probably a good tradeoff between noise temperature (which improves as the temperature is reduced) and bandwidth (which decreases). Furthermore, since currents only need to flow in the external circuitry at the (low) intermediate frequency, the design and construction of the detector mounts are greatly simplified.

As a result of the very narrow instantaneous bandwidth, spectra must be observed in a "point-by-point" fashion: data are taken for one setting of the local oscillator; the local oscillator frequency is then stepped to a new value; more data are taken; and so on until the complete spectrum has been obtained. Probably the best analogy is to a CVF or a scanning grating spectrometer. Although it is possible in principle to operate hot-electron mixers as single sideband devices, the maximum *double* sideband bandwidth is well matched to the resolution required for most astrophysical observations. As the extra circuitry required for SSB detection is quite complex, we have not bothered to install it here - for the rare observations where higher resolution is required the bandwidth is limited by using a selectable low-pass filter in the i.f. strip - resolution bandwidths between 500 kHz and 4 MHz are available, with the noise performance being somewhat better at the low end of this range.

Since the sky transmission at the zenith will rarely be better than 25% on Mauna Kea at 461/492 GHz, we have to expect that the sky brightness will fluctuate in the time it takes for a blob of wet air to blow across the telescope aperture - typically a few seconds. Accordingly, receiver C was designed to allow for very fast scanning when compared to earlier InSb receivers. The maximum scan rate is 10-msec/pt, for which an 80% observing efficiency is obtained. Thus for a scan consisting of 50 points we could complete 2 full scans every second. The evidence from the commissioning run is that this is sufficiently fast to give very good baselines even under less than ideal conditions (no need for lectures in Creative Baseline Removal here!)

In late May of this year Dennis Bly, Bob Barker and I (all of MRAO) escorted receiver C to Hawaii, and began the installation process. Richard Prestage of JACH joined us to work on the VAX D-task, while Glenn White (QMC) arrived a week later bearing another detector. Unfortunately the 115 GHz Gunn oscillator (used to provide the LO power for the CO observations) had been found to be extremely attitude-sensitive a few days before the receiver left Cambridge, and there were some anxious days as Millitech (in Massachusetts) laboured to repair it. In the interim we worked at 492 GHz, and of course we found a number of major and minor problems, most of which however were sorted out by the time we got the receiver on the telescope on the 8th of June.

The actual commissioning time was in two tranches, each lasting about a week and separated by several days. For the first session, we concentrated on trying to understand the overall behaviour of the system, including pointing offsets, focussing etc, as well as some very subtle bugs involving the microprocessor software and calibration hardware. It quickly became apparent that there was a major problem with "standing waves" in the optics between the receiver and telescope optics (secondary and primary mirrors). At this point it is necessary to digress again to describe exactly what I mean by this overworked term.

Most cm-wave spectral-line astronomers will be familiar with the roughly sinusoidal modulation of the spectrum that results when some of the incident signal rattles around inside the telescope structure, interfering constructively at some frequencies and destructively at others. Fortunately, the magnitude of this effect decreases with decreasing wavelength, and the period scales inversely as the size of the telescope, so that for small mm-wave telescopes the problems are much less pronounced. In the case of receiver C however, with its very low intermediate frequency, another mechanism comes into play. Some (small) fraction of the local oscillator incident on the mixer is reflected back out of the dewar and illuminates (let's say) the secondary mirror. Again, some of this (a tiny fraction) is reflected back into the mixer. The resulting modulation of the total LO power is not significant, but in the time taken for the scattered LO to traverse the 15-metres or so between dewar and secondary mirror, the LO frequency has changed, just due to the non-zero width of the LO spectrum. The change in frequency is tiny - a few Hz maybe - but this is enough to cause the delayed LO to look like a "signal" to the mixer (this is not the full story, but it is near enough for a first go).

Since the thermal signals we are looking for are at such a low level, and the mixer bandwidth so low, the imposter is still comparable to the true signal. As might be expected the magnitude of the effect depends on the relative phases of LO arriving by the direct and delayed paths, and so the amplitude is modulated with a period of about $0.5 \cdot (c/15\text{-m}) = 10\text{MHz}$; about 6.5-km/s at 460 GHz. Although nearly all of the ripple subtracts out when position switching, the magnitude is obviously very dependent on the actual position of the secondary mirror, so the quality of the subtraction is reduced as the telescope tracks and deforms under gravity, as the temperature changes and, particularly, if the secondary moves either to maintain the homology corrections or for beam-switching. Obviously this also makes it very hard to use beam-switching, as even a tiny change in the secondary mirror position causes a large change in the ripple amplitude and phase.

Well, in the first week of the run we had just about got things sorted out, had tested out most of the observing modes to be sure that the VAX and micro software were OK, and had just about gotten to grips with the calibration in the presence of these huge standing

waves, when the weather closed in. The next few nights were spent doing lots of tests, but there wasn't even a chance of astronomy. By this time we were all pretty disheartened, and welcomed the chance to go down to Hilo for a beer and a swim, and to recover for a day or two. All the same we had seen a spectrum (we thought) in W49, so it clearly wasn't hopeless.

Two days later Glenn and I were back up to investigate the detectors, and by the end of the break had got both of the detectors in the dewar working pretty well, with comparable noise performances of about 500K DSB each at 462 GHz and 900-1000 K at 492 GHz. The weather on the first night of the second session looked pretty ominous - thick, high cirrus - but in fact we quickly realised that the sky transmission was excellent, at around 25-30%, and very stable. We were working at CO 4-3, and the spectra started flooding in. With such a superb sky it was very simple to test all sorts of things, but in fact it all seemed to be working already. It was just a shame that we hadn't had such a night earlier on in the run, but it did reinforce very effectively the lesson that, even on Mauna Kea, very few nights are usable above 345 GHz, and that some form of flexible observing will be necessary if we are ever to capitalize on the high frequency performance of JCMT.

We managed to make a lot of progress in the next few nights, but as soon as we switched to 492 GHz the standing waves came back to haunt us, and we never did get a satisfactory detection of CI, even in OMC1 (which was just rising as the morning shift ended). Quite why 492 GHz is so much worse is a bit of a mystery, but it may well be due to the fact that the 123 GHz gunn oscillator is pushing current technology to its limits, and is intrinsically less phase-stable than the 115 GHz gunn. Along the way we spent hours investigating the apparent telescope emission temperature (only to find eventually that the skydip program was incapable of determining the value of η_{tel}), and we exhumed the almost forgotten *user-switch* mode of observing, to allow us to use combined focus- and beam-switching (this smears the standing wave effects over the observing passband, reducing the amplitude of the fluctuations in the spectrum).

By the end of the run we had established that RxC is a very competitive system for observations of galactic CO 4-3 (in order to compare a DSB scanning receiver with a conventional SSB multiplexed receiver, multiply the former's DSB noise temperature by the square root of twice the number of spectral channels; for two polarizations of comparable noise temperature then divide by 1.414 to get the single channel equivalent). It is not however possible to offer RxC for PATT observing at CI yet. Beam-switching of the secondary mirror under control of the receiver micro works, although as noted the standing wave is sufficiently different in the two beams that the resultant switched spectrum is pretty ratty and effective use of beam-switching therefore also awaits a cure for "the standing wave problem".

The solutions to this problem are in fact obvious enough, if not necessarily easy to implement. Most importantly, we need to install a local oscillator of very much greater spectral purity (If this were easy we would have done it first time round!), but we can now see a number of approaches which should, when combined, give the 10-20dB improvement we need; work is underway at MRAO to implement these in time that they can be tested before the next PATT scheduling meeting. There is thus every prospect that we will have available a common-user 492 GHz receiver in time for the next semester; if the telescope surface can also be improved by a few microns before then and the pointing can be maintained at its current level we will have a dynamite system!

Rachael Padman
MRAO

COMMISSIONING OF THE EXPERIMENTAL SIS RECEIVER

The RAL/Kent 250 GHz SIS receiver was finally operated on the JCMT in May where, as expected, it worked very well. First light was acquired on May 23 when observations were made of G34.3+0.2 in the J=5-4 line of CS. In the laboratory the performance of the receiver had indicated double sideband receiver noise temperatures 50-100K at all the frequencies at which it had been measured in a range from 228 to 265 GHz. On the telescope, however, a direct comparison with receiver A suggested values more consistent with 130K. A 10dB attenuator inserted to stop an amplifier oscillating added 12K to the laboratory values but even so a discrepancy remains. We are now investigating its origin, which lies not in any degradation of receiver performance between laboratory and telescope, but rather in the difficulty of measuring SIS noise temperatures where the local oscillator power is not hugely greater than the signal power incident across the whole waveguide band. Any claim we might put forward to have built the world's most sensitive heterodyne receiver at frequencies > 200 GHz requires an evaluation of this difficulty, as it applies both to our receiver and to those of IRAM and CSO. We were lucky to be able to make immediate comparisons between the SIS prototype and Schottky receiver A. Their relative performance is summarised in Table 1 and noise comparisons are illustrated in Figure 1. In the rather damp prevailing weather conditions the SIS prototype ran seven times faster than receiver A. Owing to reflection of local oscillator power from a lens in the cold load path, which varied as the telescope was tipped, it was necessary to calibrate the receiver manually, a fairground-quality experience. The helium cryostat hold-time was greater than 24 hours.

Table 1 - Relative performance of SIS prototype
and receiver A at 245 GHz

	Dsb receiver noise temp (K)	Beamwidth (arcsec)	Relative beam efficiency
Schottky A	540	19.8	1
SIS prototype	130	21.0	0.93

Installation at JCMT was almost too smooth to be true, due to the military precision of Charles Cunningham's planning, the valuable help of Doug Wade and Carol Bergeron from HIA, and that of the JCMT staff. The very simple electronics, coupled with careful measures adopted to avoid blowing up junctions after an outbreak of this occurrence in January, must also have helped. It was thus possible to test the receiver by making many useful astronomical observations during seven days of fair weather. One such observation is shown in Figure 2.

Most of the credit for the success of the SIS development programme must go to Steve Davies and Charles Cunningham for sticking at it over a long period with such patience, determination and skill. The mixer block for the present receiver was designed by Dave Matheson, Frazer Strong-Jones made the scaled model measurements which permitted the r.f. filter structure to be optimised, and Ivan Bishop designed and constructed the chopper system. As SIS mixers are 'high Q' systems, the facilities of the RAL high precision workshop were invaluable for machining components of small size with sufficient accuracy to ensure they work as designed. The Kent mechanical workshop assured the timely fabrication of less critical components.

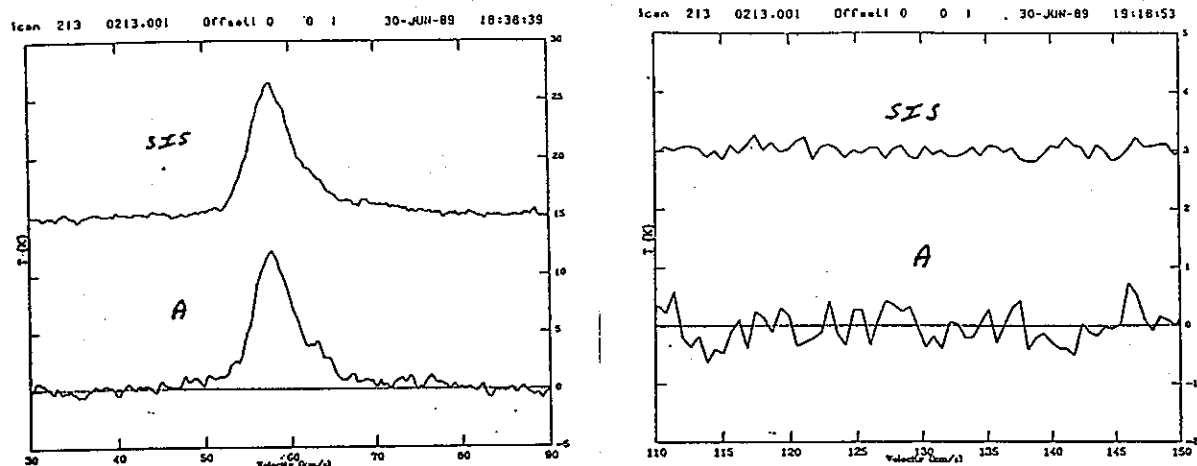


Fig. 1. Comparison with Receiver A.

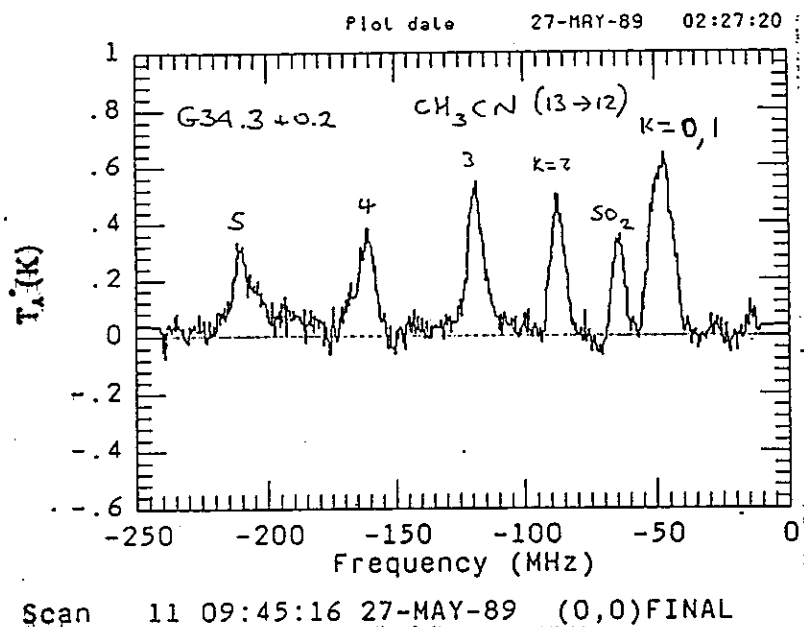


Fig. 2. Vibration components in the $J = 13-12$ rotation line of CH_3CN

Our first successful SERC application for funds towards developing an SIS receiver was made in 1982, following an unsuccessful attempt in 1981. The Common User policy cannot be said to have expedited the development of SIS receivers for the JCMT, having contributed about a year's delay between 1986 and 1989.

A prototype receiver of the type we operated at JCMT costs about one third of an equivalent Common User receiver, both in manpower and hardware. As I see it, the principal advantage of the Common User receiver is its more elaborate phase-locking system which enables velocity resolution $< 0.3 \text{ km s}^{-1}$ to be maintained.

After the observations the 245 GHz receiver was taken home for conversion to 345 GHz.

Les Little
Univ. of Kent at Canterbury

REPORT ON THE PATT MEETING FOR SEMESTER Q (Sept.'89 to Feb.'90)

Venue

The semester Q PATT meeting was held in Bristol on July 11-12, 1989. I was ably helped by Alistair Glasse (ROE) in my task as JCMT Tech Sec.

Scientific proposals

Of 124 JCMT proposals that were considered, 44 were awarded time, in addition to one long-term from semester O and one long-term from semester P. A typical award is for 5 shifts, each of 8 hours.

Some statistics

Number of 16-hour nights requested	:	359
Number of nights available for PATT	:	105
Number of line proposals	:	83
Number of continuum proposals	:	49
Number with UK PI	:	60 (48%)
Number with CDN PI	:	34 (27%)
Number with NL PI	:	07 (06%)
Number with OTH PI	:	23 (19%)

Number of nights awarded to UK	:	43.9
Number of nights awarded to CAN	:	21.6
Number of nights awarded to NL	:	09.2
Number of nights awarded to OTH	:	30.4
Number of nights given to U. Hawaii	:	12.0

Percentage of time to partner countries (time to OTH credited to the partner countries in the ratio UK/CAN/NL = 55/25/20) :

UK	:	57.7 %
CDN	:	27.8 %
NL	:	14.5 %

Allocations for Semester Q

Proposal No	PI	Allocation
LT/O/3	Avery	48h (end of LT status)
LT/P/83	Robson	96h
M/Q/1	Feldman	16h
2	Clark	20h
3	Graf	48h
4	Coleman	64h
7	Myers	32h
10	Avery	32h
11	Jaffe	48h
14	Halliday	16h
17	de Muizon	24h
20	Genzel	96h
22	Chini	32h
23	Redman	64h
27	Joseph	32h
29	Hughes	64h
33	Sahai	48h
34	Rogers	40h

Proposal No	PI	Allocation
39	van der Veen	32h
42	Hayashi	24h
48	Gear	32h
49	Dent	16h
53	Mountain	32h
54	Mountain	32h
57	Gear	24h
66	Sandell	32h
67	Sandell	24h
75	Matthews	48h
80	White	24h
81	Thum	24h
85	Hills	32h
86	Hills	32h
87	Padman	24h
89	Scott	40h
90	Naylor	20h
91	Stutzki	32h
92	Moore	24h
97	White	48h
100	Robson	16h
113	Moriarty-S	32h
114	Redman	24h
115	van der Hulst	48h
116	Stacey	48h
118	Sandell	56h
119	Mezger	16h
120	Bastien	24h

total = 1680h (105 nights = 210 shifts of 8h each)

Allocations to the Joint Astronomy Centre, Hilo

In addition to all the 8-hour daytime shifts, 60 full nights were given to JACH for engineering and commissioning uses, plus 2 full nights for discretionary uses. These 62 nights represent 34.2% of the total available time and, since this is significantly greater than the 10% needed for comparable work on UKIRT, it is of interest to see how the time will be used:

Purpose	Allocation
Commissioning of UKT14 polarimeter	7 nights
Commissioning of 345GHz SIS testbed receiver	7 nights
Calibration of UKT14	2 nights
Pointing and tracking	14 nights
Mm-metrology of JCMT dish	8 nights
Heavy engineering	12 nights
New observing modes	2 nights
Beam mapping	1.5 nights
Efficiency measurements	1.5 nights
Receiver G setup	1 night
Receiver C testing	2 nights
Computer hardware changes	2 nights
Discretionary time 2%	2 nights

total = 62 nights (124 shifts of 8h each)

A recommendation from PATT

It is recommended that proposers check their Right Ascension coordinates, and that they not submit a JCMT proposal if their sources are not accessible in the coming semester!

A request from PATT

Would anyone submitting a JCMT proposal to use receiver G please also submit a full backup proposal (not just a paragraph on your receiver G proposal)? Please state on such full backup JCMT proposal that it is a backup, with no JCMT time requested.

Acknowledgements

This meeting marked the end of term for 2 JCMT PATT assessors: Lorne Avery and Les Little. Thanks to both for their hard work.

The Bristol meeting went smoothly, thanks to the efficient and cheerful organisational capabilities of Jane Shepard & Michael Morton (SERC, Swindon).

Next PATT meeting

It is scheduled for 9 and 10 January 1990, in Bristol, UK.

J.P. Vallée
JCMT Tech Sec

APPLICATIONS FOR TELESCOPE TIME: ARRANGEMENTS FOR SEMESTER R

For Semester R (March 1990 - August 1990) the closing date for applications will be October 31, 1989. Postal applications should be sent to:

The Executive Secretary, PATT
SERC
Polaris House
North Star Avenue
SWINDON SN2 1ET

Enquiries may be made by telephone (0793 411198) or Telex (449466). Application forms may be obtained from the above address, as also may sets of Notes for the Guidance of Applicants. Those who have not previously applied for telescope time on SERC telescopes are strongly advised to obtain copies of these Notes.

In Canada copies of the application forms can also be obtained from the Radio Astronomy Section of the Herzberg Institute of Astrophysics.

A new application form is being used for the first time for Semester R; a copy of the form is being mailed with the newsletter.

J.P. Vallée

INSTRUMENTS AVAILABLE FOR SEMESTER R

The following instruments should be available to users on the JCMT during semester R (March 1990 - August 1990)

Heterodyne (spectral line) receivers:

Receiver A1.

This receiver nominally covers the frequency range 220 - 275 GHz. Two mixer sets are used to achieve this range: A1(lower) operates well up to 240 GHz, while A1(upper) is better at frequencies above 240 GHz. Frequencies somewhat outside this range may be accessible with some degradation of performance. Receiver A1 is a dual-channel device, and thus is receptive to both polarizations. However, this depends on the availability of two mixers covering the same frequency range; so far only one working mixer has been available in the upper frequency band, and for the for most of the last year or so Receiver A1 has been operated in a 'hybrid' mode, i.e. with one mixer from each frequency range. Observations are possible in only one frequency band at a given time, and thus only single polarization observations can be accommodated. This situation is likely to continue through semester R.

Typical double sideband receiver temperatures at the band centres are 440 K and 650 K for the lower and upper bands respectively, corresponding to single sideband system temperatures of about 1100 and 1600 K respectively in the best cases. Receiver temperatures will increase with distance from the band centres.

Receiver B1.

This is a single channel (polarization) receiver. Prior to recent rather serious problems, the lower frequency limit of the receiver was about 326 GHz and it had been used at frequencies as high as 372 GHz, where the limiting factor is the atmosphere, due to an absorption band around 373 GHz. Typical double-sideband receiver temperatures at the band centre were about 900 K, corresponding to single sideband system temperatures of about 2700 K, increasing away from the band centre. The recent difficulties have resulted in the receiver being unusable below 347 GHz, and every effort is being made to return it to its previous state. Also, various alternatives are actively being developed. Both SIS testbed and Schottky mixer receivers for the 345-GHz band are expected to be commissioned on the JCMT during 1990. Tests of a 245-GHz prototype SIS receiver in May 1989 proved very successful; some of the hardware for this receiver will form part of the 345-GHz SIS receiver. In addition, an SIS receiver covering the band 300 - 360 GHz is currently being tested on the JCMT in collaboration with Ed Sutton and his group. (See separate report by Adrian Webster. Ed.)

Receiver C1.

Receiver C1 is a heterodyne receiver for the 450 to 500 GHz waveband, using InSb 'hot electron' detectors as mixers. Because of the finite time constant of this form of mixing, the IF bandwidth is limited to a little less than 1 MHz. It is therefore necessary to 'sweep' the local oscillator frequency across the line to obtain a spectrum. This leads to the major consideration when planning observations with this type of receiver: if one observes a spectrum covering n channels the effective system temperature will be increased by the factor \sqrt{n} . Since the mixers respond to both sidebands the normal resolution is somewhat less than 2 MHz (about 1.3 km/sec), but higher resolutions can be obtained by switching in filters (with widths between 250 kHz and 2 MHz) in the IF chain. Two mixers, sensitive to orthogonal linear polarizations, are provided.

Receiver C1 underwent extensive commissioning tests on the James Clerk Maxwell Telescope during June 1989. As a result of these tests, the Joint Astronomy Centre has accepted the receiver for astronomical observations during semester Q, and, until further notice, in a strictly limited sense: only CO J=4-3 (461.04 GHz) observations with two-load (hot, ambient) calibration can be accommodated. Observers should be aware that although the operation of C1 is straightforward, the atmosphere prevents useful observations for more than one-half of the time on average, so that users should be prepared with a suitable backup programme. Furthermore, care must be taken to minimize standing waves in order to produce meaningful results.

Further modifications and commissioning tests are scheduled to be carried out during semester Q. Principal objectives are the installation of three-load calibration, the investigation of ways to decrease standing waves to acceptable levels, and mixer upgrades. Depending on the timing and the results of this work, it may be possible to offer the receiver for use over the full ± 1 GHz in both windows (461 and 492 GHz) for which it was designed during semester R. The 492-GHz window offers access to the $^3P_1 - ^3P_0$ neutral carbon transition.

Receiver G.

Thanks to the continuing arrangement with Reinhard Genzel and his group at the Institut fuer extraterrestrische Physik in Garching, it is likely that Receiver G will be offered once again for users in Semester R. Interested users should contact either Prof. R. Genzel or Dr. J. Stutzki to arrange collaborative efforts. As described in 'Protostar' (Sept. 1988) the instrument is largely self-contained. Because LO power is provided by an infrared-pumped laser, only certain discrete frequencies can be accessed, in the regions around the CO J=6-5 and 7-6 lines at about 690 and 800 GHz respectively. In the 800 GHz region, the HCN and HCO+ (J=9-8) lines can be observed, along with the neutral carbon ($^3P_2 - ^3P_1$) transition. In general the IF bandwidth is about 1 GHz, and two 'on-board' 500 MHz AOS's having spectral resolutions of 1 MHz are provided. Since July 1989 Receiver G has been mounted on the right Nasmyth platform of the JCMT, where its installation no longer requires the removal of the UKT14 bolometer system. Typical double sideband receiver temperatures range from 3200 through 4500 K. The resulting single-sideband system temperatures are extremely sensitive to atmospheric conditions, but are likely to be of the order of 5500 K or more, under practical conditions. Improvements in the telescope surface accuracy are especially critical at these higher frequencies, and work planned in semester Q on this aspect will have some influence on the precise plans for receiver G. It is likely that a period of about one month will be set aside specifically for observations with Receiver G; interested users should develop proposals with this in mind, and be aware that a low-frequency back-up proposal is also essential. (*Late news: Applications are invited for the use of Receiver G during June, the preferred month, and July 1990. In order to meet the October 31 deadline and allow time for technical assessment by Professor Genzel's staff, applications should reach Garching not later than October 15. Ed.*)

Continuum Observations:

UKT14.

The UKT14 bolometer system will be available in Semester R with the standard full range of filters to permit observations at 2, 1.4, 1.1, 0.8, 0.6, 0.45 and 0.35 mm. Sensitivities range from typically 0.2 Jy/sqrt(Hz) at the longer wavelengths, through to 10 Jy/sqrt(Hz) or more at the highest frequencies under good photometric conditions. Only about 30% of all nights allow one to achieve meaningful results at 450 and 350 microns, however. A major problem until the present has been obtaining good calibration of UKT14 data; the introduction of in-line chopper-wheel calibration (under development during the current semester) should remove much of this difficulty.

UKT14 polarimeter.

In September, commissioning tests are to take place with a polarizing rotating waveplate attached to UKT14. If these tests are successful, it should be possible to carry out submillimetre continuum polarization observations with the JCMT in Semester R. Two modes of operation are planned: (1) normal photometry (chopped, beamswitched) with the polarizer fixed at different angles, and (2) detection of signal modulation as the polarizer waveplate is spun continuously (non-chopped). Pending extensive tests to determine instrumental limits, no suggestions can be offered as to the sensitivity of the polarimeter to source polarization. Any new developments regarding the UKT14 polarimeter (after its Sept. run), will be transmitted on the computer networks via NEWS/STARLINK (UK) and via JCMT-L/UALTAVM (Canada).

Spectrometer Backends.

Currently only one spectrometer can be expected with confidence to be in use at the telescope: AOSC is an acousto-optical spectrometer which offers a resolution of about 330 kHz and a total bandwidth of 500 MHz. Developments to the microcomputer code in the near future should lead to the availability of spectral line observing using the chopping secondary mirror. The use of this technique should lead to a major improvement to baselines and a reduction in sky contributions to the noise level. Of the two other spectrometers, AOSD and the autocorrelation spectrometer ('KENT'), a decision is pending during the current semester on which to maintain on a longer term basis until the arrival of the DAS (an autocorrelation spectrometer being built in The Netherlands, expected to be commissioned during 1990). AOSD offers a spectral resolution of 1 MHz and a total bandwidth of 500 MHz, while KENT has a range of spectral resolutions from 880 down to 110 kHz, with a maximum total bandwidth of 320 MHz. Both backends have suffered serious hardware failures within the last year.

Telescope Performance.

Observations with Receiver G late last year showed that the mean surface rms accuracy over the whole 15-m diameter of the JCMT was perhaps as good as 35 microns. For this figure, at the longest wavelengths (using, say, Receiver A1), the beamwidth and beam efficiency are about 21 arcsec and 0.79 respectively, at 460 GHz the corresponding numbers are about 11 arcsec and 0.55, while at the highest frequencies in use (around 800 GHz) they fall to 6 arcsec and 0.15. More recent (July 1989) Receiver G observations suggest that there has been some degradation in telescope performance since the previous measurements; the surface will be measured in October and adjusted as necessary.

The rms pointing errors have recently been reduced and are currently better than 2 arcsec in both azimuth and elevation; because of the increasing use of the JCMT at higher frequencies, effort will continue to go into reducing these errors still further in the near future when test time is available.

*Henry Matthews
JACH*

THE USE OF THE SUTTON SIS RECEIVER IN SEMESTER 'R'

The trial of Dr. Ed Sutton's 345 GHz SIS receiver on the JCMT in August was very successful and he has been approached to find out whether or not arrangements can be made whereby PATT and UH observers can use it instead of the existing Schottky receiver. Dr Sutton has agreed to offer users the same kind of collaborative arrangement as has been so successful for Dr. Reinhard Genzel's receiver.

Potential users are therefore invited to prepare applications for the use of this receiver during March 1990. The applications should be drawn up in the usual way, but must have been devised in consultation with or approved by at least one of Dr Sutton's team (Ed Sutton, Bill Danchi and Paul Jaminet) and must have at least one of their names on the list of investigators. The applications should then be submitted to PATT or UH in the usual way.

During March, sources are visible over the RA range from about 4 to 22 hours, so a wide variety of objects will be accessible. The extra sensitivity available with this receiver should make CO studies of external galaxies more feasible than hitherto. Since access to the Orion region is limited in March, and since Ed Sutton himself will doubtless be putting in a competitive proposal to complete the spectral line study of Orion those wishing to study galactic molecular clouds may consider it preferable to concentrate on the galactic centre and the first galactic quadrant.

The technical details of the receiver which the potential user will need to know are as follows. The noise temperature cannot be guaranteed but is usually no greater than 300 K double sideband over most of the tuning range. The tuning range is from 300 to 360 GHz, although it may be possible to go lower than this: anybody interested should contact Dr. Sutton. The receiver has one mixer and is therefore single-channel, and lacks a sideband filter so it is double-sideband. Frequency changes are not difficult and can be carried out quickly. The bandwidth available is determined by the spectrometer in the usual way, and is a little less than 500 MHz for AOSC.

The address for correspondence with Ed and his group is:

Space Sciences Laboratory
University of California
Berkeley
California 94720
USA.

Telephone: 415-642-1361.

The extent of the demand for this receiver is important: if too few applications are received then it may not be worth Dr. Sutton's while to come to the JCMT. In its trials, the receiver proved itself to be sensitive, stable and easy to use, and superior in these regards to the common-user Schottky receivers. Users are most warmly encouraged, therefore, to apply for time on this receiver.

Adrian Webster
JACH

COMPUTER NEWS

Data Export and Archiving

The policy for archiving and data handling for all data taken with the JCMT is as follows. Observers will be supplied with one standard, 1600 bpi, Vax backup tape of their data in the GSD format before they leave Hawaii whenever requested and possible. Due to a shortage of manpower this service may not be possible all the time, however in all cases a tape will be mailed to the observer upon request.

Special requests, like extra copies of tapes or data written in FITS or ASCII format, will be fulfilled but not on short notice. These special tapes will be made when time allows and then mailed. Observers should not expect to receive special tapes before they leave Hawaii. Such requests should be made to Thomas Walker or David Brock (usernames TMW and BROCK respectively).

All data taken with the JCMT is archived onto a set of magnetic tapes and kept at the Komohana Street office. Requests for data from these archive tapes will be fulfilled when time allows, usually not more than three weeks. Again, request for archived data should be made to Thomas Walker or David Brock.

Thomas Walker
JACH

FITS tapes

The JCMT is now capable of providing data output in FITS format. Currently, we support "POPS-style" format for spectral line data, and NOD2 format for continuum data. Observers will only be provided with FITS format upon special request (see above). NRAO is planning to hold a short meeting at the end of October to work toward standardizing the FITS single-dish format. We hope to both contribute to this, and move towards any resulting standard as soon as possible.

Richard Prestage
JACH

SPECX

Rachael Padman has released SPECX V5.4, which is now in use on the telescope and in Hilo. This version has a number of improvements over V5.3. Copies of SPECX V5.4 may be obtained from the JAC (contact me - username RMP) - it will also be made available on Starlink.

PLEASE NOTE: due to an change in co-ordinate system conventions, which was unfortunately not reported to Rachael, data taken after approximately September 1988 will appear inverted when read into SPECX V5.3. This problem was cured in version 5.3A, but observers reducing recent data with an older version of SPECX should be aware of this effect.

Richard Prestage
JACH

THE SUPPORT SCIENTIST'S CORNER

Last time I wrote about what we expect from a visiting observer. This time I will give my view about what an observer should expect from his/her support scientist.

We provide scientific and technical support in order to help both inexperienced as well as experienced observers to carry out their scientific programmes as efficiently and reliably as possible. It is not always easy to obtain observing time on JCMT, and although radio astronomy does not differ that much from telescope to telescope, the software and receivers are different; some things which are difficult or impossible to carry out at one observatory may be trivial at another.

Prior to a run the support scientist will have found out about the status of the receivers to be used in the observing run, and about any possible problems with the telescope, receivers or software. If he cannot answer all your questions, he will at least be able to direct you to somebody who can. If the program requires special software or uses our instruments in a non-standard way, please contact your support scientist long before your run.

The support scientist will help you to set up a source catalogue on the JCMT microvax. If you have more than one source, this is likely to speed up the observing and it is also generally more secure than to type in the coordinates at 14000 ft.

The support scientist is also there to help you to plan your observing run and make sure that the scientific goals can be reached. This should be done before you start observing, either in Hilo, or during the acclimatisation period at Hale Pohaku. The support scientist will not only have opinions about how often to calibrate, check pointing, focus etc., but also about how strong signals to expect, what integration times to use, how to map, or how often to tune the receiver. The list is almost endless. You should also discuss possible backup programs with your support scientist. If it appears likely that backup observing will occur (i.e. a program different from the one you have got time on), you should also check with the AIC to ensure that your backup does not interfere with any other scheduled program on the telescope.

The support scientist is also expected to give you a first guided tour through our few data reduction packages (SPECX and NOD2) and if necessary provide a quick introduction to VMS. He should also provide you with information about the documentation and utility programs that exist. Although the documentation is still relatively sparse, it is getting better all the time.

Although the support scientist is nowadays only up for the first observing shift (due to shortage of staff and the difficult logistics in operating a telescope at 14,000ft), he will be on standby during the whole observing run. If problems arise, that the telescope operator cannot solve, he can always be reached by phone, and if necessary, he will come back up.

I should mention that if observers are not smart enough to ask for help, it is not likely that they will get any. We are all overworked, and therefore more than happy to stay out of the way, if we see that our experience is not required. Some support scientist (like myself) have rather strong views about proper observing, and I have noticed that it is not always appreciated. Luckily I don't work as a support scientist very often, and even when I do, I am now trying not to interfere too much.

Sometimes we feel that we are on a oneway street. We try to provide the users with pointing sources, and secondary calibrators both for continuum and spectral line work, but, there is no feedback. Therefore, if you know of suitable pointing and calibration sources that are not in our catalogues, please contact us. The same if your calibration differs from ours. If you for example measure beam or aperture efficiencies, it would help us (and other users) if those values could be included in the data base we are trying to establish. Personally I would also appreciate the additional small effort it takes to flux

calibrate your pointing sources (BLAZARS - UKT14 observations), and if you could communicate those results to either Prof. Ian Robson (Lancashire Poly) or myself if they are not used. Such data, when combined with other observations, are scientifically valuable and will be used to study the mm-variability of blazars. It also helps me to keep my pointing source up to date, because I do update fluxes on a semiregular basis.

*Göran Sandell
Joint Astronomy Centre, Hilo*

JCMT USERS' COMMITTEE & BOARD

JCMT Users' Committee met on 18th April in Montreal, at the invitation of Dr Daniel Nadeau, and next day were invited by Dr John MacLeod to visit the Radio Astronomy section of the Herzberg Institute of Astrophysics in Ottawa. This was the last meeting attended by Ernie Seaquist, Paul Scott and Herman van de Stadt; they are being replaced by Bill McCutcheon (UBC, Vancouver), Anthony Lasenby (MRAO) and Paul Wesselius (Groningen).

The report on telescope operations highlighted (?) the exceptionally bad weather experienced during the winter: normally poor weather is responsible for the loss of about 25% of possible observing time, this winter it had been more like 50%. Oscillations in elevation angle of the telescope apparently were due to a badly supported drive bearing, and had been cured. A design study to investigate the possibility of accomodating more receivers at the Nasmyth foci is underway. The bolometer UKT14 had been performing well, and it was hoped that the repair to receiver A would prevent it from warming up spontaneously. With the arrival and successful commissioning of the Canadian acousto-optical spectrometer the requirements for spectrometers at the telescope were to be reviewed.

Users requested that more calibration data be available, and that data on weather conditions and sky noise be collected. It was agreed that 2 - 3% of the available observing time (4 shifts in semester Q) should be allocated at the discretion of the AIC.

The committee discussed what arrangements would be appropriate if receivers were provided for the JCMT by groups from outside the JCMT consortium. The committee welcomed the collaboration with Professor Genzel and hoped that the arrangement to use his high frequency receiver would continue, and encouraged negotiation with Dr Sutton following the trial of his 345 GHz receiver on the telescope in August. If necessary, the committee was prepared to recommend an award of guaranteed time.

Progress on the construction of new instrumentation was noted, especially the digital autocorrelation spectrometer and the 245GHz SIS testbed receiver. The proposal to build a common-user 345 GHz SIS receiver was endorsed. Interferometry was considered and the committee recommended that project scientists should be identified to investigate both VLBI and one-arcsecond interferometry at millimetre wavelengths.

The next meeting will be at the Royal Observatory, Edinburgh on 12th October.

JCMT Board also met in Canada - in Ottawa on June 1st and 2nd. The meeting included an opportunity to meet Canadian users of JCMT, and those developing and building instruments for the telescope.

The Board was encouraged to hear that it might soon be possible to sign the international agreement between Canada, the Netherlands and the UK setting up the JCMT collaboration. It was reported that the University of Hawaii were installing high-bandwidth links between the summit of Mauna Kea, Hale Pohaku and the U of H Hilo campus. There was a discussion about observing time lost to various causes and it was noted that the reliability of receivers was probably becoming the single most serious problem. It was decided that the Board would approve at each meeting a broad-brush forward plan for the use of engineering and commissioning time and that the JCMT Time Allocation Group of PATT would be responsible for approving requests for time to implement this plan.

The Board congratulated the team responsible for the 245 GHz testbed receiver which had just completed a highly successful trial run on the telescope. Some consideration was given to 'flexible scheduling' to make best use of 'super-dry' weather, but the implementation of this will depend on a thorough understanding of what makes exceptionally good observing conditions. The proposal made by Ottawa - Kent - RAL to construct a common-user 345 GHz SIS receiver was approved by Board.

Financial matters occupied a fair proportion of the meeting with both the report of the James Clerk Maxwell Telescope Board's Financial Procedures Review Panel (more adjectives than members!) and papers on outturn, allocation, estimates and Forward Look for the internationally-shared operating costs being considered.

The next meeting will be at MRAO, Cambridge on 2nd and 3rd November, and will include a session where UK scientists will report on results obtained with the JCMT and instrumentation being developed.

Jocelyn Burnell

LATE EXTRA: we are delighted to learn, since that Board meeting, that the Chairman of the Board, Professor Bob Wilson, has been awarded a knighthood; we offer him our warmest congratulations.

Jocelyn Burnell

JCMT INSTRUMENTATION PROGRAMME

As a result of the March 1989 Announcement of Opportunity, seven proposals were received to build new instruments or for research and development leading to future instruments. These involved ten groups in the UK, Canada and the Netherlands. The proposals will be assessed and decisions made on whether to fund them by November. The first work should then be starting early in 1990, and with a bit of luck, the first of the new receivers may be available early 1991.

Meanwhile progress continues apace on other JCMT instruments. A new SIS receiver was successfully used at 245 GHz (see separate article) and an InSb receiver (RxC) made the first JCMT observations at 460 GHz.

A polarimeter to go on UKT14 will be tested in September. Next year will see some exciting new heterodyne systems on the telescope, including RxB2, a Schottky dual polarisation 345 GHz common-user receiver, and a new wideband digital spectrometer, the DAS. A 345 GHz SIS receiver may also be made available.

Any developments and information on receivers available for observing will be advertised as widely as possible. *Watch this space.*

Bill Dent

POINTS OF VIEW

Observing Efficiency at Sub-millimetre Wavelengths

Much has been said in recent times about the efficiency of observing with the JCMT; clearly one would like to have the on-source observing time approach 100%, particularly during the precious dry periods when the telescope can be used at the highest frequencies for which it was designed. While tinkering with the software is certainly in order, and obtaining better receivers and backends a prime goal, another important key is flexible scheduling of the observing programmes. In what follows we would like to offer some personal views, with the aim of stimulating discussion, on the latter topic.

In the current scheme of things, there are many ways in which an observer on the JCMT may 'waste' telescope time, e.g., (1) by doing a low-frequency programme as scheduled during prime high-frequency atmospheric conditions, (2) by being forced to do a backup programme for reasons of poor weather or failed equipment, and (3) by having to 'fill in' the observing shift with second-rank sources because the prime source has not yet risen, or has set. While there are no specific statistics for such 'wasted' time, experience suggests that approximately half of the total useable time is 'lost' in this way.

True flexible scheduling would see only those programmes on the telescope at any given moment, for which the weather conditions are suitable, the required equipment is functional, and the proposed source(s) accessible. Given the nature of things, only the latter is predictable more than a few hours in advance. This already suggests that the telescope should be scheduled by LST rather than by shift. Thus, let us suppose that, in the perfect case, the telescope crew (operator and support scientist) would decide which programme(s) to do on arrival at the telescope, inform the appropriate observer(s) at their home institute(s), and start up the required programmes. Such a scheme thus contains strong elements of both service, and remote, observing. The major difference is that this would be the normal method by which observations are made. It is clear that remote observing capability is a prerequisite for telescope efficiency, as is a well-prepared observational programme. We would suggest that the protagonists of remote observing seriously consider their potential contribution to telescope efficiency by this means, even though it may already be clear that fully-implemented remote observing is unlikely to cost less than sending observers to Hawaii.

To allow flexible observing to work requires that the local JCMT staff be aware of the scientific priority and time allocation for each programme. This point brings us to examine the current proposal process for the JCMT. The comment has been heard that this is an apparently random process, particularly from those who do not get time on the JCMT. It is also a mind-numbing experience for those taking part in the PATT meetings and associated exercises, somewhat akin to the New York Stock Exchange on a bad day, or a country hog auction. There seems to be sufficient pain on both sides to justify an attempt to find an alternative process. Let us offer one, for the sake of debate.

Under this scheme, proposals may be submitted at any time for the use of equipment which has been announced as available at the JCMT. Each proposal is sent to, say, four appropriate referees, who pronounce on the scientific assessment and suggest a priority and time allocation independently. These assessments are sent to a central location (either at the JCMT or at ROE, or both), where an aggregate priority and time allotment is assigned to each programme. Proposals will be scheduled as equipment, weather and source availability permit, high priority programmes taking precedence. The semester system will be abandoned in favour of scheduling the JCMT for not more than one month in advance, and then only within the context of flexible scheduling. Accepted proposals which have proven to be impossible to schedule for whatever reason within one year of submission will be returned to their authors for re-evaluation and resubmission (if appropriate).

Combining this with the flexible-efficient observing approach discussed above has some advantages overall over the current system. We are purposefully glossing over many of the ramifications which occur to us, since they may best be left to coffee-room debates, but some aspects may be mentioned here. The free-format submission process removes the pressure of deadlines and should result in better-prepared proposals and more relaxed assessments. A rejected proposal can be re-submitted almost immediately, thus providing the appeal mechanism at present denied proposers. The multi-referee system removes to a large extent the potential randomness in the current one-referee system: an observed fact at other telescopes outside the PATT system is that referees sometimes offer a wide range of assessments on a given proposal.

While this all may sound fine in the first instance, there are some unpleasant side-effects if the pure form of this scheme were to be realized. Let us state two.

First, it is unlikely that the observer would be at the telescope. This means the astronomer would be even more out-of-touch with technical reality than is the case now, and the thrill of observing first-hand would be lost for those who savour it (ourselves included). Perhaps one becomes less of an explorer, and more of a couch-potato astronomer in such a world. However, this is what remote observing means in any case, so maybe one should make the most of the potential advantages instead.

Second, the observations must be entrusted to local staff. Astronomical expertise continues to be required on site, and astronomers of the calibre we would need are unlikely to be attracted to a life of servitude in Hawaii if there is no appropriate reward. There are at least two corollaries, therefore: (1) proposers would have to be prepared to accept local astronomers as observational collaborators, and (2) the Hawaii-based astronomical support staff complement would have to be increased substantially, in view of the additional work involved in maintaining a flexible schedule.

The point of view expressed above has been strengthened by the participation of one of us (HM) in recent tests of the Cambridge/Queen Mary College receiver at 0.6mm wavelength, and by the experiences of Reinhard Genzel's group at 0.4 mm, both groups having suffered extensively because of recent weather conditions. As the JCMT moves more towards the shorter wavelengths, the question of how to cope with scheduling observing programmes becomes more important. It is time to open a serious debate on the subject.

*Henry Matthews, JACH
Wil van der Veen, ROE*

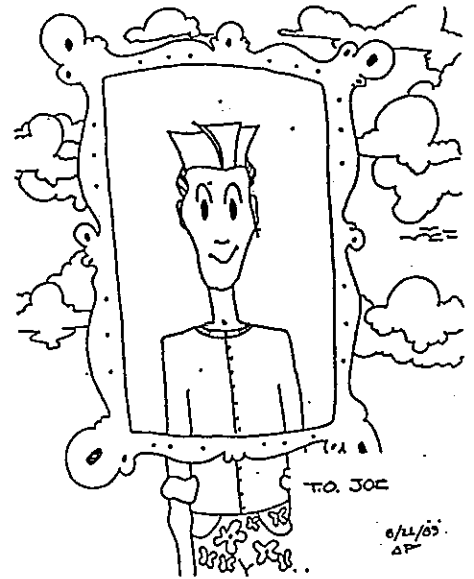
Dear reader

Would you be prepared to entrust your observations to JACH staff and forego the pleasures of working at 14,000ft?

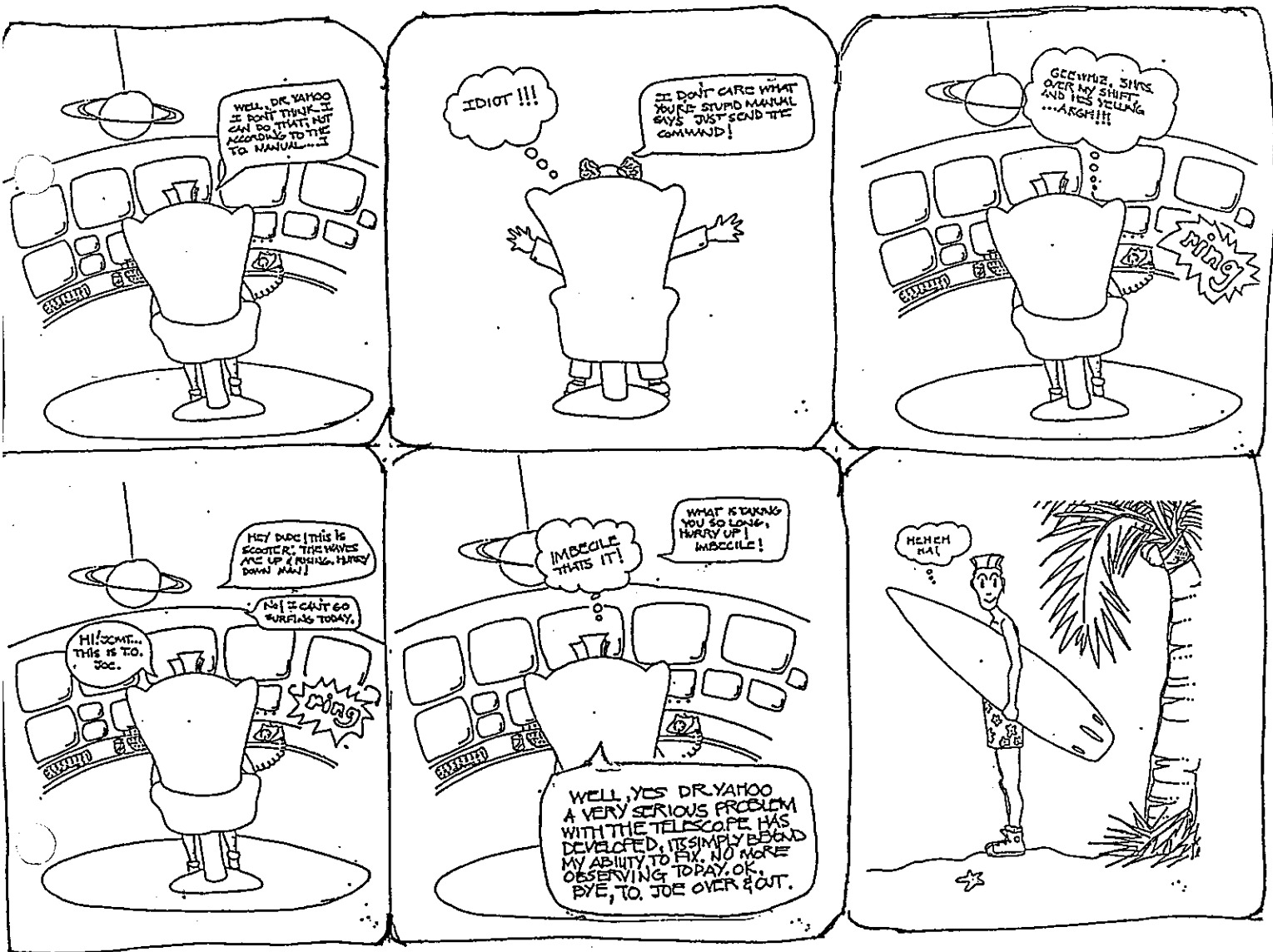
Let's have your Point of View.

Ed.

P.S. In reaching your decision you should not overlook the fact that Hapuna beach is less than two hours free-wheeling drive from the telescope. Why is that relevant? Well, please meet, on my right, T.O. Joe, the creation (alter ego?) of Kimberly Pisciotta.



T.O. JOE in: Remote Observing at its best.



DIARY

October 31, 1989: Last date for receipt by PATT of applications for Semester R (March 1 1990 - August 31 1990).

March 26-30, 1990: 7th Manchester Astronomical Conference on Molecular Clouds, Manchester, England.

STARLINK Directory of JCMT News

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668 8295	Alistair Glasse
668 8306	Dorothy Skedd
668 8307	Bob Stobie
668 8314	Bill Dent
668 8316	Jacques Vallée
668 8316	Alex McLachlan
668 8317	Jocelyn Burnell
668 8376	John Lightfoot

The number to dial for the ROE switchboard is:

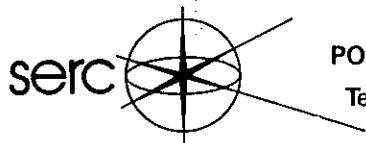
031 668 8100

Telex: 72383 ROEDIN G

FAX (new number): 031 668 8264

Protostar is distributed within Canada by the HIA, Ottawa. Readers in Canada wishing to be placed on the mailing list should contact:

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PATT 3
(Millimetre &
Submillimetre)

JAMES CLERK MAXWELL TELESCOPE
APPLICATION FOR TELESCOPE TIME

READ 'NOTES FOR GUIDANCE' - PRINT ENTRIES IN BLUE OR BLACK

For Office use only
REF:-

SEMESTER

2 i) Principal applicant:
Surname _____ Title _____ Initials _____ Possible observer
Y/N
Institution Department Post

ii) Principal observer (if different)
_____ Y/N

iii) Collaborators (state institution)
_____ Y/N
_____ Y/N
_____ Y/N

iv) Principal contact: _____ Telephone & Ext. _____
Address _____ Fax _____
_____ Telex _____
_____ E. Mail _____

3 TITLE OF INVESTIGATION (12 WORDS MAXIMUM) _____

4 SCIENTIFIC CATEGORY ☐ Solar System ☐ Stellar ☐ Galactic & Interstellar ☐ Extragalactic & Cosmology ☐ Other

5 LONG TERM STATUS: Y/N
If yes total number of useful nights/weeks needed to complete programme
HIGH FREQUENCY: Y/N

6 ABSTRACT OF PROPOSED OBSERVATIONS

7 ABSTRACT OF BACK UP PROGRAMME FOR POOR OBSERVING CONDITIONS

8 DETAILS OF OBSERVING TIME, INSTRUMENTS ETC FOR THIS SEMESTER
NB. If own instrument, not previously used on telescope, attach a concise description on a separate page.

Shifts (8 hours)	Frontend (see users manual)	Observing Frequencies (molecule/transition)	Sources

i) Preferred dates
ii) Impossible dates (give reason)

9 LIST OF PRINCIPAL SOURCES

<u>Name</u>	<u>RA</u> (hh mm)	<u>Dec</u> (dd)	<u>Brightness/Flux</u> (T_r^* (K)/F(mJy))	<u>V(lsr)</u> (km/s)	<u>Linewidth</u> (km/s)	<u>Notes/priority</u>
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10 BREAKDOWN OF TIME REQUESTED

a) Line observations Receiver(s) Backend

<u>Rest freq</u> (GHz)	<u>Req sensitivity</u> (rms; K)	<u>Freq resolution</u> (MHz)	<u>Total number of spatial points</u>	<u>Total time (hrs)</u> (incl overheads)
---------------------------	------------------------------------	---------------------------------	---	---

b) Continuum observations Receiver

<u>Filter</u> (microns)	<u>Aperture</u> (arcsec)	<u>Req sensitivity</u> (mJy)	<u>Total number of spatial points</u>	<u>Total time (hrs)</u> (incl overheads)
----------------------------	-----------------------------	---------------------------------	---	---

c) Other requirements (own instrument, polarisation, etc.)

11 OBSERVING

Sidereal time interval

Observing support required

12 (i) Have applications for observing time on other telescopes/satellites for this or similar programmes in the coming semester been made YES/NO

(ii) If YES state:

- a) Telescope/satellite
- b) Title of programme
- c) Whether simultaneous observations required YES/NO

13 RELATED APPLICATION/PUBLICATIONS

(i) Related PATT applications over last 4 semesters (include unsuccessful applications)

Semester/Year	Telescope	Ref	Request	Allocated	Clear nights	Comments
---------------	-----------	-----	---------	-----------	--------------	----------

(ii) Title and reference of all publications (incl. preprints) over last 4 semesters which have resulted from PATT time.

(iii) Other publications relevant to this application

14 (i) Are the observations primarily for a student research training programme? YES/NO

If YES, state

a)	Name of student(s)
b)	Project title(s)
c)	SERC studentship no(s) (UK only)

(ii) Are the observations associated with a current research grant? YES/NO

If YES, state

a)	Name of principal investigator
b)	Grant number

15 Indicate experience of intended observers who have not previously used this telescope

16 FUNDING

Funding Source

(i)	<u>Name</u>	<u>No. of nights</u>	<u>Reason</u> (data reduction, etc.)	SERC/NRC/ASTRON/OTHER
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(ii) Please indicate any other anticipated expenditure (freight, remote observations etc.)

(Case NOT to exceed this A4 page. One side of diagrams/references may be attached if desired).

We have read the 'Notes for Guidance' relating to applications to the Panel for the Allocation of Telescope Time and if an award is made, understand that all participants may be required to sign a form of indemnity before being permitted to use the equipment. We are not bound by any contrary conditions governing the proposed investigation including obligations to third parties incurred in respect of ownership and use of research results and patents.

Date _____

Principal Observer

Head of Applicant's
Department/Establishment

Administrative Authority
(State position held)

The original typed copy of the completed application form and scientific case for support, together with EIGHT copies of each and at least THREE copies of any supplementary material, should be despatched to reach the council by the appropriate closing date (see below) and should be addressed to:-

The Executive Secretary,
Panel for the Allocation of Telescope Time,
Science and Engineering Research Council,
Polaris House, North Star Avenue,
SWINDON SN2 1ET

SEMESTER: MARCH - AUGUST

Applications must be received on or before: 31 OCTOBER

SEPTEMBER - FEBRUARY

30 APRIL

TO BE COMPLETED BY THE APPLICANT		COMMENTS AND SCHEDULING PREF.	NO. OF SHIFTS (8 HOURS)	
INVESTIGATOR(S) DEPT(S)/ INSTITUTION(S)/T&S REQUIREMENT	SHORT TITLE OF INVESTIGATIONS		REQUESTED	MINIMUM

ADDRESS FOR ACKNOWLEDGEMENT

SCIENCE AND ENGINEERING RESEARCH COUNCIL
POLARIS HOUSE,
NORTH STAR AVENUE,
SWINDON SN2 1ET

We acknowledge receipt of your application form
dated _____ please quote
reference _____ / _____ in future
correspondence.