PROTOSTAR

NEWSLETTER
of the
James Clerk Maxwell
Telescope

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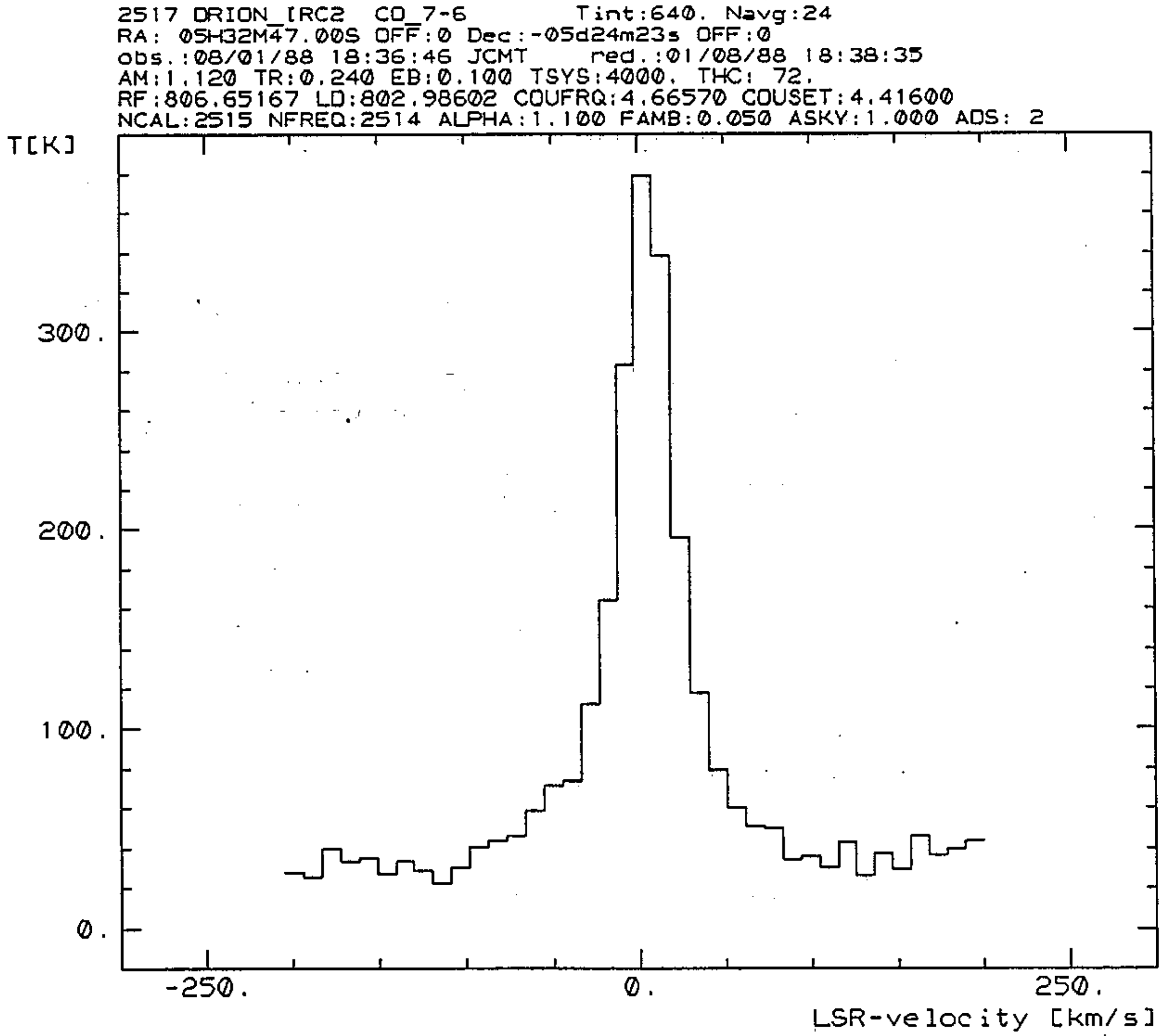
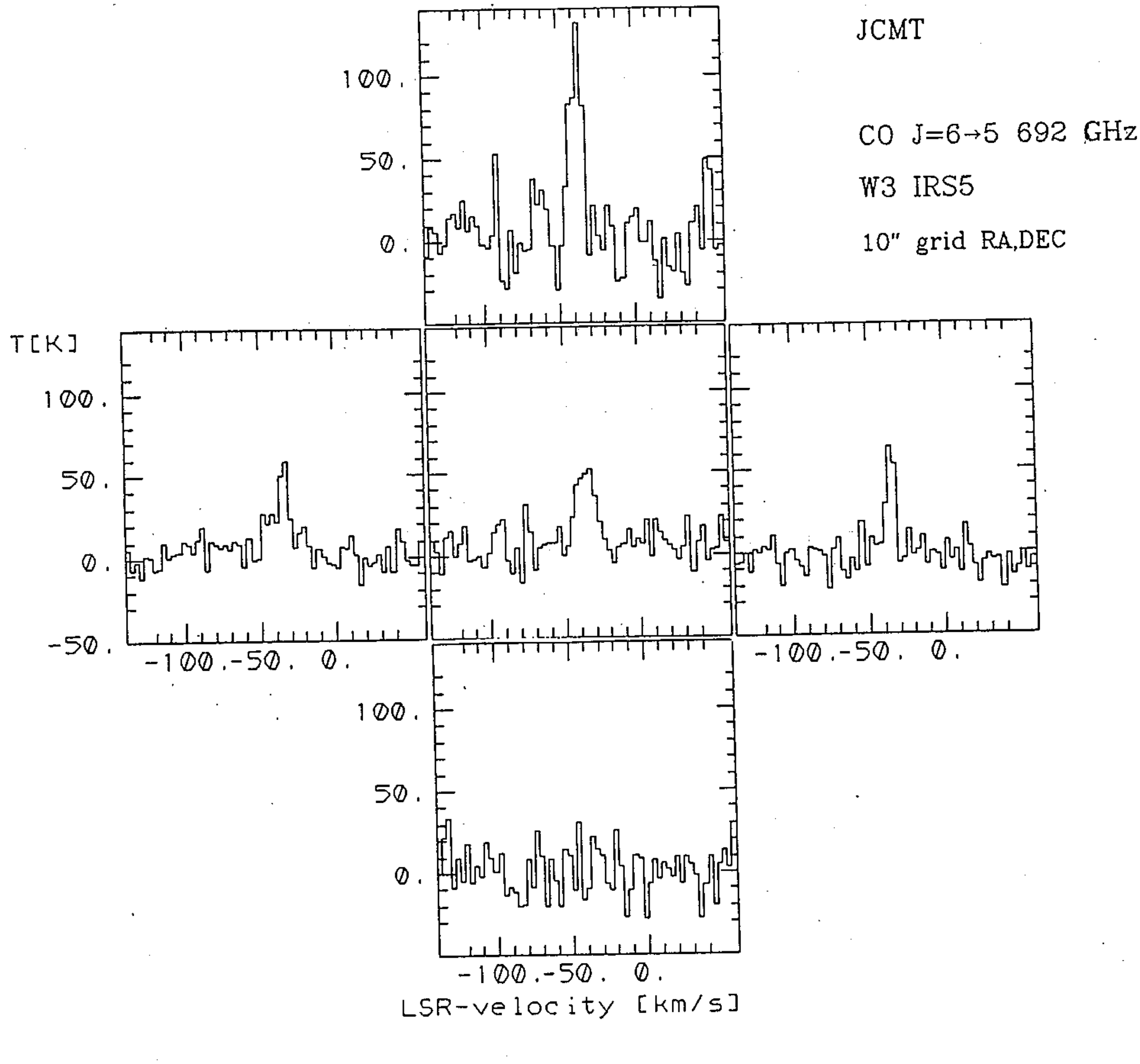
JCMT reaches 800GHz with a Coherent Detector !



This spectrum of the J = 7–6 transition of CO in Orion was observed on JCMT with the submm heterodyne receiver of the Max Planck Institut for Extra-terrestial Physics. The test run in August demonstrated that the dish surface and pointing already provide useful performance at this wavelength (372 microns) even with detectors which demand phase coherence across the aperture. Note the large width of the line, which is of course real since a heterodyne detector was used. The temperature scale is however somewhat arbitrary in that the overall efficiency was taken as 10%. This was an estimate of the value for point sources: it may be too low by a factor of perhaps 1.5 for a source as extended as this. (Yes indeed, the "hot core" of OMC1 is well resolved with the JCMT beam.) The point to note however is that these high-J CO lines can be extremely bright when observed with a small enough beam.



Further spectra obtained with the MPE submm receiver. This time the line is the J = 6–5 transition of CO at 692 GHz and the source is W3. Integration time is 320 secs per point. Note the rapid changes in the intensity and shape of the line at points separated by only 10 arc seconds. This illustrates both the tight beam of the telescope and the wealth of fine detail there is to be studied in such objects. (See the article "First Trials of JCMT at 800 GHz with a Heterodyne Receiver" in this issue.)

LETTER FROM HAWAII

The last Letter showed the JCMT staff to be pleased by the progress in setting the surface of the dish, but resolving to do better on the pointing. Engineering time was set aside at the start of March for a systematic campaign to find out what was limiting the pointing accuracy, and the observations of stars, especially those transiting near the zenith, quickly pointed the finger of suspicion at the azimuth track. This is the circular track made up of 14 steel plates upon which run the azimuth rollers situated at the four corners of the telescope structure. The suspicion was soon confirmed by measurements with tiltmeters (electronic spirit levels) which showed the telescope structure to rock and twist as it was driven in azimuth in just the right sort of way to cause the pointing problem. Fixing the problem was then a matter of choosing whether to rip up the track and to lay it again flatter or to modify the complete pointing algorithms to correct for the irregularities in the height of the track. The former would involve months of downtime so the latter was implemented instead. Sidney Kenderdine modified the telescope tasks to read a data file containing the tiltmeter measurements and to make the appropriate corrections. This was implemented in Version 025 of the software and worked first time. Had we of little faith anticipated this we would have had it implemented in 024 and the users would have had automatic pointing corrections since April, but we didn't so they have had to put up with manual ones (just as good really).

Overall, the pointing has improved to typically 2–3 arcsec in both coordinates, which compares nicely with the 5 arcsec in the telescope design specification. Well, there were those occasions when something specific and horrible went wrong, and the pointing became much worse. Like the earthquake in May which damaged the azimuth encoder; it didn't mangle or crush the encoder, but only mildly ruined it in a most entertaining way. The broken encoder almost worked and, since the earthquake coincided with a software change, there was much merry fun trying to find out what had gone wrong. Then there was the foot–shooting episode in which the elevation overspeed safety trip, designed to protect the telescope from running away and wrecking itself against the buffers, was mounted for convenience on the elevation encoder mount. Except that this did not prove to be too convenient because the torques on the device twisted the encoder mount slightly and ... But seriously though, the JCMT does usually point with an accuracy of 2–3 arcsec these days. Not only is this better than the design specification, it is, we think, better than the pointing accuracy of all other radio, millimetre and submillimetre telescopes, and is beaten only by a handful of optical telescopes. Not that we can allow ourselves to become complacent: it is already clear that we shall have to improve on this for work at the highest frequencies, and 1 arcsec is a nice round number to aim at. Don't expect this by next semester though. All of the above pointing work involved most of the staff of the JCMT in one way or another, but it was masterfully coordinated by Iain Coulson, to whom much of the credit for the improved pointing belongs.

The May earthquake does bring up a couple of issues. In the first place, do you recall that your humble scribe, in grasping for a meaning behind the March 1st earthquake in the last Letter, stated "Perhaps it is just a warning that when we finally put the telescope pointing right Madame Pele can easily put it wrong again"? Much has been written on how astronomy evolved from astrology; could it be that I am labouring in the wrong branch of the subject? A prediction made in March proven right in May? Perhaps, if I set up in private business, Nancy Reagan will put some work my way.

Secondly, the May 11th earthquake had its epicentre, not in one of the usual places for earthquakes in these islands such as beneath Mauna Loa or Kilauea, but under Mauna Kea. This explains why this earthquake damaged the encoder whilst two others of comparable strength did not. But more importantly, one has to remember that earthquakes hereabouts often signify the presence of lava on the move. Mauna Kea is not extinct but dormant: the last eruption took place about 3,000 years ago and more are possible. Maybe we had better hurry and get as much submillimetre astronomy done as we can: Puu Maxwell could overwhelm us before we get the first SIS common–user receiver out here.

As for the surface of the dish, the last Letter left us poised to refocus it and to improve it from there, and that is precisely what happened. The refocussing took all the adjusters which were stuck at their limits of travel and moved them into their useful range. Holography and readjustment have since left the surface accuracy at 38 microns rms; but this is an upper limit, given the way the assumptions affect radiometric measurements, and the true figure could be even better.

The common–user receivers have suffered mixed fortunes. The bolometer (UKT14) has maintained its performance but the heterodyne receivers have both deteriorated. The receiver temperature of RxA has increased by about 25% since last year, which is quite likely due to the fact that the receiver warms up of its own accord every month or two, and thereby thermally cycles the mixers, which they don't like. The receiver temperature of RxB has deteriorated by a factor of 2, which is much more serious and is possibly due to the ageing of the carcinotron. A spare is on order, but unfortunately Thomson–CSF are having trouble making it.

One of the highlights of the semester was the trial of the Max–Planck–Institut high–frequency heterodyne receiver on the JCMT. This is described elsewhere in this issue of Protostar; suffice it to say that we were delighted that high–resolution, high–frequency observations were obtained.

The back–ends are performing much as described in the last Letter.

The Canadian AOS is now in Hawaii, undergoing tests and software development in the Komohana Street base, and we hope to have it installed at the telescope within a couple of months.

The chopping secondary has been upgraded. The encoders which give the positions of the xyz tables are now absolute encoders and not relative, and the result is that the system can now chop and refocus at the same time. This gives a large increase in efficiency when observing with UKT14.

On the software front, version 025 is likely to be released to the users imminently. Then 026, with an improved interface to the D–tasks, will be implemented.

Overall, the picture is one of steady progress interrupted by various difficulties which appear and then are overcome. One very encouraging sign is that we have six telescope operators in post at long last. The stability that this brings to the operations is most encouraging, and the corresponding reduction in the time that the support astronomers have to spend at the telescope can only result in improvements to the various systems and techniques. The support and constructive criticism of the users are as fully appreciated as always.

Aloha and mahalo.

Adrian Webster
JCMT, Hawaii

NEWS FROM CANADA

The Canadian Acousto-optical Spectrometer (AOSC) was shipped to Hawaii in early August and Russell Redman is spending a month there helping to prepare it for installation on the JCMT. The AOSC has a single frequency resolution of about 330 kHz, and 2048 channels with a spacing of 250 kHz, resulting in a total bandwidth of about 500 MHz.

During the three month period commencing in mid-July and ending in mid-October, Doug Wade from HIA-Ottawa will be at the Rutherford Appleton Laboratory learning all about SIS receivers. He will be working on the prototype SIS receiver for 245 GHz and on low-noise FET and HEMT IF amplifiers.

John MacLeod
HIA-Ottawa

Canadian Support for Travel to the CFHT and the JCMT

I am pleased to report that the NSERC has accepted my proposal to reimburse the travelling expenses of Canadian university astronomers observing with either the CFHT or the JCMT during the fiscal year 1988/99. The total funding will be increased to $90K in order to cover both telescopes.Consequently the principal investigator on each successful proposal to the CFHT or the JCMT may apply to my office for the reimbursement of the expenses of anyone based at a Canadian university.

In order to keep the costs within the expected amount of the grant, it is important that the reimbursements be limited according to the guidelines published in Cassiopeia Summer Solstice 1987 No. 55, pages 42-43. These rules now will apply to observing runs on both the CFHT and the JCMT. In particular, expenses related to data reduction such as an extended stay at Waimea or a stop enroute to or from Hawaii should be charged to the astronomer's own grant. In special cases where an observer does not have access to such other funds I shall consider requests for additional reimbursement.

The economies started last July have resulted in a small surplus in the 1987/88 grant. With NSERC approval I have used the remaining funds to cover some astronomers who already have used the JCMT.

Donald C. Morton
Director
Herzberg Institute of Astrophysics

FIRST TRIALS OF JCMT AT 690 AND 800 GHz USING A HETERODYNE RECEIVER

The JCMT was originally conceived as an instrument which would operate mainly in the band around one millimetre wavelength, and the specification for the surface accuracy was therefore set at 50 microns, i.e. a sixteenth of a wavelength at 375 GHz. However when Mauna Kea was chosen as the site it was obvious that it would also be important to exploit the submillimetre "windows", which extend to wavelengths as short as 330 microns (900 GHz). A goal was therefore set of achieving 30 microns accuracy under "benign conditions" (essentially at night). After we had made good progress in setting the surface, as reported in the last edition of Protostar, and made measurements with the UKT14 bolometer which showed that the dish was already forming a reasonably good beam in these submillimetre windows, there was great interest in making a test with a heterodyne receiver. Detectors of this type are of course preferred for millimetre and submillimetre spectroscopy because of the very high frequency resolution they offer, but they also have the property of being "coherent" detectors. That is, they only detect the signals that add up in phase over the whole surface of the dish. There is therefore a direct relationship (Ruze's formula) between the telescope efficiency measured with a heterodyne receiver and the real accuracy of the surface. The JCMT does not yet have such a receiver for these wavelengths, but an opportunity to try one came recently when a group from the Max Planck Institute for Extraterrestrial Physics (Reinhard Genzel, Urs Graf, Andy Harris and Juergen Stutzki) had completed a run with their submm heterodyne system on UKIRT.

The instrument was brought down from UKIRT and installed on the JCMT at the f/35 Nasmyth focus. This was no minor job, as the dimensions of the receiver (in metres) are about 1.5 by 1 by 0.7. The local oscillator power is generated by a submm molecular laser, which in turn is pumped by a far-infrared CO_2 laser producing about 20 Watts – protective goggles are necessary when working in the vicinity of the receiver since both laser beams are of course invisible. The mixing is done by liquid-nitrogen cooled Schottky diodes, but instead of the familiar waveguide mounts an open "corner-cube" structure is used. Since only certain frequencies are available from the laser LO, a separate dewar with an appropriate detector and IF amplifier is used for each spectral line. To provide a backend with sufficiently large frequency coverage, it was also necessary to install the MPE dual acousto-optical spectrometer, which has a 1 GHz bandwidth, and in order to give adequate rejection of sky noise, temporary modifications were made to the secondary mirror system to allow beam switching at a rate of 2 Hz under the control of the MPE receiver. One great advantage of the Nasmyth focus is that the instrument is not required to tip with the telescope – which turned out to be very important one evening when the laser was unstable and it was necessary for someone to tend to it every few minutes whilst we were observing!

For the first observing session, during second shift on the night of 30th July, we decided to observe at a frequency of 692 GHz (430 microns wavelength), corresponding to the J=6–5 line of CO. This was the first time that the system had been run at this wavelength and there were some difficulties with the lasers and detectors. The old problem of the ground loops between different parts of the the telescope and the control room also showed up again and caused everything to be rather unstable. Nonetheless the sky miraculously turned out to have fully 30% transmission (unexpectedly good for this time of year), and by about 5 a.m. we were observing, and signals from Mars were soon detected. As it happened these were the first real observations using the new "025" software and several problems were encountered – which way was East? – as well as a fault in the secondary mirror which prevented us focussing. However as the shift drew to a close we managed to observe CO in OMC1, and even to make a small map of the source.

After a day spent working on the system – the MPE team on the receiver and Adrian Russell and Rachael Padman on the grounding – we reconvened in the early hours of the following morning to try observing at 806 GHz (370 microns – the CO J=7–6) line. Once again the sky was superb, and we obtained a very nice spectrum of OMC1 (see front cover) and we were also able to detect the HCN J=9–8 line. Noise temperatures as low as 3200 K double-sideband were recorded. A spectrum of CO 7–6 in W3 was obtained, but for some reason we were unable to find Mars. Finally, on night three – after another day of hard work on the equipment – we managed to get a nice "map" of Mars at 692 GHz (Figure 1). The data were consistent with the convolution of the Martian disc of diameter 17-arcseconds with the nominal 7-arcsecond diffraction-limited beam. More encouragement came from the antenna temperatures, which indicated an overall coupling efficiency of about 16% at 692 GHz. We also mapped the CO emission in the central region of W3-IRs5, which showed that the spectrum changes totally over angular scales of less than 10 arc seconds. At about 5.30 a.m. a big wet cloud came over and blighted the mountain for the 5 remaining shifts of the run. The submillimetre windows remained effectively closed even though the transparency at 230 GHz was measured at better than 90%.

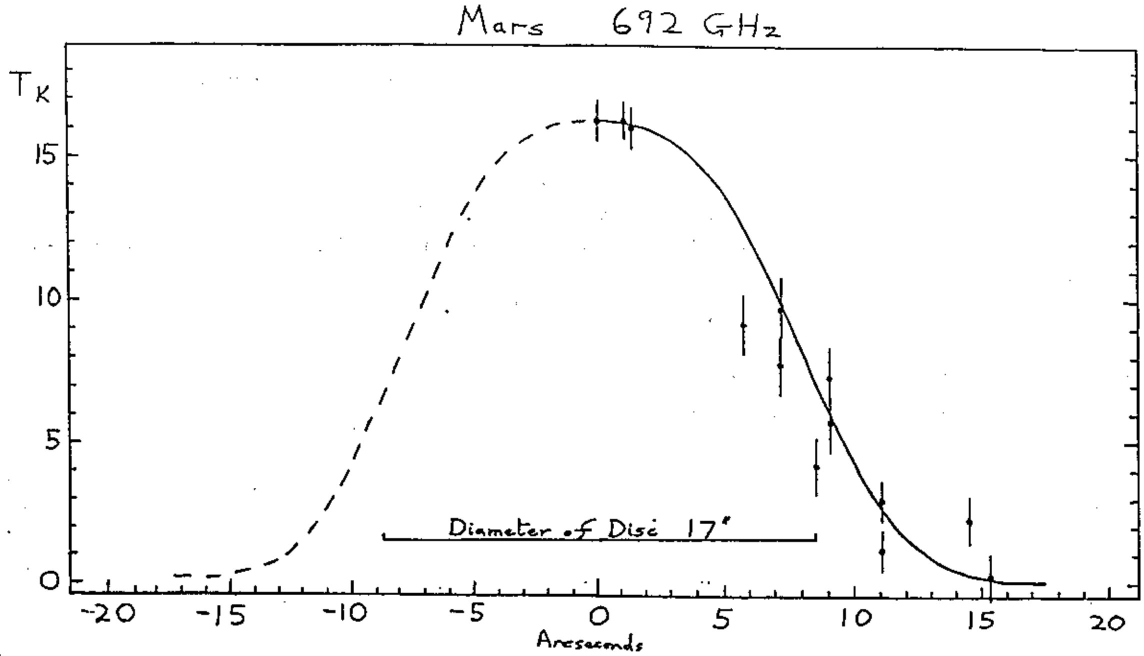


Figure 1. Observations of Mars at 692 GHz. The signal from Mars was measured on a grid of points. There were too few measurements to make a proper map so the results have been plotted here in the form of signal strength versus radius from the centre of the disk. Also shown is the profile expected for a uniform disk convolved with a Gaussian beam of 7 arc secs FWHM – the diffraction limit. The good agreement shows that both the dish surface and the telescope tracking are well up to expectations.

What have we learnt from this experience? Technically we have found that there are no fundamental problems in mounting the MPE system on the telescope, and scientifically we have had a nice trailer for the astronomy to come. The OMC1 spectrum shows dramatically the very high brightness temperatures which can be observed in active regions once you get to a high enough frequency so that the surrounding cloud becomes optically thin to line radiation. The W3 observations similarly show the value of the very small beams that can be obtained at these wavelengths and hint at the wealth of source physics that it will be possible to explore with JCMT. We have also had a graphic illustration of the difficulties in doing spectroscopy at these wavelengths, both in operating such a complex receiver (which should of course get easier when the interface to JCMT has had more work done on it) and with the weather (which we can't do much about).

From the point of view of the telescope, however, the most important lesson is that we really do have a good surface. From the efficiencies deduced from the Mars and OMC1 measurements, the upper limit to the surface errors of the telescope is 38 um RMS, and it seems likely that the true number is a good deal less than this. Since the holography does not yet seem to have reached the limit of what it can do and we have not yet even started to work seriously on thermal control of the telescope and enclosure, this is most encouraging. For night-time observations the surface accuracy is already close to the goal, and much better than the specification. Because we are still on the steep part of the curve, even modest improvements in the surface accuracy should improve the the submillimetre efficiency of the telescope very significantly. Further brief trials are scheduled for January and a more extended period of observations are planned for next July. Applications to use this system in collaboration with the MPE group are being accepted by PATT for the next round (see PATT Matters).

Cobbled together by Richard Hills
from accounts by Adrian Russell,
Rachael Padman, Juergen Stutzki
and Reinhard Genzel.

NEWS FROM THE PANEL FOR THE ALLOCATION OF TELESCOPE TIME (PATT)

JCMT Time Allocation Group Chairman departs

On Sept 1, 1988 the chairman of the JCMT TAG, Professor Ian Robson, gives up this position to become chairman of the JCMT User Committee. Ian has been an extremely fair and hard working chairman and I'm sure I speak for all the remaining members of the group when I say his contribution will be greatly missed. Thank you Ian.

Ian is succeeded as chairman of the TAG by Dr Richard Hills. A new member of the TAG is Dr Matt Griffin (Queen Mary College).

PATT Report for Semester O

The semester O PATT meeting was held on July 6–7. Of the 144 JCMT proposals that were considered, 44 were awarded time. Some of the statistics for this semester are as follows:

Number of 16–hour nights requested	491
Number of nights available for PATT	96
Number of Line proposals	102
Number of Continuum proposals	51
Number with UK PI	80 (55.5%)
Number with CDN PI	33 (23.0%)
Number with NL PI	13 (9.0%)
Number with OTHERS PI	18 (12.5%)

Number of nights awarded to UK	47.9
Number of nights awarded to CAN	19.8
Number of nights awarded to NL	17.2
Number of nights awarded to OTHERS	11.2

Percentage of time to partner countries.

UK	56.3%
CAN	23.5%
NL	20.2%

(Time to OTHERS is credited to the partner countries in the ratio UK/CAN/NL= 55/25/20).

In addition to essentially all the 8–hour daytime shifts, 72.5 nights were awarded for engineering and commissioning purposes. This can be compared to 91.0 nights in semester M and 63.0 nights in semester N.

As can be seen from the above table, the percentage of time awarded to each of the partner countries is close to their rightful share. This has been accomplished in part by the efforts of the members of the JCMT–TAG and in part by the fact that each country requested a relatively large amount of telescope time. With the introduction of a LOTUS spreadsheet system and portable computer it is now possible to obtain a real–time calculation of each country's time share and still take into account the effect of collaborators from different countries. In future semesters it would seem that the only requirement necessary for each country to receive its rightful share of telescope time is for that country to submit a reasonable number of proposals.

The problem of long delays in the distribution of PATT material within Canada has largely been solved by sending a copy of all proposals to Ottawa by courier immediately after the semester deadline, where they are available for immediate redistribution as soon as the names of referees and assessors are known.

JCMT time allocations for Semester O

Proposal	Author	Time(hours)	
LT/M/O/1	Sandell	48	
LT/M/O/2	Duncan	48	
LT/M/O/3	Avery	48	(awarded long-term status)
M/O/6	Mitchell	40	
10	Henriksen	24	
13	Israel	96	
14	Robson	64	
15	Seaquist	32	
27	Smith	32	
28	Hayashi	32	
31	Russell	32	
32	Sandell	24	
35	Russell	24	
37	Boland	40	
38	Boland	32	
40	Israel	32	
41	Wesselius	48	
45	Avery	24	
51	Hasegawa	24	
52	Hasegawa	24	
54	Fich	32	
55	Naylor	24	
56	Stacey	32	
61	Dent	16	plus daytimes for dry runs
63	Mountain	32	
65	Webster	8	
66	Bell–Burnell	24	
68	Mountain	32	
69	Coleman	64	
79	Handa	32	
82	Rowan–Robinson	48	
87	Emerson	32	
91	Padman	32	
92	Padman	48	
95	Scott	40	
99	Richardson	40	
108	White	48	
112	Joseph	32	
115	Skinner	24	
128	Hasegawa	16	
135	Nadeau	24	
136	Kompe	24	
137	Genzel	32	
140	Woodsworth	32	

Morley Bell
JCMT Technical Secretary

PATT MATTERS

Richard Hills, the new chairman of the Time Allocation Group, has contributed the following:

Notes on proposals

One of the continuing concerns of the JCMT TAG is to improve the quality of the assessment that we are able to give to proposals and to try to give more helpful feed-back to the applicants. The thing that makes this so difficult is the large number of applications – 144 at the last round. The whole process of refereeing, assessing, discussing and grading each proposal takes many person-hours so you can see that the total effort being consumed is colossal. Here are some thoughts on how you can help us with this.

1) Please don't submit unreasonably large numbers of applications: it is great if you have lots of ideas for things you want to do, but it must be better for you to choose for yourself which are the ones you most want to do rather than submitting them all and letting PATT decide.

2) Despite previous instructions to the contrary, do not submit several applications for a single scientific programme just because it uses more than one instrument or needs different wavebands on a single instrument. The only thing you have to make sure of is that your instrumental requirements are clearly set out in the proposal. I am not sure why this subdivision was introduced originally, but it certainly produces unnecessary work in processing and assessing applications, quite apart from the additional effort you have to put into preparing them. It can also lead to silly situations where one part of a project gets time, but the scientific usefulness is reduced because the rest of it does not. I for one would certainly prefer to see proposals which set out the whole of a scientific programme whatever combination of instruments are needed. This will also help us to allocate time in reasonable-sized chunks and not just 2 or 3 shifts at a time.

3) Make sure that your objects really can be observed during the semester for which you are applying. We are still having a considerable number of cases where we go to the trouble of getting the proposals copied, refereed and assessed, only to have to throw them out at the meeting because some of the critical objects are at impossible RA's.

I personally find the business about what time of year an object at RA X will have an Hour Angle of Y at Hawaiian Standard Time Z terribly confusing. After agood deal of playing with different ways of presenting it I have come up with the following table. This shows what month you should ask for to have your source transit at a certain time of night. If you want to observe it for a full 8 hours then you will need to choose a month that puts it in the middle of one of the two shifts. For applications where the objects span a range of RA you should look for the time of the year which will give you the optimum coverage with either single shifts or whole nights. Remember that where the range of RA justifies it, whole nights are preferable because you avoid the disruption of changing the instruments and software setup in the middle of the night. The use of capitals and lower case is just to remind you which months fall into the two scheduling semesters.

Table shows which month to observe so source transits at given time. CAPITALS for summer semester (deadline Oct 31), lower case for winter (Apr 30).

|--- FIRST SHIFT ---|-- SECOND SHIFT ---|

RA \ HST	16	18	20	22	24	02	04	06	08	10	12	14
24–22	Jan	Dec	Nov	Oct	Sep	AUG	JUL	JUN	MAY	APR	MAR	Feb
22–20	Dec	Nov	Oct	Sep	AUG	JUL	JUN	MAY	APR	MAR	Feb	Jan
20–18	Nov	Oct	Sep	AUG	JUL	JUN	MAY	APR	MAR	Feb	Jan	Dec
18–16	Oct	Sep	AUG	JUL	JUN	MAY	APR	MAR	Feb	Jan	Dec	Nov
16–14	Sep	AUG	JUL	JUN	MAY	APR	MAR	Feb	Jan	Dec	Nov	Oct
14–12	AUG	JUL	JUN	MAY	APR	MAR	Feb	Jan	Dec	Nov	Oct	Sep
12–10	JUL	JUN	MAY	APR	MAR	Feb	Jan	Dec	Nov	Oct	Sep	AUG
10–08	JUN	MAY	APR	MAR	Feb	Jan	Dec	Nov	Oct	Sep	AUG	JUL
08–06	MAY	APR	MAR	Feb	Jan	Dec	Nov	Oct	Sep	AUG	JUL	JUN
06–04	APR	MAR	Feb	Jan	Dec	Nov	Oct	Sep	AUG	JUL	JUN	MAY
04–02	MAR	Feb	Jan	Dec	Nov	Oct	Sep	AUG	JUL	JUN	MAY	APR
02–00	Feb	Jan	Dec	Nov	Oct	Sep	AUG	JUL	JUN	MAY	APR	MAR

|--- FIRST SHIFT ---|-- SECOND SHIFT ---|

Another reason that proposals have been failing unnecessarily is that they do not give the information necessary for us to judge whether the observations are practical with the JCMT and its current instrumentation. At the moment this is especially true of extragalactic spectral-line observations, where the limitations of the backends and of the stability of the system means that lines wider than 250 MHz cannot be observed unless they are very bright, and that long integrations (i.e. substantial fractions of an hour or more) are probably not worthwhile even on lines which are expected to be only 100 to 200 Mhz wide. (These are my estimates of the current limits. Please consult the staff in Hawaii for more details.) So until these problems get sorted out please limit your proposals to the easy cases and give estimates of expected line brightness and width.

Finally we do realise that it is difficult to get everything into the one page. However please remember that this limit only applies to the actual scientific case; things like source list, references, diagrams and perhaps special technical details can all go on the second page. In fact you can get nearly 900 words onto a page with 12 characters per inch and single spacing (which is actually 6 lines per inch - I know it says 5 in the original PATT newsletter, but I think standard single spacing is what was meant.) This is really quite a lot: it certainly seems it when you have got 144 of them to read! Also PATT did leave a loop-hole, although my fellow assessors will probably shoot me for drawing attention to it. If there are things that really will help to avoid mistakes being made, you can include them as "additional information", which will be sent to the referee and assessors. Remember to send 3 copies (4 for long term applications) so that the office only has to separate them out and post them on. However please use this option only when there really are special reasons why your proposal cannot fit in the standard limits. Do not use it simply as a way of extending the scientific case and reiterating the arguments in gory detail; that will only get the assessors annoyed, with the predictable effect on the grading of your proposal.

Back-up proposals.

As the high-frequency capabilities of the telescope improve, we are going to be increasingly facing the problem that the atmospheric transmission and stability are not always good enough for us to use the high frequency "windows" profitably. At frequencies above about 400 GHz (i.e. wavelengths shorter than about 750 microns) the probability of being able to make worthwhile measurements at any given time is certainly no greater than 50% and is probably a good deal less. In contrast, the fraction of the time which is useable at 250GHz appears to be more like 90%. There has been much discussion at the PATT and elsewhere about how to deal with this fact. Obviously the telescope cannot be allowed to stand idle just because a high-frequency observation is scheduled and the weather isn't good enough! A whole range of possibilities, including "flexible scheduling", "over-rides" and remote observing have been considered. Most of these schemes would involve some form of intervention in the observing programme by the authorities, which would be triggered when conditions reached a certain level (e.g. precipitable water vapour below say 1.5mm). Alternative teams of observers would be standing by to exploit these opportunities. The present conclusion, however - given the heavy pressure on the team in Hawaii and on the accomodation on the mountain - is that it is not yet practical to introduce any such schemes at JCMT. It will therefore continue to be up to the scheduled observers to make their own judgements as to whether the conditions are such that they will get more science done by shifting to a different waveband. For programmes which already contain a suitable mix of high- and low-frequency observations and in which useful results can be obtained even if only the low-frequency observations are possible, there is no change. For applications where the main thrust of the proposal is the high-frequency observing, however, the PATT will in future be placing much more emphasis on the back-up proposal, since this is in fact the programme which the time is most likely to be used for. Clearly the present one-line back-up programme, typically something like "CO J=2-1 mapping of Galactic Sources", will not be adequate.

For the coming round then, full back-up proposals will be needed for all high-frequency proposals (i.e. those using receiver C or the MPE receiver, and those using UKT14 in which measurements at wavelengths shorter than 800 microns form an important part of the project. Observations in the outer parts of the band of receiver B, below say 330 GHz and above 368 Ghz, should also be included on this list.) Applicants can do this in one of two ways: a) by including the back-up proposal with the main one, or b) by nominating a separate proposal (submitted at the same round) as the programme that would be carried out if the conditions are not good enough for the high-frequency one.

It seems to me that method a) will be appropriate where the science of the backup proposal is somehow related to that of the main one, so that much of the scientific case and the source list, etc, apply to both. The new PATT forms for JCMT will give more space for description of the backup proposal. I fear however that these will not be ready for the coming round, so all we can do this time is to apply as much ingenuity as possible to the use of the spaces on the existing forms. The two-page limit on what is copied to all the members will not be relaxed, so the proposers will have to judge how best to allocate their space between the main and the backup cases. Remember that what PATT will be concerned about on the backup programme is the quality of the science that will be done and the degree to which it may overlap with other projects they are considering. There may be cases where the mechanism of sending additional material for the referee and assessors can help with this, but I would again urge everybody to use this option sparingly.

To use method b) you should simply give the title of the proposal, plus the name of the P.I., for the programme which would serve as the backup. At this stage I see no reason for imposing any restraints on this process apart from the obvious ones: to serve as a backup for a high-frequency proposal an application must be principally for observations at the lower frequencies; it may be one of your own, one from other people in your own institution, or an entirely separate one; the only thing that is essential is that you have the agreement of all the parties involved - indicated by appropriate cross referencing in both proposals, or if retrospective action is necessary by a note to the first assessor. This is clearly essential since in some cases we may now have observations being made by one group on behalf of another, quite apart from the subtle effects that such linkage may have on the prospects of an application succeeding in its own right. PATT will be making judgements based on the gradings of both proposals; in some cases, it may decide to award time separately to both, in others to just one or the other.

Finally I can see no reason why those putting forward proposals which are principally for "low"-frequency work should not indicate their intention to change to a specific high-frequency programme should the weather conditions and the state of the instrumentation allow it. Either of the methods described above could be used to cover this case too.

Use of the Submillimetre Receiver from the Max Plank Institut for Extra-terrestial Physics.

As described elsewhere in this issue, the first tests with this system have been very encouraging. A modest amount of further observing has been assigned for semester O. Prof Reinhard Genzel has agreed to make this instrument available on JCMT in semester P. For this current round at least, the applications should all be from collaborative teams involving the MPE group. The main reason for this is the extremely specialized nature of the receiver: it is absolutely essential to have the experts present for the system to run. It should also be true that the unique amount of experience that the MPE group has of observing at these wavelengths will be of benefit to people in the JCMT user community who wish to get into the field. Those interested in using this receiver should therefore contact Prof Genzel (or Dr J. Stutzki - e-mail STUTZKI@DGAMPE5D on EARN) as soon as possible to discuss the projects they want to do and to resolve any technical questions. The MPE group will not discriminate among those who apply - the assessment and selection of proposals will still be the responsibility of PATT. It seems reasonable to assume that the PI will normally be the person who initiates the proposal. However there may well be overlapping proposals from different groups and the MPE people will discuss with the applicants the possibility of forming wider collaborations where this seems appropriate. This may also help to provide flexibility during the actual run to adjust the observing to the conditions that occur. Applicants should also discuss with the MPE group whether they would wish to participate in the backup programmes. In order to avoid an impossible last-minute rush in sorting these things out, the deadline for detailed draft proposals to reach Garching is 10 Oct. The reason for specifying this involvement with the MPE group before the PATT deadline is to allow their technical knowledge and experience of planning such observations to be incorporated into the proposals. (If groups prefer not to do this, I can see no reason why they shouldn't submit proposals independently. PATT will obtain a technical assessment from the MPE group and collaborators from the MPE will be added to the proposal should it get time.)

The main features of the receiver are as follows. It uses liquid-nitrogen cooled Schottky mixers with noise temperatures of typically 3200 to 4500 K double sideband. The LO is an IR-pumped laser which can only operate at a number of discrete frequencies. Different lines are selected by changing the IF frequency. At around 800 GHz the lines of CO J=7-6, HCN J=9-8 and HCO+ J=9-8 can all be reached, along with a neutral carbon line, while at 690 GHz the CO J=6-5 line is available. The backend consists of two 500 MHz AOS's with 1 Mhz resolution. For most lines a bandwidth approaching 1 GHz is available. (For more technical details see Harris et al. (1987) Int. J. IR and mm Waves, vol. 8, page 857, or contact J. Stutzki.)

In estimating sensitivities, applicants should take note of the substantial losses that occur at these high frequencies. I do not have the latest figures, but I believe that reasonable numbers for semester P would be: transmission of telescope and membrane – 0.85; forward spillover and scattering – 0.65; and coupling to the main beam (i.e. the Ruze factor to take account of surface errors) – 0.35 at 690 GHz and 0.25 at 806 GHz. Although better conditions do of course occur, it would be wise to assume an atmospheric transmission of no greater than 0.25 at the zenith and to remember how rapidly this falls with increasing air-mass. These observations are likely to be scheduled in July 1989 – there will be only a single block of time assigned because of the logistics. The chance of having a zenith transmission of 0.25 or better is only about 1 in 3. Strong lines can be observed in somewhat worse conditions, but clearly you must plan your backup proposals thoroughly. At present these should not involve UKT14 because that needs the same focal position.

A further important point to note is that, because of the problems of atmospheric fluctuations, the receiver is normally operated with the chopping secondary mirror. To limit the off-axis beam distortion the throw is normally set to 2 arc minutes. This means that observations of extended sources will be difficult. Because the surface errors are significant at these wavelengths a considerable amount of signal will be received from an error pattern distributed around the main beam, so that the interpretation of observations of complex sources will be hazardous,especially at 800 GHz.

Richard Hills

APPLICATIONS FOR TELESCOPE TIME: ARRANGEMENTS FOR SEMESTER P

For Semester P (March 1989 – August 1989): the closing date for applications will be October 31, 1988. 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 (0793–26222) 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.

Once again you are reminded that the scientific justification portion of your JCMT applications (excluding figures and references) is not to exceed one page of normal typescript. Several applicants have consistently submitted excessively long proposals and the JCMT Time Allocation Group has decided that if they are to give each applicant the same competitive opportunity, then it is unfair to include those proposals that have used several pages of scientific justification to impress the referees. Thus, in future, proposals with scientific justifications that exceed the specified limit <u>will not be considered by the JCMT–TAG</u>.

Morley Bell

INSTRUMENTATION AVAILABLE ON THE JCMT IN SEMESTER P

Receiver A

Receiver A has persisted in its unfortunate habit of warming up periodically. This, combined with the fact that it is necessary to warm it up deliberately in order to change the mixers for different astronomical programmes, has thermally cycled the A(L) mixers so many times that their performance has deteriorated. To a first approximation the noise of both mixers is about 25% greater than was reported in the last Protostar. As soon as it is possible, these mixers will be sent back to RAL for refurbishment.

At the time of writing there is still only one A(U) mixer in Hawaii. It is hoped that the second one will be refurbished and sent to Hawaii in Semester 'O', although it is doubtful whether it will arrive in time for the observations scheduled for September and October. Here are some of the latest measurements of Trec (DSB)

Freq (LO)	Mixer A	Mixer B
222.0	460	-
224.5	470	-
226.5	402	490

Receiver B

The new synthesizer for RxB has now arrived and will be installed in time for the coming semester. The noise temperature of Receiver B increased steadily last semester, despite the installation of a second signal mixer in May 1988. The noise is now about twice what it used to be. Thomson CSF have informed us that the new high-frequency carcinotron cannot be delivered before November 1988.

Here are some of the latest measurements of Trec (DSB)

Freq (LO)	Trec (DSB)
329.3	1380
330.6	1370
337.5	1300
341.6	1300
344.2	1440
349.9	1450
354.5	1900
355.8	2070

Back ends

The broad-band side of AOS-D has strong additive noise at one end of the passband which restricts the useful range to about 300 MHz. The narrow-band side has additive noise throughout its range, and the use of this side is not recommended. AOS-C has arrived in Hawaii and it is hoped to commission it at the telescope in the coming semester. The Kent Correlator is working well; the low-resolution mode is fully commissioned and work is in hand to commission the other modes.

Adrian Russell

Receiver C (490 GHz)

Two points need to be made about this receiver. Firstly, it is not expected to arrive at the telescope until December; no guarantee can be given that it will be commissioned in time for semester P. Secondly, as Richard Hills has indicated elsewhere, if indeed the instrument is ready in time PATT will require applicants to have back-up programmes that can be tackled if observing conditions do not allow the use of high-frequency instruments.

Alex McLachlan

THE JCMT INSTRUMENTATION PROGRAMME

A bit of history ....and a plea

In June 1984 the Receiver Working Group of the then UK/NL Millimetre-wave Telescope project initiated an instrumentation programme that produced the instruments currently in use at the telescope. Although some R & D projects started by the Receiver Working Group are still in progress the construction phase will effectively come to an end with the expected delivery soon of Receiver C and the completion of the Digital Autocorrelation Spectrometer early next year.

The initial instrumentation programme was severely constrained by underfunding due to the prior claims on limited resources by more pressing areas of the project. When Canada joined the consortium in July 1987 the situation markedly improved and the higher level of funding made possible the issuing in September of that year an Announcement of Opportunity for instrumentation. Whereas the Call for Proposals issued four years earlier by the Receiver Working Group had been directed towards the acquisition of specific types of instruments the Announcement of Opportunity was unrestricted in scope. Although several projects were started as a result of the Announcement of Opportunity it was felt by many people that not enough consideration had been given to the real needs of the astronomers and that an open invitation of this type tends to encourage instrument builders to build instruments that they like to build. That is why most of you will have recently received a questionnaire from Professor Ian Robson, Chairman of the JCMT User Committee. If you have not yet returned your completed questionnaire please do so as soon as you can; responses will determine the content of the next phase of the instrumentation programme.

Management of the Programme

It is expected that the current exercise will eventually lead, via an invitation to tender, to the placing of a number of contracts for common-user instruments. Administration of such contracts will be the responsibility of the JCMT management team at ROE. A member of the team will be assigned as Liaison Officer for a particular contract and he/she will be expected to work closely with the contractor to bring the contract to a successful conclusion. In addition, an External Scientist will be appointed to protect the interests of the future users of the instrument. The External Scientist will be independent of ROE and the contractor and will be actively engaged during key stages of the project such as specification, testing and commissioning. He/she will interact formally with the user community through the JCMT User Committee. The first External Scientist to be appointed is Dr Rudi le Poole of Leiden University. He will be taking an interest in the Sub-millimetre Common-User Bolometer Array (SCUBA) to be built by ROE.

Alex McLachlan

JCMT BOARD AND USER COMMITTEE

Recent meetings

This is an unofficial, undoubtedly biased and erratic account of the last meetings of JCMT User Committee and JCMT Board, offered to satisfy those who thought they might find such a report interesting!

User Committee last met in April at Dwingeloo in the Netherlands, and much appreciated the hospitality of the Netherlands Foundation for Radio Astronomy. The visit included a tour of the laboratories to see the instruments and the research and development work being done there for the JCMT. This tied in well with one of the major items on the agenda which was the receiver construction programme. The User Committee supported a proposal from HIA (Canada), RAL (UK) and Kent (UK) to build a 345 GHz SIS 'common-user' receiver, and recommended funding of research and development work on SIS devices by Cambridge (UK) and Groningen (NL), and on quartz waveplates for polarimetry by Aberdeen (UK).

There was a substantial report from the computing services section of the Joint Astronomy Centre in Hawaii. The discussion following presentation of that report focussed mainly on the problems observers are having reducing their data at their home establishments. FITS format tapes should be the standard, recommended the Committee.

A preliminary discussion on submillimetre interferometry created considerable interest. Both a two-element interferometer (incorporating JCMT) and a synthesis array are to be considered.

Professor Rod Davies' term of membership and chairmanship expired with that meeting, and the JCMT Board meeting that followed a month later at ROE was also his last Board meeting.

The Board gradually worked its way through the problems of intellectual property rights in a multinational collaboration, the tripartite agreement governing that collaboration, an exhaustive report on JCMT and its operations, the financial and manpower provisions, whether the accounts should be kept in dollars or pounds or both, and so on. It gave its approval to work on SIS junctions at Groningen and Cambridge and to work on quartz waveplates. The preliminary stages of the SIS receiver and the bolometer array were approved; approval of later stages is still pending. The Board also set up a small working group on the astronomical goals and the long-term instrumentation programme for the JCMT.

User Committee meets again on October 26 and 27 at ROE, and the Board on November 29, 30 and December 1 in Hilo.

Jocelyn Burnell

Composition of the User Committee

The JCMT User Committee is the principal channel of communication between the telescope users and the project. The present members of the Committee are:

Professor E.I. Robson, Lancashire Polytechnic (Chairman)
Professor Dr W.B. Burton, Leiden
Dr M. Griffin, Queen Mary College
Dr J.C.G. Lesurf, St Andrews
Dr T.J. Millar, UMIST
Dr D. Nadeau, Montreal
Dr P.F. Scott, MRAO

Dr E. Seaquist, Toronto
Dr ir H. van de Stadt, Groningen
Dr G. Wynn-Williams, Hawaii

Composition of the JCMT Board

UK representation on the Board has changed with effect from September 1, 1988; the composition of the Board is:

Professor R. Wilson (UK) Chairman
Professor Dr W.B. Burton (Netherlands)
Professor P.P. Kronberg (Canada)
Professor E.I. Robson (UK)
Dr J.E. Baldwin (UK)
Dr W. Brouw (Netherlands
Dr N.B. Hall (Hawaii)
Dr B.R. Martin (UK)
Dr D.C. Morton (Canada)

SOFTWARE FOR THE REDUCTION OF JCMT DATA

UK Astronomers will be interested to know that the reduction packages SPECX (for the analysis of line data) and NOD2 (for continuum data) are now available on Starlink as 'Associated Items'. This means that they are available on any node, but individual site managers may decide not to keep the software on-line unless requested to do so by users. To find out whether the packages are installed at your node, type:

$ NOD2 or $ SPECX

- if the packages are not installed, some sort of error message will occur; you should then tell your site manager that you would like to use the software! Introductory information is also available for both packages - consult the Starlink documentation for more information.

Separate arrangements are being made in the Netherlands and Canada for the reduction of JCMT data.

If any JCMT users have questions or suggestions concerning data reduction packages, they should feel free to contact me at ROE (REVAD::RMP,RMP@UK.AC.ROE.STAR).

Richard Prestage

SOLAR OBSERVATIONS AT THE JCMT

In Semester 'N' Dr Charles Lindsey of the University of Hawaii made some trial observations of the Sun at the JCMT using his own helium-4 bolometer system. The observations were made over a weekend and suffered the usual technical problems that any detector has on the telescope for the first time, but several measurements of the solar millimetre flux were made and the trial was deemed a success. The observations did not interfere with the following nights' observing either: the solar observations were made with the louvres in the carousel open and were terminated at 2 pm, and this seems to have been enough to ensure that the dish was still in good shape (literally) in the evening.

The question now arises: is anybody else out there interested in observing the Sun? We have absolutely no idea what the demand for solar observing might be, and this is a request for anybody who has an interest to get in touch with me to give us some idea what might be wanted. The reasons for this are twofold: first we need to plan how much daytime work to support, and second we need to know which of our instruments to try out on the Sun. Not surprisingly, we are a little uneasy about pointing our sensitive, cooled receivers and detectors at such a bright source, but we do draw some courage from the fact that Charlie's bolometer did not suffer a meltdown, or even a particularly enhanced boiloff of cryogens. That there membrane is awfully good.

So, who is interested in doing what with which of our instruments on the Sun?

Adrian Webster
JCMT, Hawaii

SOLAR ECLIPSE 1991

Prompted by Adrian Webster's note, this is a reminder to solar physicists that there will be a total eclipse of the sun on the morning of July 11, 1991 and that Mauna Kea will lie in the path of totality. This will last just over 4 minutes and occur when the sun is at 73 degrees azimuth and 20 degrees elevation – about 12 degrees above the summit ridge as seen from the JCMT. This early warning is given because of the need for interested parties to prepare collaborative proposals for consideration by PATT; details of when to submit such proposals will be given later.

Alex McLachlan

DIARY

October 3–6, 1988:	URSI Symposium on Submillimetre and Millimetre Wave Astronomy. Kona, Hawaii.
October 31, 1988:	Last date for receipt of applications to PATT for Semester P (March 1989 – August 1989).

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