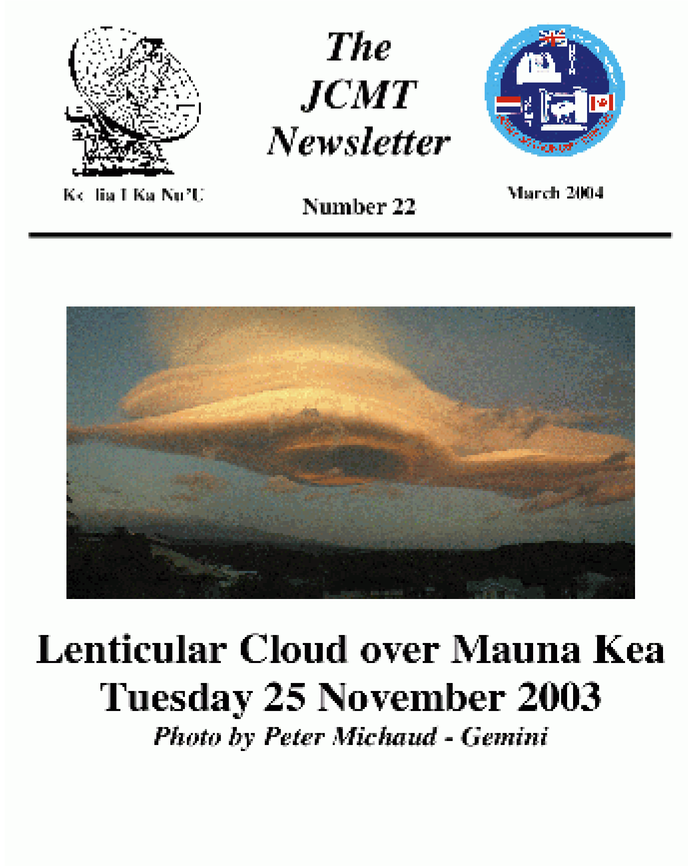
This newsletter was originally published in electronic form by the Joint Astronomy Centre on their web site. This PDF version was created using the web pages still available in August 2014. The most important pages are preserved. The missing pages tend to be administrative in nature and are unlikely to have historical value.

The JCMT Newsletter



March 2004 Issue Number 22

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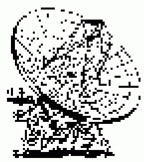

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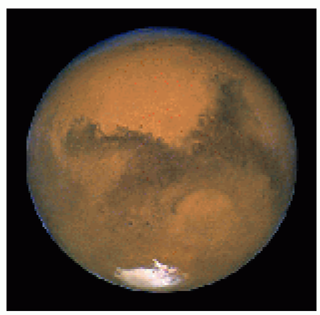

Martians Prefer Blondes

Hydrogen Peroxide Discovered in Martian Atmosphere

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Gerald Moriarty Schieven

From the Director's Desk

Regular readers of this column will be aware that the approved development programme of the JCMT is extremely ambitious: over the next 2.5 years, the entire suite of instrumentation will be replaced! Management of this process of change, while at the same time maintaining an operational facility, is a very significant challenge.

The first step in this process, and major event of 2004 (currently scheduled for May), will be the arrival of ACSIS. ACSIS is the new multichannel spectrometer backend being developed for the JCMT by the Dominion Radio Astrophysical Observatory in Canada. It will be commissioned on the telescope in June/July in conjunction with the deployment of a new software suite called the Observatory Control System (OCS), which has been under development at the JAC for some time. The OCS will replace many old software systems at the JCMT and will, among other things, bring heterodyne observing fully under the control of the OMP for the first time. ACSIS will of course replace the DAS, which will be phased out in later in 2004 after long and venerable service.

The other major instrument developments in the programme are HARP-B and SCUBA-2. The former is progressing well and should arrive at the JCMT in early 2005. The latter continues to make excellent technical progress, with delivery scheduled for early 2006, although funding for the full project is not yet in place.

At its meeting of November 2003, the Board reaffirmed its commitment to the eSMA project. This exciting development will enable the JCMT to link with the SMA and the CSO to perform submillimetre interferometry at 230 GHz (using RxA) and 345 GHz (using HARP-B). An ad hoc panel studied this project last year at my request, and concluded that the eSMA will be competitive against other competing facilities (IRAM, CARMA, ALMA) until ALMA comes on line in 2007. Plans for the technical work required for linking with the other two observatories are currently being drawn up.

In parallel with these technical developments, most of the community will by now be aware that the JCMT Board has been considering its strategy for the implementation of large-scale surveys in the era beyond 2006, primarily with HARP-B and SCUBA-2. Open meetings have been held in the UK and in Canada, and some very useful preliminary conclusions have emerged. I will shortly be issuing a message to the user communities to focus their deliberations in advance of the next Board meeting in May.

Returning to the present, I am pleased to report to users of the JCMT that the performance of the facility continues to improve. Our efforts over the last 18 months to reduce the fault rate through a number of measures, including the adoption of a more rigorous approach to the identification, analysis, prioritisation and repair of faults as they occur, have brought the baseline fault rate of the JCMT down to 2-4%. This is a noteworthy achievement, the credit for which belongs to the support staff of the facility.

Finally, it is my pleasure to report the arrival of one new face and one familiar one. Harold Butner arrived at the JAC in November 2003 as a support astronomer, replacing Robin Phillips. Harold is an accomplished submillimetre astronomer with many years of experience as a support scientist at the SMTO; I am confident that he will be an asset to the JCMT. The familiar face belongs to Jeff Cox, who has returned to the JCMT as a part-time TSS to cover a shortfall of effort. I welcome them both.

Professor Gary Davis
Director JCMT
12 February 2004

Applying for Time in Semester 04B

Dear Colleague,

This important announcement contains details about submission procedures for Semester 04B. Please read carefully and circulate amongst any colleagues who may be interested in requesting JCMT time. Please note the new proposal deadline date for ***ALL*** proposals.

Submission Dates:

For telescope time in Semester 04B (1st August 2004 - 31st January 2005) the closing date for ***ALL*** proposals is

Important Note to UK Applicants:

Because of an approved long-term large-scale survey project, the r.a. ranges 02^h (+/- 3^h) and 11^h (+/- 3^h) will be heavily oversubscribed in semester 04B for projects requiring weather grade 2 and 3^* (0.05 < tau(cso) < 0.1).

Important Note to European Applicants:

The JCMT has recently joined a consortium of European radio observatories known as RadioNet (http://www.radionet-eu.org). RadioNet was recently awarded 12.4M Euro by the EU for an Integrated infrastructure Initiative under the FP6 programme.

The RadioNet programme includes a transnational access component. Under the terms of this programme as defined by the EU, European observers of the JCMT are entitled to have their travel and subsistence costs funded by RadioNet.

The detailed procedures have not been defined at the time of writing. The key points for potential applicants are as follows:

- The PI, and a majority of the applicants, must be from an EU member country (excluding NL and UK) or an EU associated state.
- Proposals which meet this criterion should apply according to the usual procedures described in this call. Proposals will be assessed through the existing mechanisms. No special procedures are

anticipated.

When the detailed procedures are known, they will be promulgated through the JCMT and RadioNet websites. Eligible applicants will also be notified.

SCUBA-2 Infrastructure Work:

Infrastructure work for SCUBA-2 will begin in semester 04B, requiring a significant amount of telescope down-time (approximately 35%). The down-time will be distributed throughout the semester so that no particular r.a. range will be affected, although significantly less observing time will be available.

Electronic Submission of PATT Applications:

To get a proposal form, please download by sending a blank email, with only "REQUEST TEMPLATES" in the email subject line, to jcmtprop@jach.hawaii.edu

Complete information for electronic submission of UK and International proposals is available in the article:

UK/INT Electronic Submissions

Complete information for electronic submission of Netherlands proposals is available from:

NL Electronic Submission

Complete information for electronic submission of Canadian proposals is available from:

CN Electronic Submission

Paper Copy Submission:

Paper copy submissions are no longer accepted for ANY queue. Please follow the instructions above for electronic proposal submissions.

Status of Instrumentation:

SCUBA:

SCUBA will be available for use during the semester. For further information instrument status, etc., see the SCUBA web page at:

Applying for SCUBA observing time in Semester 04B Please note that there are no current plans to fix the filter drum or to install new filters in semester 04B.

An "integration time calculator" is available at

SCUBA ITC

SCUBA Polarimeter:

This instrument will be available for use during the semester in full imaging and in single-pixel modes. Both can be done at 850 and 450 microns wavelength (simultaneously). Although 450um polarimetry can be done, we are currently in the process of characterizing the 450um instrumental polarization. Currently we cannot guarantee that 450um polarimetry will be calibratable during 04B, but once the IP has been determined calibration can (we hope) be done retroactively. Only photometric polarimetry and jiggle-map imaging polarimetry are available. Scan-map polarimetry is **NOT** supported. More information is given on the polarimetry web page, at:

Polarimetry with SCUBA at the JCMT. See also the SCUBA web pages for information on the status of SCUBA.

An "integration time calculator" is available at

SCUBA ITC

THUMPER:

THUMPER, a two hundred micron bolometer camera, has been delayed and it is not yet known when the instrument will be ready for shipping. Furthermore when it does arrive, installation and commissioning will need to fit around our very busy engineering schedule next semester (see above). Hence we are not soliciting any THUMPER proposals for semester 04B.

Heterodyne Instrumentation:

It is expected that RxA3, RxB3 and RxW (both C- and D-band) will be available for use during the semester. Further details and the current status of each instrument are available on the receiver page at:

Heterodyne summary for Semester 04A

An "integration time calculator" is available at

Heterodyne ITC

Heterodyne Polarimetry:

Spectral-line polarimetry has been done successfully in previous semesters. For more information on this observing technique, including sensitivities and integration times, contact Gerald Moriarty Schieven at g.moriarty-schieven@jach.hawaii.edu.

DAS/ACSIS:

The ACSIS spectrometer (see the ACSIS web site) is scheduled to arrive and to be commissioned in semester 04A. Once ACSIS is fully commissioned, the DAS will be taken off-line, expected early in 04B. For the moment, however, continue to DAS spectrometer settings for calculations of integration times, etc. (See the DAS Guide for more information.)

Visiting Instruments:

FTS:

The Lethbridge FTS will be available for use as a visiting instrument in semester 04A. Interested parties should contact the PI, David Naylor, at naylor@uleth.ca for more information. The FTS web page can be found here.

The JCMT e-mail exploder:

Instructions are accessible from the JCMT homepage detailing how to subscribe/unsubscribe and/or modify your entry in the automatic e-mail distribution system. Please take a few minutes to check that you have a current valid e-mail address registered, and delete any non-functioning addresses:

Subscribing to the JCMT Email Exploder System

The JCMT Newsletter:

A new newsletter is under construction, and will be available in late August at:

The JCMT Newsletter Index

Please consider submitting a science or technical article for the March or September 2004 Newsletter about the work you've been doing at the JCMT, to the editor, Gerald Moriarty Schieven.

And Finally:

If you have any comments about the scheduling, the submission deadlines and procedures, etc - please contact me.

Gerald Moriarty Schieven
JCMT Scheduler

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JCMT Joins the RadioNet Consortium

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Gerald Moriarty Schieven

The Nightwatchman

Edition 7

Spring 2004

Hilo, March 1

TSS Support

The JCMT is happy to welcome back Jeff Cox. Many of you will recall that Jeff worked at JCMT for many years once upon a time and he will now be returning in a part-time capacity.

Also, Greg Sarge will be leaving JCMT to pursue other opportunities.

The Crew Room

Long the poor-weather sanctuary of staff and observers alike, the JCMT crew room is finally going to undergo a substantial renovation. In the coming months the crew room will receive a substantial face-lift which should be welcome to all who use the JCMT. In addition to new paint and flooring, the crew room will receive updated cabinets, kitchen hardware, furniture, and maybe even some new electronics. Many of the improvements should appears this spring with others to follow.

Many thanks go to Jim Hoge who developed the initial extensive plan for renovating and upgrading the crew room. And, many thanks as well go to Marge Dougherty for her tireless work iterating on, organizing, and executing the crew room renovation plans at a time when the ETS staff has had its hands full with a multitude of JCMT and UKIRT projects.

La Citation du Semestre

A star shines on the hour of our meeting.

Elvish Greeting, The Lord of the Rings

Happy summer eclipse chasing (total lunar and partial solar)!

Jonathan Kemp

www.jach.hawaii.edu/~jkemp

j.kemp@jach.hawaii.edu

REPORT FROM THE JCMT UKTAG
Semester 04A

Summary

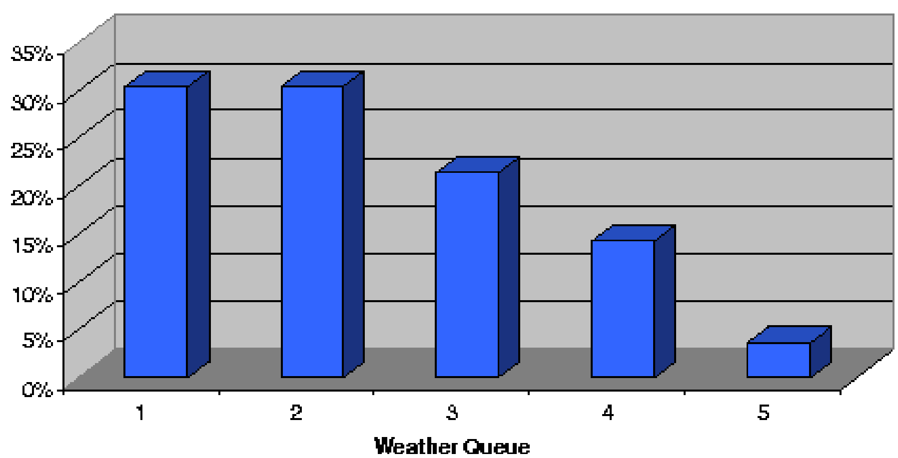
The JCMT UKTAG received 53 proposals for consideration in semester 04A, representing a slight but not significant increase from previous semesters. Of these proposals, 31 (58%) were awarded time in the UK queue. In addition, 3 long term programmes were carried over from previous semesters, including the SHADES project which is progressing well.

After removal of the observatory's engineering requirements, Director's discretionary time, and the University of Hawaii fraction, the UK's allocation for semester 04A amounted to 142.5 shifts. The total request (including the long term projects) was for just under 242 shifts, giving an oversubscription factor of 1.7.

The successful proposals and their allocations are posted on the JCMT web-site .

Weather Statistics

Weather queues 1-3 continue to be the most sought after, driven by the demand for SCUBA. The graph below shows the fraction of projects allocated time in each weather queue for 04A.



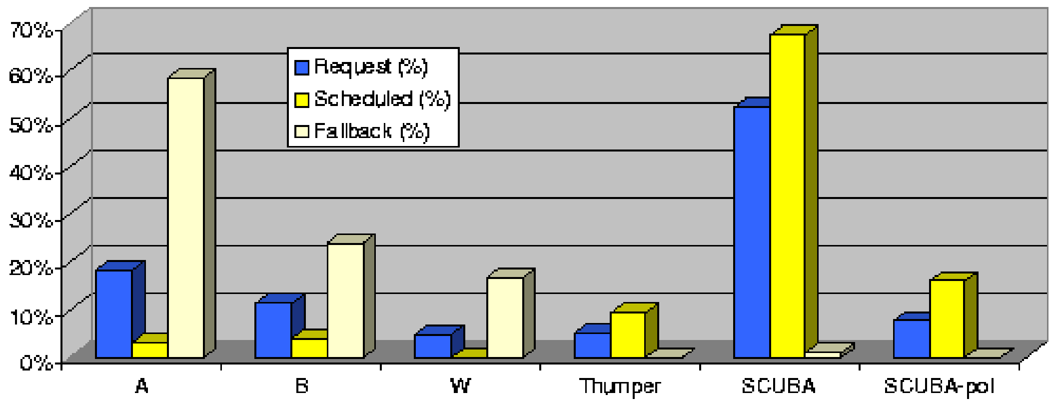
Allocations in weather queues 1-2 represent 60% of the total time awarded. The weather statistics over the past few years show that $tau_{CSO} < 0.08$ occurs for ~30-40% of the time, peaking as high as 60% and dropping as low as 10%. This clearly varies with season and climatic conditions such as El Niño, but, as usual, we expect that a lot of observers will leave the telescope disappointed by the weather!

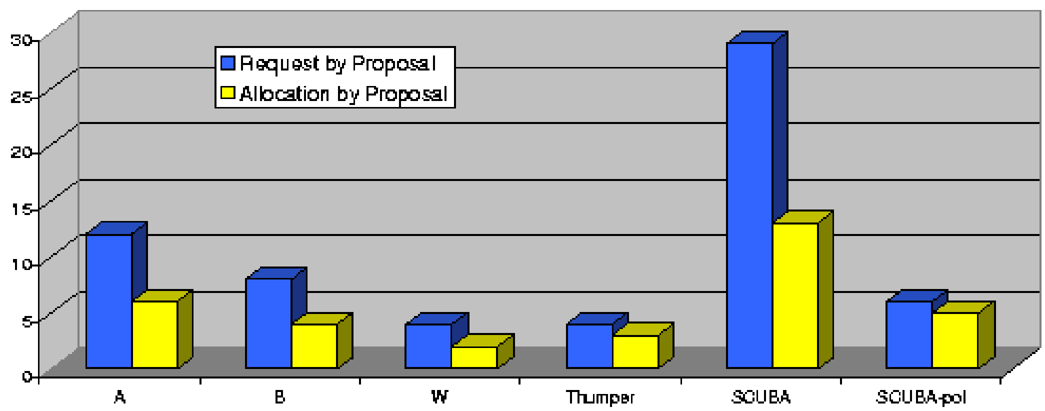
In many respects, the graph above reflects the importance of a flexibly scheduled queue for getting the most highly ranked proposals completed on the shortest timescale, and the new OMP clearly has a role to play here. Unfortunately, it also dramatically illustrates the dearth of projects we have to flexibly schedule when the weather is relatively bad.

Instrument Statistics

The graphs below show the distribution of proposals, received and allocated time, across the JCMT instrument suite. The top graph shows the fraction relative to the total number of shifts in that category, while the bottom graph shows the number of proposals.

Naturally, as SCUBA dominates the number of proposals we receive a large fraction of the scheduled time (67%) goes to SCUBA projects. This is shown in the top graph. The flip-side of this is shown in the bottom graph which indicates that most of the proposals that are rejected (the difference between the two columns in the lower graph) are also SCUBA ones. Conversely, the fallback projects are dominated by projects requesting the A and B band receivers.





The Receivers

The RxA and RxB instruments still remain popular instruments for the JCMT UK community. From the graphs above, one notices a tendency for RxA time to be awarded as fallback. Although there is no remit for the TAG to do this, it does relieve pressure from the shift allowance (impacted by SHADES) and frees the TAG to allocate more science programmes than it normally could. It is timely at this point to remind people that fallback does not correspond to a low-rank and it is hoped that, with a properly flexible schedule as we now have, these projects will be completed. Furthermore, the weather statistics are in favour of the completion of RxA fallback proposals.

Only four proposals requesting RxW were received. One was awarded time in the ANS queue (see later) and the other in the fallback queue, providing 'good-weather' cover for when SCUBA is warmed up.

SCUBA & SCUBA-polarimetry

SCUBA still remains the most requested instrument in the UK queue. The request for, and allocations of, polarimetry time remains healthy and steady (the top ranked proposal this semester was for polarimetry).

Thumper

Once on the telescope, Thumper will be a unique instrument with unique capabilities at 200?m. It continues to generate a significant amount of interest in the UK queue and of the 4 proposals received this round, 3 were awarded time totalling 7 shifts.

What are the UKTAG looking for in proposals?

A significant fraction of proposals received are resubmissions (sorry, no graph!). Twenty-one of the 04A proposals are identical or very similar to proposals submitted in previous rounds. Some are to complete on-going projects which have been adversely affected by weather or instrument/telescope faults. Others are resubmissions of proposals which did not originally get time. The TAG have noticed and commented on the fact that very few of these refer or are seen to respond to any previous feedback given. The Panel do look at resubmitted proposals and to whether previous feedback has been addressed. The feedback is intended to help improve proposals and the TAG refers to it when reading resubmissions. If a proposal is being resubmitted, then please refer to the feedback, even if you found it unhelpful!

At times it is still difficult to find projects which can be flexed against SHADES. As a reminder, SHADES operates within the ?CSO = 0.05-0.1 weather band as measured on the WVM radiometer, with fields centred around the 02h and 12h RA range. Proposals targeted at these RA ranges (outside of the SHADES weather band) are very welcome by the TAG and the JCMT scheduler!

Finally, the Panel still do look for large and ambitious programmes (of the order of 8-10 shifts). A caveat to this is that when such large programmes are received they are naturally scrutinised more carefully by the Panel, assessors and referee(s) alike.

What is ANS anyway?

We have had a number of queries as to the meaning of ANS. It stands for "Allocated but Not Scheduled" and is intended for top ranked proposals requiring good weather conditions. It is a special flex queue which was invented in response to the SHADES programme. The SHADES allocation of 30 shifts per semester carries with it 40 flex shifts to help ensure its success - these 40 shifts have to be filled from the queue somehow. If there is a top ranked proposal, and especially one which requires good (i.e. band 1) weather, then it is given an allocation but not actually slotted into the schedule. It is specifically meant to be flexed against the SHADES time on the telescope, so essentially an ANS project awarded 3 shifts of band 1 weather time has a flex allocation of 70 shifts! It is thus hoped that this should see it to completion. According to the weather statistics, we would expect approximately 10 shifts of the 70 to be in band 1.

Another advantage that we see is that the ANS projects do not come out of the allocation budget and instead form a part of the 40 flex shifts allocated to SHADES. 5 projects were awarded ANS status in 04A, totalling 7 shifts, each requiring band 1 weather.

The SHADES observers have agreed to cover the observing, but if the PI of the ANS programme wants to travel to the telescope for some period (during the appropriate scheduled SHADES block) to do their own observing then they can do. PI's of heterodyne projects awarded ANS time are probably well advised to come out.

Antonio Chrysostomou *(University of Hertfordshire)*
Chair - UKTAG

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PATT Application Deadline

Deadlines for receipt of all JCMT applications for semester 04B is:

15 March 2004

Please read the article - *Applying for Time* before filling in your application forms for the forthcoming semester. Note that paper submissions are no longer accepted by *any* queue.

To ensure prompt processing, please ensure that your applications are sent to the correct email address in the correct format. Applications for JCMT time should be submitted to the national TAG of the Principal Investigator (PI) or, if the PI is not from one of the 3 partners, to the national TAG of the first named co-investigator on the application who is from one of the partners. If none of the investigators is employed in or by one of the partner countries, then the proposal should be submitted to the International Queue. Members of the JAC staff in Hawaii count as International unless they are the PI on an application, when it should be forwarded to the appropriate national TAG.

Country paying salary of Principal Investigator

Canada	**Netherlands**	**UK or International**

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Gerald Moriarty Schieven (gms)

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JCMT Heterodyne Instrumentation Status

The current state of the JCMT heterodyne instruments, their availability on the telescope and their sensitivities and other observational parameters can always be located on the relevant pages within the JCMT World-Wide Web site:

Status of current receivers.

RxA3

RxB3

RxW

Heterodyne Polarimetry

At the time of this writing (early March 2004) the new ACSIS spectrometer is still scheduled to arrive in May for commissioning in semester 04A. However, there are indications that its delivery may be delayed until the Fall. For the current round of application (04B), continue to use the DAS values for sensitivity, bandwidth, etc. However, the expected "Day 1" backend configurations of ACSIS can be viewed here.

DAS Spectrometer guide

DAS "non-standard" configurations

Heterodyne Integration Time Calculator This facility is a web-based and stand-alone perl script for estimating the required integration time (or rms noise) for heterodyne observations.

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Gerald Moriarty Schieven

JCMT image

JCMT Heterodyne Receivers

Summary and Status

Purpose

This page offers a summary of the basic characteristics of the current heterodyne (spectral line) instrumentation of the JCMT, with a forward look to the next semester. Links are provided to other pages, where more detailed information can be found regarding performance and operational details. It is very likely that the present page will be more up-to-date than the detailed pages. For a more general introduction and other information about the heterodyne instrumentation, please see the Guide for Prospective Users.

Overview

The JCMT operates facility heterodyne instruments in four frequency bands, known as A, B, C and D in order of increasing frequency. The basic characteristics of these systems are given below.

Receiver system	**A**	**B**	**C**	**D**
Tuning range (GHz)	211 - 279	312 - 370	425 - 510	626 - 710
Beamwidth (HPBW, arcsec)	20	14	11	8
Beam Efficiency	0.69	0.63	0.52	0.30

Recent actual performance of the receivers can be obtained from the Calibration Database.

Recent efficiency and beam shape information tends to be sparse, primarily as a result of the inaccessibility of useful planets and a lack of useful test time. Poor weather, technical faults, and receiver unavailability during September 2001 and May 2002 thwarted the most recent extended campaigns.

Note however that there are not likely to be any significant changes in basic calibration data in the past three years, especially at the longer wavelengths. SCUBA observations also indicate that the beam shape has been good, as might be expected from the continuing campaign for improved control of the antenna surface.

Click on the following for a short summary and recent updates:

- **A-band** (e.g. 230 GHz)
- **B-band** (e.g. 345 GHz)
- **C and D-band** (e.g. 460, 690 GHz)
- **DAS** (spectrometer backend to the above)

Questions should be directed to the undersigned.

Receiver A3 - 230 GHz

This receiver provides spectral coverage from about 211 to 279GHz, the lowest frequency band in which the JCMT operates for spectral line observations. The extreme frequencies can be reached with a suitable choice of sideband. A3 has a single channel with a low-noise SIS mixer having a typical noise temperature Trec(DSB) of about 70K over most of its range. A **hump in the noise temperatures** occurs between local oscillator frequencies of 245 and 260 GHz, which appeared subsequent to leaving HIA. Although A3 does not have a single-sideband filter, one can avoid the side-effects of this feature for almost all common spectral lines with a suitable choice of sideband (note that the sideband ratio is not unity especially near this "hump"; see results of tests using HC_3N lines). Also, **close to 219.56 GHz** ($C^{18}O$ 2-1) tuning to the upper sideband is recommended, as a local oscillator fault leads to a tuning offset for the lower sideband. For further information see the A3 Web pages and the User's Guide.

Current Status

Especially during periods of relatively poor sky transmission A3 sees extensive use. It has worked reliably throughout most of the past two years, following extensive repairs to the helium cryostat and subsequent reintegration of the receiver in July 2000. Its present performance (last surveyed in February 2002; see compendium of results in this figure) continues to show some worsening of the noise "hump" since first delivered, although the frequency range affected does not appear to have expanded. Click here for **historical performance** (DSB receiver temperature vs time) from first light until August 2002 for the LO frequency range 226 through 236 GHz.

Anticipated for semester 04A

A3 should be in service with nominal performance, although we will be monitoring the noise "hump" for further changes.

Receiver B3 - 345 GHz

B3 has two low-noise tunerless SIS mixers which are tuned to the same frequency using a common local oscillator. The receiver tunes automatically between LO frequencies of 310 to 366 GHz; i.e. sky frequencies from 306 to 370 GHz should be accessible with one or both mixers. Observations slightly outside this range may be possible, although some manual adjustment may be required. Note that at the extremes of the frequency range the receiver noise temperature increases very substantially, and in the worse cases one or both mixers may not show true heterodyne behavior. The most recent extensive performance data, obtained in February 2002, is shown in the attached plot; this can be compared with the situation in March 2000. In both cases the mixer noise temperatures are color-coded - green for channel A, red for channel B.

B3 is usually used in single-sideband mode (i.e. the image sideband is suppressed), although observations are sometimes made in double-sideband mode. Both channels of B3 are capable of observing a spectral window up to 920 MHz wide simultaneously. Using a single channel allows one to observe with the spectrometer maximum of 1.8 GHz instantaneous bandwidth.

As always, we recommend obtaining "standard spectra", and observing either Mars or Uranus if possible to establish the veracity or otherwise of the temperature scale.

For additional information, refer to the B3 Web pages, and/or the User's Guide.

Current Status

For the most part B3 has been functioning reliably in the past year or so. Considerable effort in that time frame on the part of technical staff have done much to smooth over some remaining rough edges in B3's operation. The most recent data indicate that the characteristics of the multiplier (which was replaced in early 2002 following damage during a storm) have shifted the overall useful frequency range slightly downwards over that available until that time.

We have had some difficulty in the past year with frequent observations of **low signal strengths**; the origin of these effects has never been completely clear - in view of the large number of changes to the telescope and its infrastructure it has been difficult to make controlled experiments to isolate the cause, except to note that similar problems appear to have affected the other heterodyne receivers. Observers are urged to make careful observations of test sources. The **historical performance** averaged over all frequencies since first light show a marked and steady increase in the receiver temperatures with time.

Anticipated for semester 04A

B3 should be available with unchanged performance: typical DSB Trec values of between 120 and 160 K (i.e. SSB Trec's should be 250-320 K) can be expected, except at the extremes of the frequency range (outside about 315 - 365 GHz).

Receiver W - 460 and 690 GHz

This receiver consists of four mixers, two for use around 460 GHz ("C" band), and two designed for use over the 660-690 GHz region ("D" band), all mounted within a single cryostat. The two C-band channels, or the two D-band channels are normally used simultaneously to achieve improved sensitivity. The D-band mixers have tunerless (non-adjustable) backshorts, while the C-band mixers may be optimised. Receiver W is not configured to allow simultaneous operation with C and D bands, however. Receiver W is usually operated in single-sideband mode. Additional information can be found in the User's Guide and on the Receiver W Web pages.

The **C-band mixers** have a typical DSB Trec value of about 150-200K over the operating range of about 430 to 510GHz. Data obtained in mid-October 2001 are shown for the C-band region.

Overall during the past year receiver W has been used rather sporadically at D-band, a result of the relatively low coincidence rate of user demand and excellent sky conditions. The D-band mixers have a DSB Trec of typically 350-450K at midband. Receiver temperatures (see D-band plot of SSB values here) were surveyed in August 2001; at 660 and 691 GHz the DSB values for channels A/B were 317/376 and 441/372 K respectively. During 2001 one of the two **D-band mixers** suffered a failure and was replaced; it appears to be offer better performance than its predecessor. A failure of the LO control in the first part of 2002 removed the option of using D-band.

Basic instrumental parameters at both C and D bands remain extremely scarce, however. We had hoped to obtain a significant amount of "E&C" time in the early part of semester 01B to help rectify the situation, but poor weather conditions did not allow useful observing to be done. Observations scheduled for May 2002 were also ineffective due to problems with W and poor weather. Hence as always it would be extremely valuable for observers at C and D bands to make efficiency measurements and beam maps on planets.

Current Status

The receiver is working reasonably well, although very few observations have been carried out at D-band.
July 2003 - Mixer A of C-Band is not working. It was sent to the UK for repair.

Anticipated for semester 04A

We expect current performance characteristics to be unchanged.

Spectrometer backend ("DAS")

The DAS is an autocorrelating spectrometer which provides the signal processing for all heterodyne instruments at the JCMT. Possible sampled bandwidths are 125, 250, 500, or 920MHz wide with one or two inputs (i.e. one or two mixers), or 1800 MHz with one input channel. The narrowest bands correspond to a spectral resolution of 95kHz (190kHz using two input channels). At 1.8GHz bandwidth the spectral resolution is about 1.5MHz. Some special configurations can be used to allow more than one line to be observed at the same time if the lines are suitably situated in frequency space. 1MHz corresponds to 0.87km/s at 345GHz. See the User's Guide for further information.

Current Status

The DAS is operating normally in all modes. Improved environmental control installed in last couple of years has been a welcome positive change. In recent times the DAS has suffered a number of faults associated with individual subbands, with particularly strong sensitivity to unstable input signals; this appears to be fixed after an extended visit by ("Doctor DAS") Rob Millenaar. Mahalo, Rob!

Anticipated for semester 04A

We expect the DAS to be operating normally. The new ACSIS correlator is expected to arrive within this timeframe, although it is not likely to impact regular observing during semester 04A.

Please address any comments, suggestions or requests regarding this Web page to Per Friberg

Updated: 28 July 2003

Heterodyne polarimeter

A polarimeter for use with all heterodyne instruments

Linear polarimetry is possible with the heterodyne instruments, and is useful for e.g. masers and polarized molecular cloud spectra (the "Golreich-Kylafis effect": ApJ 243, L75). Observations are performed similarly to those with the SCUBA Polarimeter. Half-wave plates exist for the A, B and D bands; only A and B band polarimetry has been tested.

This observing mode has produced good results (e.g. Greaves et al. 1999; ApJ 512, L139) but is still somewhat experimental and is supported on a best efforts basis. Observing and data reduction are not automated and projects will include substantial overheads (of order 100%). For more information on use, observing and data reduction see this manual.

We are currently developing a new and significantly more powerful heterodyne instrument polarimeter, Rover, that should be available collaboratively on the JCMT. The web page describes our plans (and also shows some scientific results from the existing heterodyne polarimeter).

A3 pages B3 pages WC/D pages

JCMT image here

"Day 1" ACSIS Configurations

At the time of this writing (early March 2004) ACSIS is still scheduled to arrive in May 2004 to be commissioned by July. However, there are indications that its delivery may be delayed until the Fall.

When ACSIS is fully commissioned, the expected "Day 1" configurations available are listed below. "Hybrid" mode is ACSIS-speak for use of more than one subband. The hybrid modes have some significant subband overlap (20% or so), resulting in a lower overall bandwidth than quoted. The bandwidths given are independent of whether there are 1 or 2 mixer inputs. Although there is no 125-MHz bandwidth, the number of available channels more than compensates for that in terms of spectral resolution using the 250-MHz bandwidth.

Bandwidth	# Channels	Resolution	Hybrid?
250 MHz	8k	30.5 kHz	N
500 MHz	16k	30.5 kHz	Y
1000 MHz	2k	488 kHz	N
2000 MHz	4k	488 kHz	Y
1000 MHz	32k	30.5 kHz	Y

Gerald Schieven

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Lethbridge Fourier Transform Spectrometer

It is likely that the Lethbridge FTS will be available for use during semester 04B. Further information is available at:

http://www.uleth.ca/phy/naylor/fts.shtml

The Lethbridge group welcomes scientific collaborations with other JCMT users. Please contact Prof. D.A. Naylor (naylor@uleth.ca) to arrange collaborative efforts.

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Gerald Moriarty Schieven

Joint Astronomy Centre

James Clerk Maxwell Telescope

B. Weferling

4 February 2004

Overview of SCUBA opacity calibration 2003

In 2003 a number of developments and problems relating to the SCUBA flux calibration occurred. This page will give an overview. The table at the end summarises the situation. This document will be updated upon final conclusion of the opacity calibration issues in 2003.

- **Water Vapor Monitor:** The Water Vapor monitor is in use at the JCMT since July 2000, but only during 2003 has it been developed from an instrument that merely delivers a rough on-site opacity estimate into the main device used for opacity corrections. The instrument is currently calibrated against the polynomial fits to the 225GHz-CSO-Dipper and completes a measurement along the line of sight of the JCMT every 1.2 seconds. These characteristics make the WVM the first choice for opacity correction. The WVM measurements will become part of the SCUBA data files and SURF and ORAC-DR will be enabled to use them in the reduction. These efforts will probably be completed in the spring 2004. For more details regarding the WVM please refer to the timeline below. The WVM-Data can now interactively be queried from the WWW. This interactive archive automatically recomputes the raw WVM-Data using the most recent atmospheric model. The original measurements, based on the model current at the time of the observations can be found in the Historical WVM archive - this archive contains data since April 15 2003. Furthermore is the whole of the WVM data now available for interested users from the JCMT ftp server (please contact B. Weferling for details.) Work on an improved atmospheric model for the WVM is ongoing in a collaboration with the Cavendish Laboratories. Details about the current empirical WVM calibration can be found in R. Phillips, B. Weferling, T. Jenness MNRAS 2004 (in preparation).

- **225GHz-Dipper:** The 225GHz-Dipper which serves as the basis for the polynomial fits, was not working for most of the year. Because of a hardware failure there was no data at all from the instrument from January 14 to July 11. Despite the best efforts of the CSO to repair the device the instruments behavior and calibration remained questionable throughout the remainder of the year. Since July 12 polynomial fits have been produced where possible, but unless a proper calibration can be confirmed they will not become part of the automated reduction file csofit.dat and ORAC-DR. If it should not be possible to continue to use the instrument for the polynomial fits, the archive will be completed based on the 350µm-Dipper, which now also serves as the basis for the fits from January 13 to July 11.

- **350µm-Dipper** The NRAO/CMU submillimeter (or 350µm) tipping radiometer hosted by the CSO has been recalibrated during 2003. The details will be published in B. Weferling, MNRAS 2004 (submitted, please contact me if you need the information sooner). With this the 350-µm-Dipper has become an equal of the 225GHz-Dipper. The polynomial fits January 14 through July 11 are based on the instrument. During that time fits based on the instrument had also been provided, but using the old calibration. The new ones are completely equivalent to the normal fits and can be used without any modification, they are part of csofit.dat and orac-dr. Still, to distinguish them the folders and files are marked '350'. The preliminary files which were based on the old calibration will be kept for reference and are accessible through a separate archive folder called "old_350" that you can find here. It might become necessary to continue to use the 350µm-Dipper as the basis for the polynomial fits for some time. The polynomial fits will remain one of the major tools for opacity calibration.

Timeline Calibration 2003

Much has happened during 2003 with regard to the opacity correction. To give you some orientation, here are in summary the major events:

- **January 14:** 225GHZ-Dipper stops working.
- **March 12:** The new WVM calibration (V1.0) is installed, it includes an elevation correction. The WVM gives now 225GHZ-Tau-Fits equivalent. The new model is a hybrid based on the previous model empirically corrected with the 225GHz-Tau-Fits. On the same day the WVM measurement cycle is switched from 6s to 1.2s.
- **March 27:** The increased WVM readout rate causes VAX problems and is reverted to 6s.
- **April 2:** The WVM software is completely overhauled and improved. Because of this the WVM is for a short time reverted back to the old atmospheric model.
- **April 9:** The new WVM software (by M. Rippa in C now under CVS). Atmospheric Model V1.0 is now used again.
- **April 12:** The atmospheric Model is improved for high opacities (V1.1).
- **April 15:** From this day onwards the nightly measurements of the WVM are stored as is in the Historical WVM archive.
- **May 7:** The interactive WVM archive comes online. The data can be queried by numerical and graphical output. The output is automatically updated using the most current atmospheric model.
- **July 3:** WVM cycle finally set to 1.2s. No problems.
- **July 12:** CSO-225GHz-Dipper back online. For the period since January 14 CSO-Fits are produced based on the 350-micron-Dipper. The performance of the 225-Dipper it turns out, after some more repairs, is not satisfactory. It is attempted to recalibrate the instrument. Times for which this should not be possible will get a CSO-Fits based on the 350-Dipper. This work is ongoing.
- **October 31:** The WVM measures the highest tau recorded so far at the JCMT: 0.5893.
- **November 9:** The WVM makes its 10-million-st measurement.
- **December 8:** The CSO and Jonathan's Weather page now publish 350-Dipper data with an improved

calibration.

There are many more details and a lot of more points, please contact me if you wish to get further information.

Operational Status of Instruments and basis of Polynomial Fits

	WVM	225GHz-Dipper	350µm-Dipper	Polynomial Fits
January	Working 6s	Failed Jan.14	Working	225 until Jan. 13, then 350*
February	6s	Offline	Working	350*
March	1.2s/6s	Offline	Working	350*
April	6s	Offline	Working	350*
May	6s	Offline	Working	350*
June	6s	Offline	Working	350*
July	switch to 1.2s on 3rd	Restart on 12st/Questionable	Working	until 11th 350*, then 225 tentative
August	1.2s	Questionable	Working	225 tentative
September	1.2s	Questionable	Working	225 tentative
October	1.2s	Questionable	Working	225 tentative
November	1.2s	Questionable	Working	225 tentative
December	1.2s	Questionable	Working	225 tentative

*: From January 14 until July 11 fits based on the 350µm-Dipper based on an old calibration had been provided. After an improvement of the calibration of the instrument this period has been refittet and is now part of the archive. The old fits are still available here.

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Bernd Weferling
04 February 2004

Tau, Seeing, and Sensitivities

When you are writing your proposals (and observing templates, should you be awarded telescope time or fallback time), remember that there are web-based tools to assist you with calculating RMS noise of your observations.

The SCUBA integration-time calculator is available here.

The heterodyne integration-time calculator is available here.

High quality projects that can be done in poor weather (band 4/5) are always in demand. The opacity in the A-band window is typically a factor of 4 less than at 850 microns, so one could argue that working with reciever A in tau-cso = 0.3 is similar to working with SCUBA 850 in grade 2 conditions - certainly excellent results can be achieved. The following table should give you some idea of whether your project could be done with receiver A (or B) in grade 4 or 5 weather, and just how bad the weather can be before it's pointless to continue.

> If tau is 0.15 you get a certain rms in one hour.
>
> If tau is 0.20 you'll get the same rms in 1.4 hours
>
> If tau is 0.25 you'll get the same rms in 2.0 hours
>
> If tau is 0.30 you'll get the same rms in 2.6 hours
>
> If tau is 0.35 you'll get the same rms in 3.2 hours
>
> If tau is 0.40 you'll get the same rms in 4.0 hours.

Note that *tau* and *seeing* data can now be downloaded from the archive for any date/time from 1997 onwards. Click here for more information. In addition, WVM data can also be downloaded from the web here.

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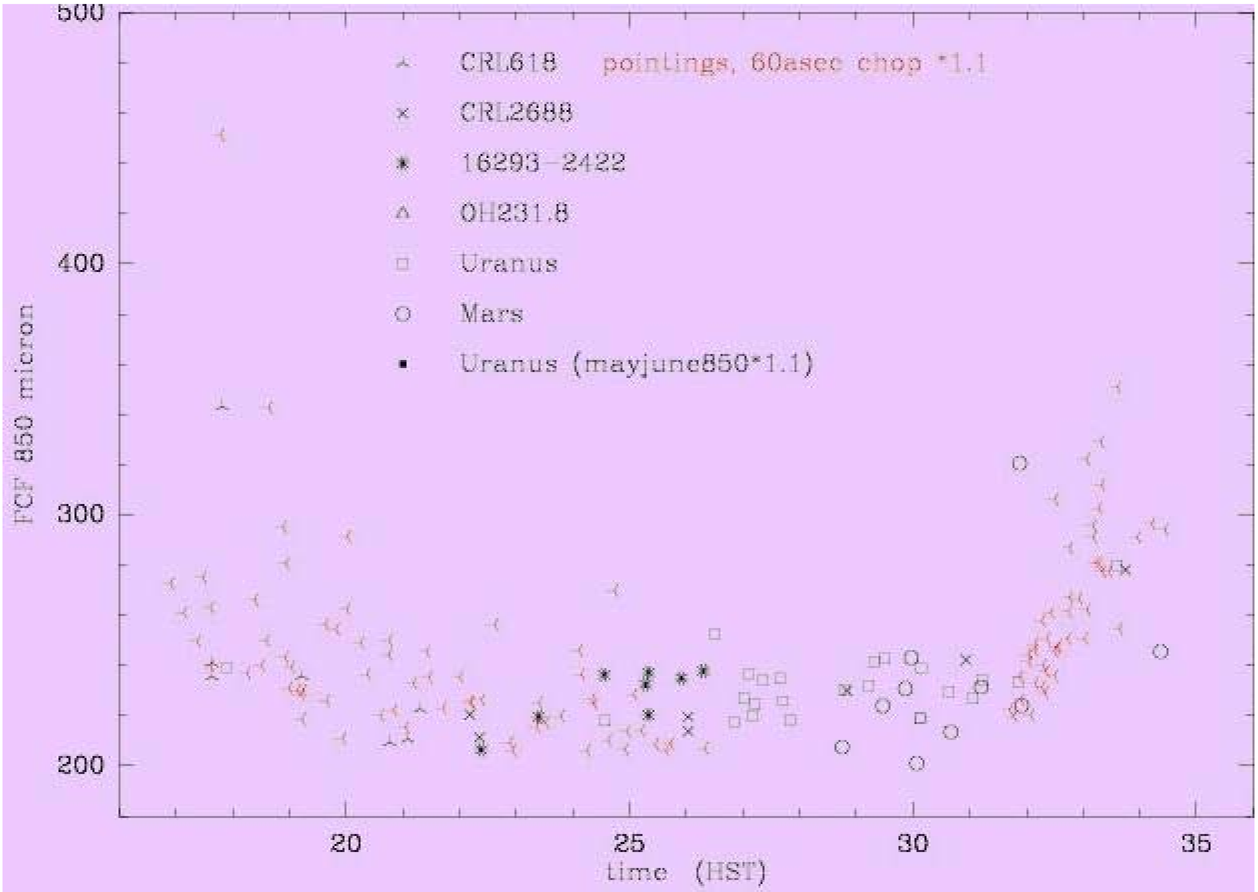
Gerald Moriarty-Schieven

SCUBA Flux Calibration Through the Night

Jan Wouterloot - JAC

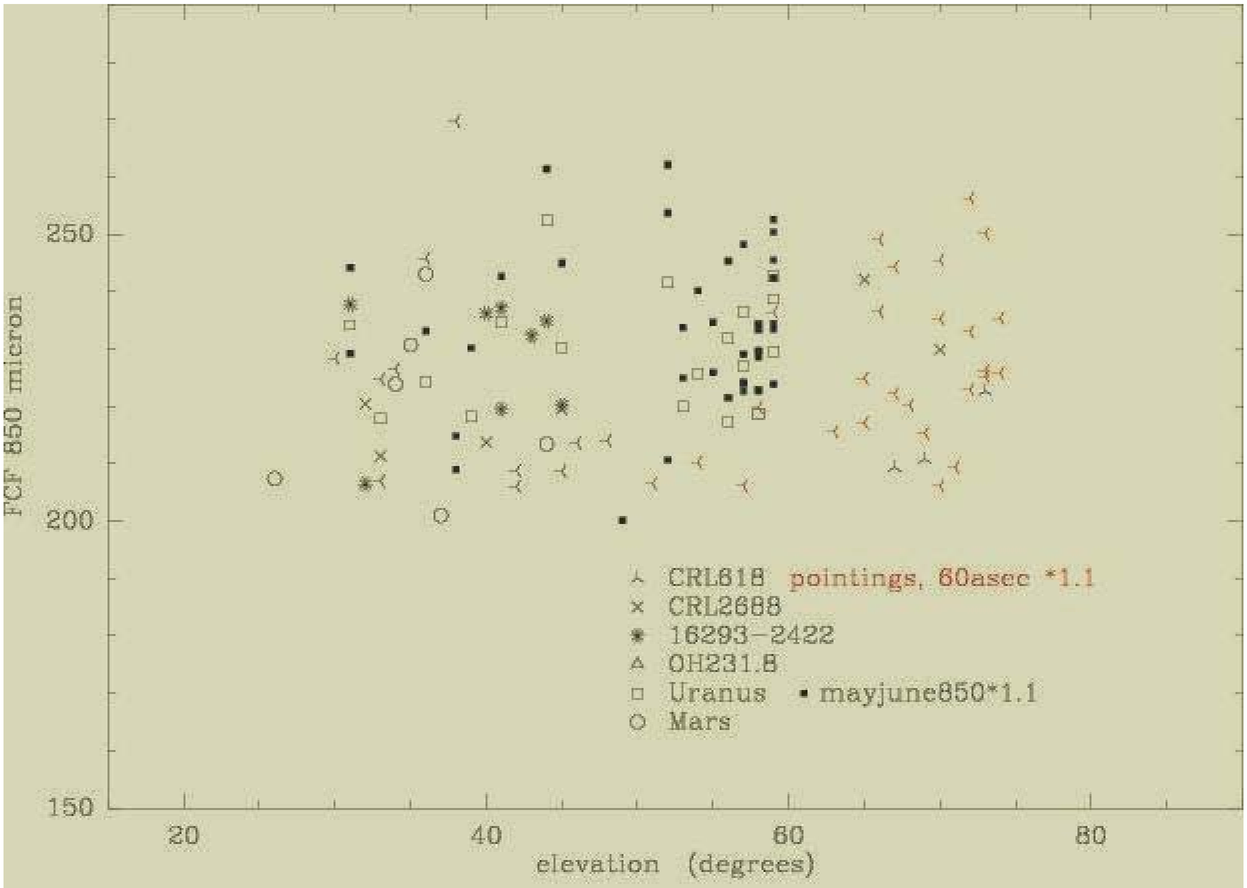
It is well-known that the surface of the telescope is not as good in the early evening and morning as during the night. Observers see SCUBA flux calibration factor (FCF) values that decrease after sunset. It is not easy to see exactly in which period the dish is good because a lot of work is needed to obtain a consistent data set. As part of an ongoing investigation into the SCUBA calibration, I have looked at SCUBA 850 micron data during 2003 when the surface had a relatively constant rms value during the whole year. This note shows some preliminary results of this investigation and is intended to make observers aware of different effects in the calibration. Later as more information is available and possible specific test observations are made, we will be able to study (and publish) this in more detail.

For this study I have used only calibration measurements of Uranus, collected by V.Barnard for the period May to September 2003 when the FCFs seem to have been fairly constant according to the SCUBA Gain Table. However the coverage of the data in Hawaiian Standard Time (HST) is not good - in this period Uranus was not visible at the beginning of the night. To remedy this I have collected some more data from the archive, omitting the period 10 February - 30 March 2003 when the FCF values were particularly bad (see the above web page). I used only days for which B.Weferling had derived csofits at 225 GHz (i.e. in 2003 before 11 July) which were used for the atmospheric calibration. First I took all jiggle maps of primary and secondary calibrators (except IRC+10216) with chopping angle larger than 90". This still did not result in a good enough data set. I added maps with 60" chopping angle of CRL618 and also pointing observations of this source. It appeared that FCF values in V.Barnards list and from the pointing and 60" Jiggle maps were about a factor 1.1 lower than for the other calibrator sources, so I used this correction factor in order to make the data points agree. This ad-hoc factor was not accurately determined and its cause still has to be investigated, and it should not be used for other purposes. The results are shown below (adding 24 hours for clarity for HST less than 12h.



The pointing observations of CRL618 (red symbols) show a steep increase in FCF at the end of the night, consistent with the other sources. Also at the beginning of the night the FCFs are higher, but with somewhat more scatter (for CRL618). Probably it would be better to plot these data versus time of sunset or sunrise rather than HST, which may be done in the near future.

Between 20h HST and 7h HST the FCF values are approximately constant. For this period I have plotted below the FCF as a function of elevation. There might be a slight increase, but it is within the noise. To confirm this it might be good to analyse data from IRC+10216 which reaches 83 degrees elevation, if there is an easy way to correct for its variability.



A previous analysis based on much less data from 2000 does not show the changes of the FCF with time. The reason is unclear at this time.

Jan Wouterloot

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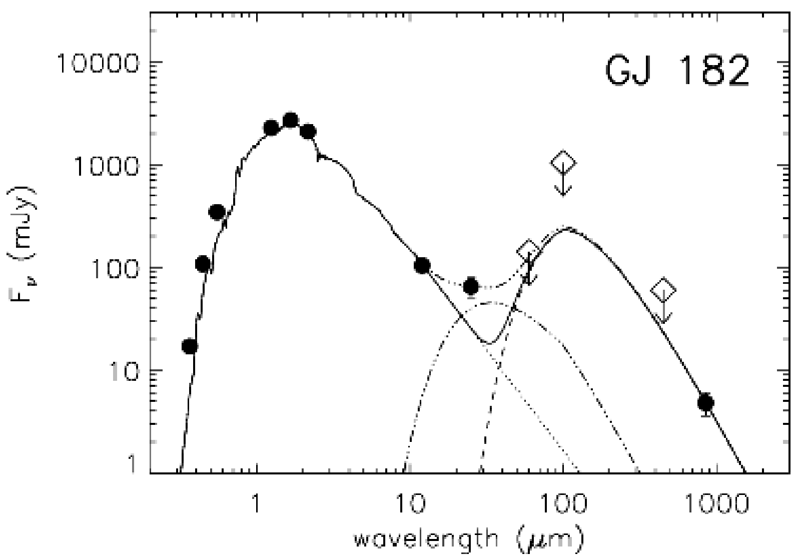
Jan Wouterloot

Debris Disks around M Dwarfs
Submm Excesses and Optical Imaging

Brenda Matthews - *UC Berkeley*
Michael Liu & Jonathan Williams - *Institute for Astronomy, Hawaii*
Paul Kalas - *UC Berkeley*

After primordial disks around forming stars dissipate, coalescing into larger planetesimals and planets, collisions between these more massive bodies can produce what is known as a "debris" disk. As material is collisionally reduced again to dust grains, the star once again exhibits an infrared excess. Hence, observation of these excesses is typically associated with the presence of a debris disk.



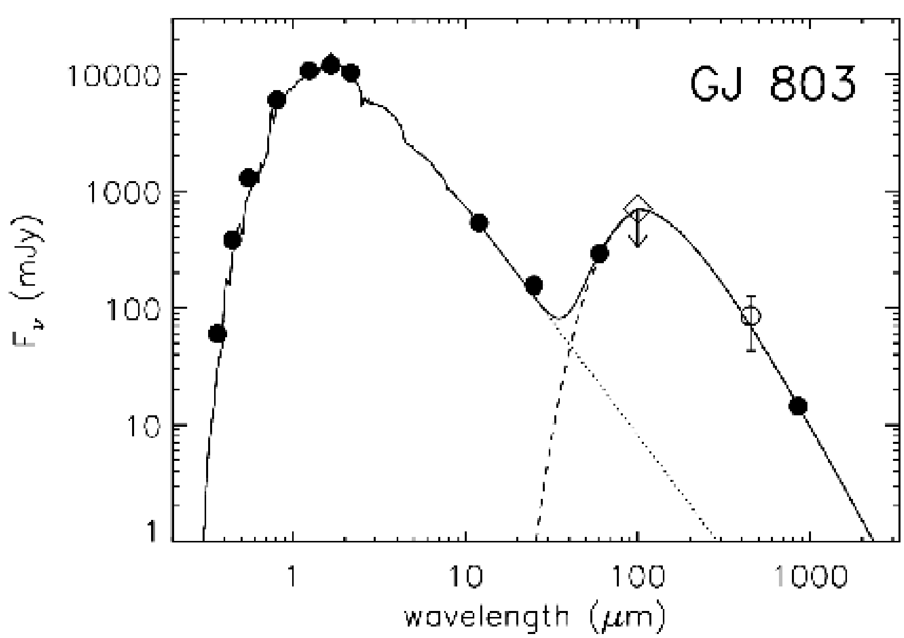


Figure 1: *SEDs of GL 803 and GJ 182 including the SCUBA 850 micron detections, and the 450 micron marginal detection and upper limit for the two stars, respectively. Optical data are from SIMBAD and the Hipparcos catalog; the IR data to 100 microns are from the 2MASS catalog and the IRAS color-corrected Faint Source Catalog and SCANPI photometry. In the case of GL 803, a modified blackbody of 40 K and beta 0.8 is fit to the SED longward of 60 micron. At this temperature, blackbody grains would not exist inward of a radius of 17 AU from the star. This inner gap could indicate the presence of planets*

within this radius. GL 803 is only 12 Myr old, so any planets present should be detectable by thermal emission.

As part of a SCUBA survey of nearby stars selected based on their ages and membership in the beta Pictoris and Local Association moving groups, we report submillimetre excesses around two M dwarfs. These are the first detections of disks such low mass stars. One of these, GL 803 (AU Microscopium) was known to have an IR excess based on IRAS 60 micron data, but for the second, GJ 182, this is the first indication of excess emission associated with disks. Figure 1 shows the SEDs of these two stars including our detections at 850 micron with SCUBA. Neither has been signficantly detected at 450 micron, but for GL 803, we have a marginal 2 sigma detection consistent with the fit of a modified blackbody of 40 K with beta of 0.8. These results are presented in Liu, Matthews, Williams & Kalas (2004, ApJ, in press), which will appear shortly on astro-ph.

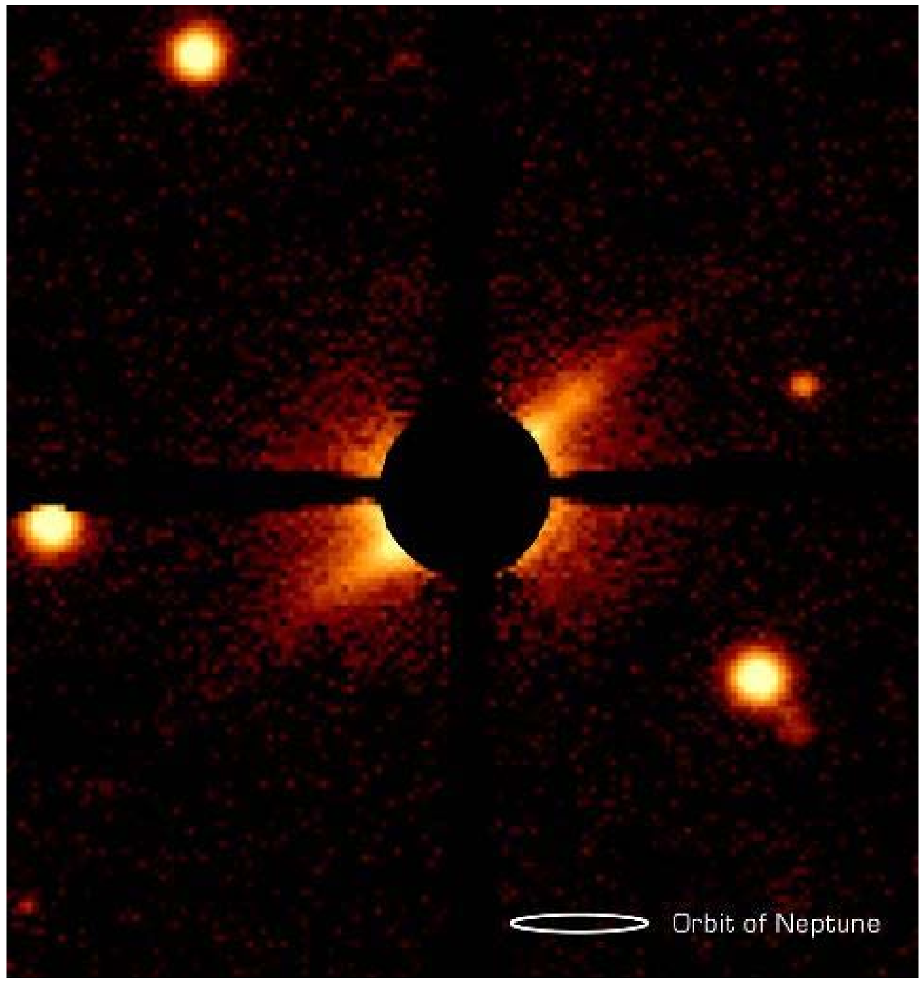


Figure 2: *Coronographic imaging of GL 803 reveals a large, nearly edge-on disk in scattered optical (R-band) light. The coronograph covers the inner 50 AU radius of the disk, but it is detected out to a radius of 210 AU. SCUBA imaging has thus far failed to resolve the disk.*

Most importantly, of the three M dwarfs we observed, excesses indicative of disks were detected around two (the third, GL 799, was not detected). If many low mass stars harbour debris disks, this could be taken as evidence that planet formation is possible around a large fraction of low mass stars. To date, only the M dwarf GJ 876 is known to have planets, detected at approximately 0.2 AU by a radial velocity survey (Marcy et al. 2001). The 17 AU inner hole inferred for GL 803 suggests that planets may form at much larger separations, and do so within 10 Myr. Based on the SCUBA data, we estimate the masses of these disks to be between 0.01 and 0.03 Earth masses.

GL 803 (M1V) has been an object of interest due to its IR excess for some time; it is included on Spitzer and HST ACS GTO programs. However, we have already followed up our JCMT detection with optical imaging of the disk (see Figure 2) using the UH 88" coronograph (as reported in Kalas, Liu & Matthews, 2004, Science). This is only the fourth optically detected debris disk; the first was beta Pictoris (A5V). These two stars are members of the same moving group. Together, these stars offer an opportunity to understand planet formation around stars of different mass formed from the same natal cloud.

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Formaldehyde emission from low mass protostars observed with the JCMT

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Formaldehyde is, after water and carbon monoxyde, one of the main component of ices in grains mantles. Recently, Ceccarelli et al. (2000a,b), Maret et al. (2002) and Schöier et al (2002) have shown that in the inner parts of protostellar envelopes, grains mantles evaporate, releasing the ices components into the gas phase, and, among them, formaldehyde. Observations of formaldehyde transitions can be therefore used to determine the physical and chemical conditions -- namely density, temperature and chemical abundances -- in the inner part of protostellar envelopes (Ceccarelli et al. 2003, Maret et al. 2003).

The most accepted scenarios predict that formaldehyde is formed on grain surfaces, by successive hydrogenation of CO. The measure of the formaldehyde abundance in the gaseous phases of the inner part of the envelopes gives some hints on the composition of the grain mantles, and in turn on the grain surface chemistry. Moreover, chemistry models predict that, once in the gas phase, formaldehyde can rapidly form complex molecules, by the so called *hot core* chemistry (Charnley et al. 1992). This chemistry was thought to exist only in high mass protostars, where the gas temperature and density are high enough to trigger endothermic reactions between species. The very recent detection of O and N bearing molecules, typical of massive hot cores, towards IRAS16293-2422 (Cazaux et al. 2003), emphasizes the chemical similarity that may exist between low and high mass protostars.In order to determine if IRAS16293-2422 is representative of low mass protostars, or rather a peculiar case, one needs to measure the formaldehyde abundance in a larger sample of protostars. We have recently observed a sample of eight Class 0 protostars, located in the Perseus, ρ-Ophiuchus and Taurus complexes, using the James Clerk Maxwell Telescope and the Institut de Radio Astronomie 30 meter telescope. Eight formaldehyde transitions were selected, three ortho and five para, ranging from 140 to 364 GHz. The transitions between 140 GHz and 280 GHz were observed with the IRAM-30m telescope, while transitions at higher frequencies were observed using the JCMT. The choice of these two instruments allow a nearly constant beam size over frequencies. The transitions were chosen to cover a large range of upper level energies, from 20 to 100 cm^{-1}, in order to probe the physical conditions in the different part of the envelope. Fig. 1 shows a typical example of lines observed towards NGC1333-IRAS4A.

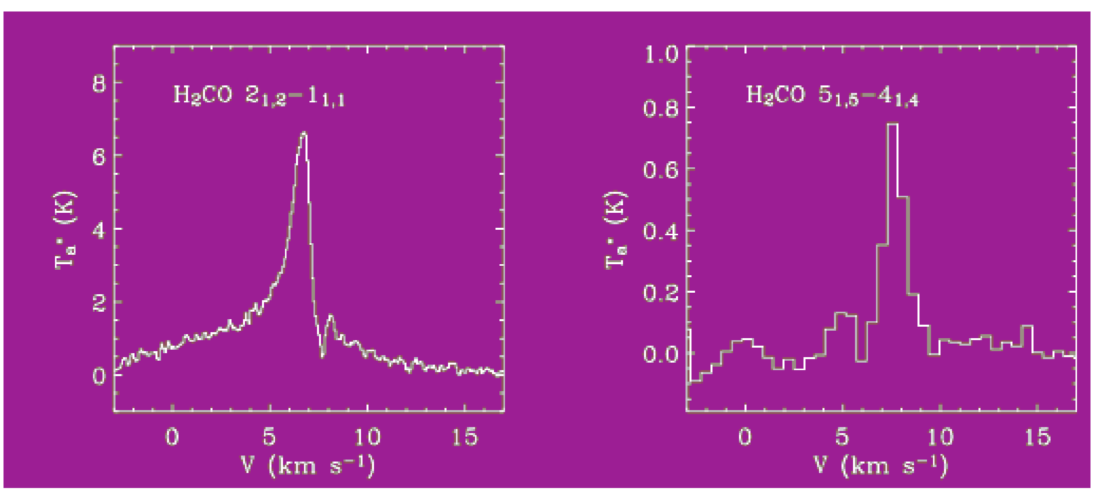

Figure 1: *Typical example of formaldehyde lines observed towards NGC1333-IRAS4A. The lines are relatively narrow, with a contribution of the wings extending at larger velocities. Some of the lines show self-absorption and / or absorption by the foreground material.*

The formaldehyde emission was modeled using a 1D spherical radiative code. The density and dust temperature profiles determined by Jörgensen (2002), from the simultaneous modeling of the continuum emission at 450 and 850 µm observed by SCUBA and the spectral energy distribution, were adopted. The gas temperature was computed by solving the thermal balance in the envelope (Ceccarelli et al. 1996). Finally, because of the importance of evaporation in the inner parts of the envelope, the formaldehyde abundance has been approximated by a step function: X_{out} in the outer part of the envelope where the dust temperature T_{dust} is lower than 100 K, and X_{in} in the inner parts of the envelope where $T_{dust} > 100$ K. These abundances have been determined by a χ^2 analysis. Fig. 2 show the χ^2 contours has a function of X_{in} and X_{out} for two sources of the sample.

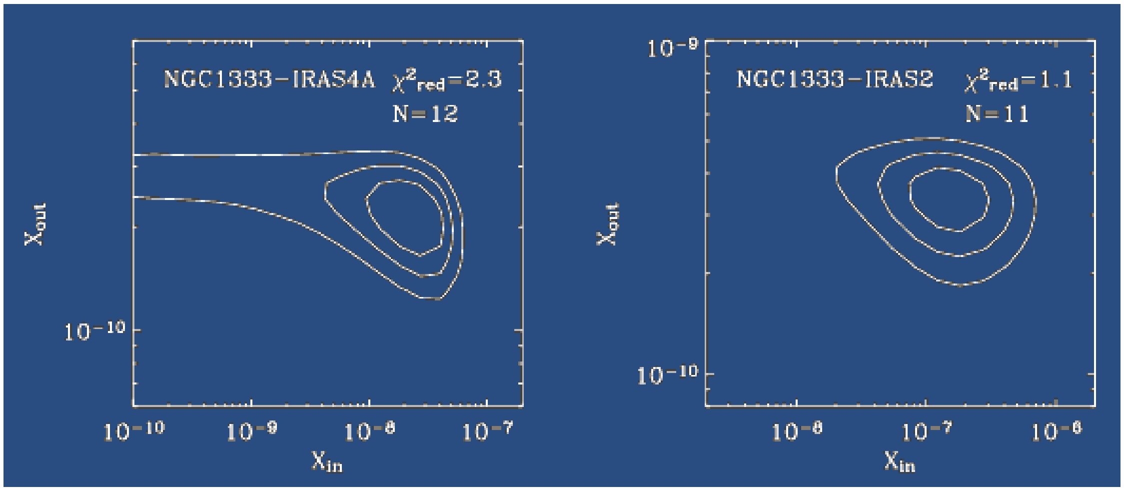

Figure 2: *χ^2 as a function of X_{in} and X_{out} for NGC1333-IRAS4A and NGC1333-IRAS2. The contour levels show the 1, 2 and 3 σ confidence level respectively. The observations are only reproduced if there is a jump in the formaldehyde abundance, between 2 and 3 orders of magnitude.*

This modelling shows that, in all the protostars but one, the observations can only be reproduced if there is a jump in the formaldehyde abundance, between two and three orders of magnitude. The position of this jump correspond to the radius where the temperature reaches 100 K, the sublimation temperature of grain mantle. In this region, the grain mantle evaporates, releasing the ices components, and among them, formaldehyde. From this point of view, IRAS16293-2422 is not a particuliar case, and all observed protostars but one harbors a hot core, where the chemistry is influenced, if not dominated, by grain mantle evaporation.

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Gerald Moriarty Schieven

The G75.78 Region:
Massive Stars Spawning Massive Stars

Joel H. Kastner & Zoran Ninkov
Rochester Institute of Astronomy
& Gerald H. Moriarty-Schieven
National Research Council of Canada, Joint Astronomy Centre

Most stars are born in sites, such as Orion, that contain luminous, massive stars. The H*II* regions and supernova remnants resulting from the presence of such high-mass (O and B) stars have long been thought to significantly alter or even disrupt the parent clouds. This process remains mysterious, however, due to the scarcity of nearby examples of regions actively forming massive stars. For example, while bipolar molecular outflows are known to be associated with certain massive protostars (e.g., Kastner et al. 1994; Shepherd & Churchwell 1996), the outflow energetics are not well understood and the outflow sources themselves are poorly characterized. It is also apparent that the chemistry of cloud cores spawning low-mass stars (and the protoplanets potentially surrounding them) is profoundly influenced by the intense UV from massive protostars. However, the impact of outflows and UV from massive stars on the molecular cloud environment --- and, hence, on future generations of young stars --- remains to be determined.

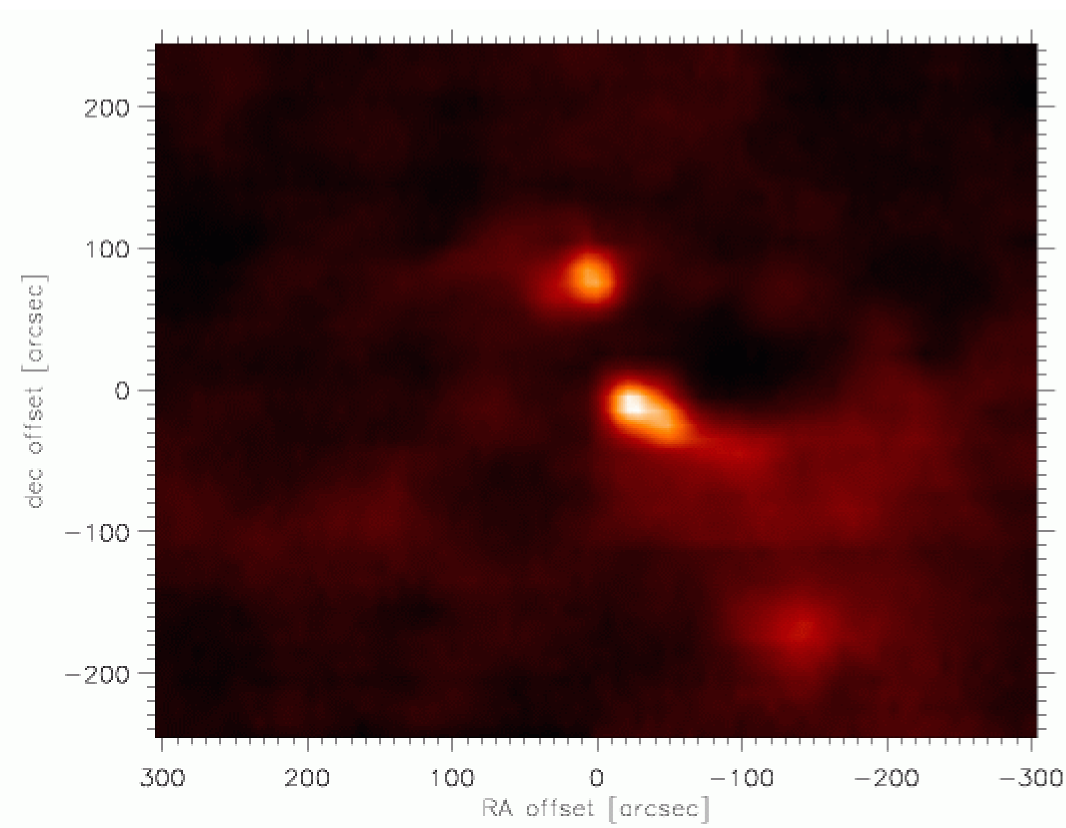

Figure 1: *10'X8' JCMT CO(2-1) integrated velocity map of the G75.78 region.*

We have been using the JCMT to map molecular line emission from the vicinity of G75.78, which lies within the maser complex ON 2. This complex region includes a large number of massive stars, spanning a remarkably wide range of evolutionary stages. G75.78 has long been known to harbor a group of ultracompact H*II* (UCHII) regions and masers (Baud 1977) and hosts a luminous far-IR source (IRAS 20198+3716), indicative of the presence of massive, deeply embedded protostars. Much of this massive star formation activity may lie within 1 kpc, based on the proximity of G75.78 to Berkeley 87 (B87), an optical cluster of ~100 members located on the boundary of the Cygnus X region (Turner & Forbes 1982). The distance to B87 appears well constrained, at D~900 pc (Polcaro et al. 1991). Furthermore, B87 itself features an unusually rich menagerie of optically luminous objects, including a rare WO star [WR 142 = ST 3], a blue straggler, the unusual variable V439 Cyg, and the red supergiant BC Cyg (Polcaro et al. 1991).

Although it is only twice the distance to the Orion molecular cloud complexes, and is far richer in terms of its massive star component, the G75.78/B87 region remains surprisingly understudied. This lack of attention is notable given the likelihood that the G75.78/B87 region illustrates an episodic, massive star formation sequence that is now making its way through, and perhaps is in the process of dispersing, a giant molecular cloud that lies no more than about 1 kpc from the Sun. The G75.78/B87 region also potentially offers an observational test of models of the effects of massive star winds and UV fields on the circumstellar environments of solar-mass (late-type) stars.

We are now exploiting the proximity and richness of the G75.78/B87 region to better constrain these and other massive star formation processes. We have recently obtained (semester 02A) a 10'X8' JCMT map of G75.78 in ^{12}CO*(2--1)* (Kastner, Moriarty-Schieven, & Ninkov, in prep.). This map has yielded detections of CO clumps and outflows in the immediate vicinity of IRAS 20198+3716 which, in turn, appears to be associated with a deeply embedded young cluster (Fig. 1). These results provide strong evidence for interactions between outflows from massive young stars and ambient cloud material in G75.78, providing new insight into its present star formation activity and its star formation history.

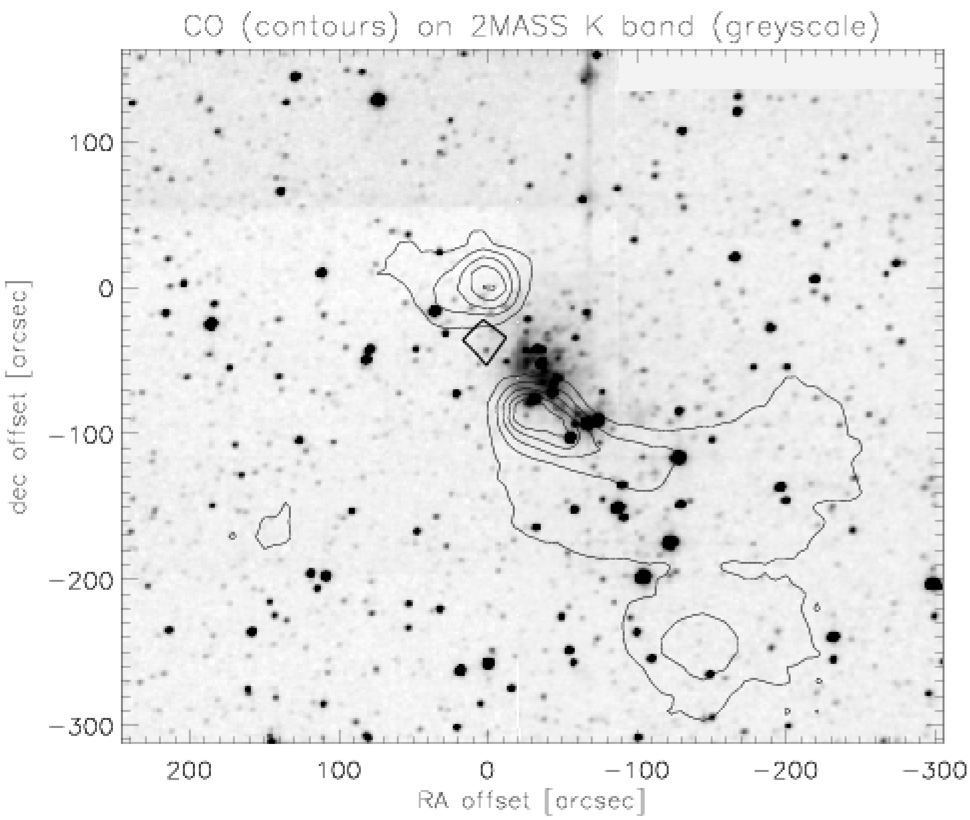

Figure 2: *Contours of the CO map, overlaid on a 2MASS K band image. The center of the Berkeley 87 optical cluster lies approximately midway between the southern CO peaks (B and C). Note the appearance of an embedded cluster of young stars between the brightest CO peaks (A and B); this cluster is not detected in optical images. IRAS 20198+3716 lies very near the center of the IR nebulosity associated with this cluster.*

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Kastner et al. 1994, ApJ 425, 695
Polcaro et al. 1991, A&A 252, 590
Shepherd & Churchwell 1996, ApJ 472, 225
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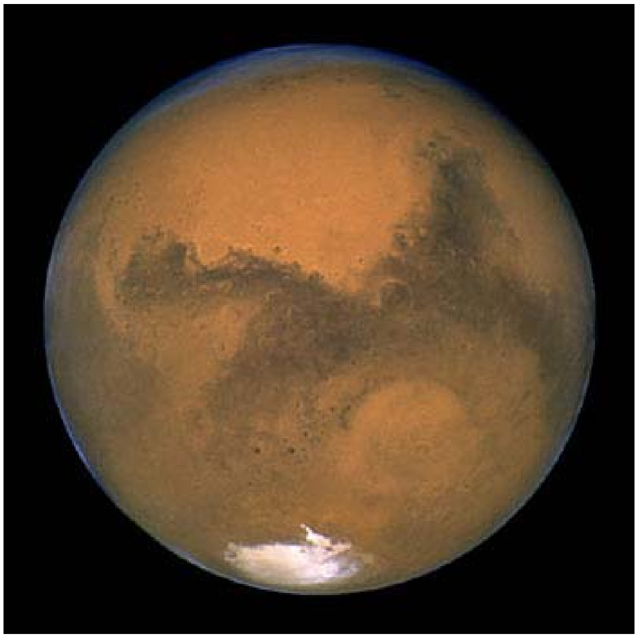

A Measurement of the 362 GHz Absorption Line of Mars Atmospheric H_2O_2

R. Todd Clancy, Brad Sandor
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Joint Astronomy Centre

The 362.156 GHz absorption spectrum of H_2O_2 in the Mars atmosphere was observed on September 4 of 2003, employing the James Clerk Maxwell Telescope (JCMT) sub-millimeter facility on Mauna Kea, Hawaii. Radiative transfer analysis of this line absorption yields an average volume mixing ratio of 18±0.4 ppbv within the lower (0-30 km) Mars atmosphere, in general accordance with standard photochemical models (e.g., Nair et al., 1994). Our derived H_2O_2 abundance is roughly three times greater than the upper limit retrieved by Encrenaz et al. (2002) from infrared spectroscopy, although part of this discrepancy may result from the different solar longitudes (Ls) of observation. Aphelion-to-perihelion thermal forcing of the global Mars hygropause generates substantial (>200%) increases in HOx abundances above ~10 km altitudes between the Ls = 112° period of the Encrenaz et al. upper limit measurement and the current Ls = 250° period of detection (Clancy and Nair, 1996). The observed H_2O_2 line absorption weakens arguments for non-standard homogeneous (Encrenaz et al., 2002) or heterogeneous (Krasnopolsky, 2003) chemistry, which have been advocated partly on the basis of infrared (8 µm) non-detections for Mars H_2O_2. Our observation of Mars H_2O_2 also represents the first measurement of a key catalytic specie in a planetary atmosphere other than our own.

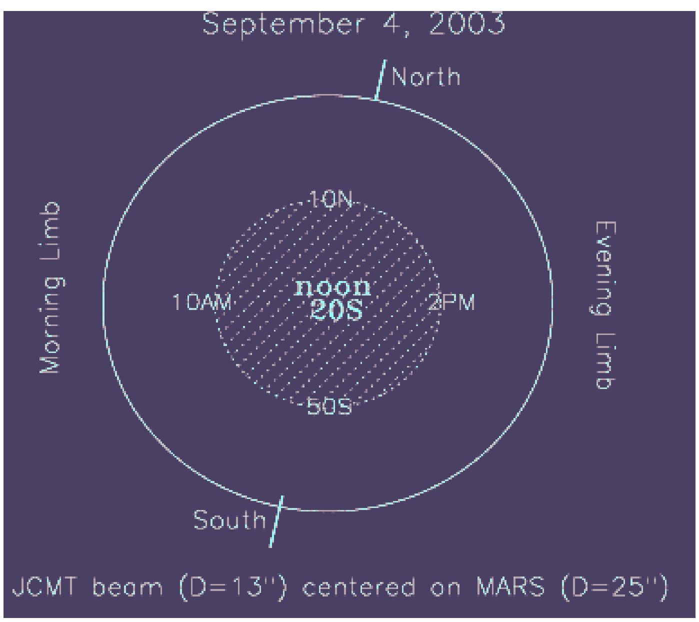
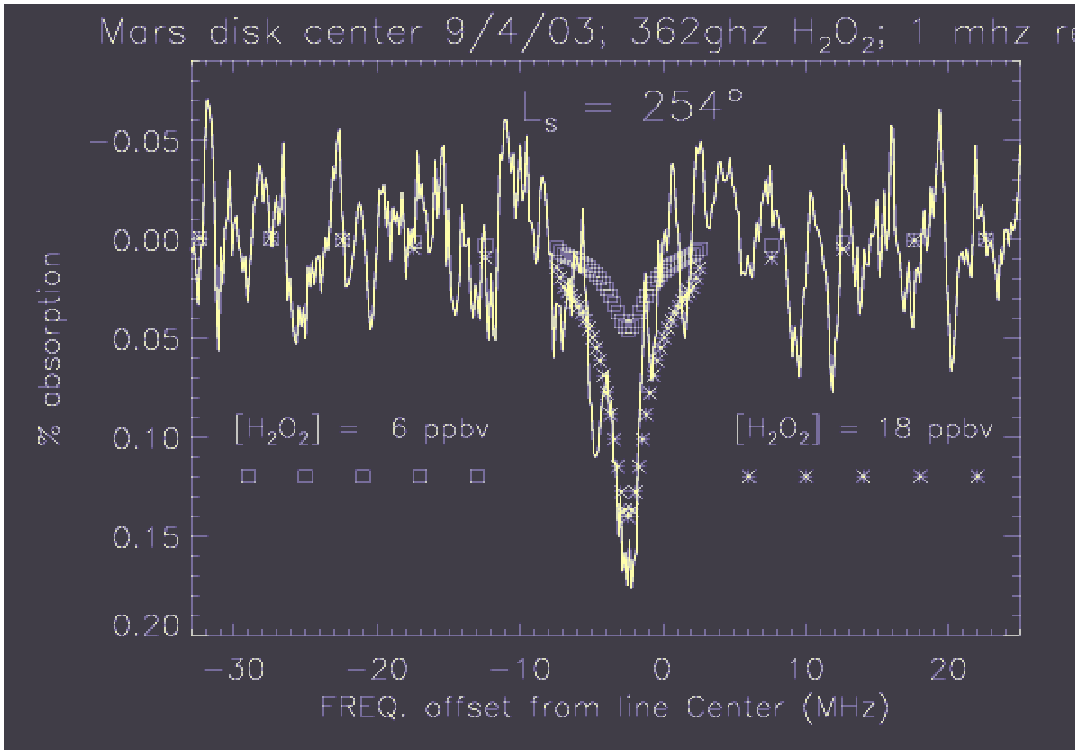


Figure 1: *A schematic of the Mars JCMT observing geometry for the September 4, 2003 spectral line H_2O_2 measurement. The solid outer circle represents the apparent Mars disk, as resolved by the FWHM primary diffraction beam (diagonally marked center circle) of the JCMT telescope at the observing frequency (362.156 GHz). The center local time and latitude, as well as the local times/latitudes of the beam FWHM limits, are indicated.*

Photodissociation of water vapor is the fundamental source for Mars atmospheric H_2O_2, such that photochemical model H_2O_2 abundances scale roughly with input model water vapor densities. The vertical column of Mars water vapor varies by >100% versus latitude and Ls (Jakosky and Farmer, 1982; Smith, 2002), which requires that comparisons of model and observed H_2O_2 abundances be adjusted for equivalent water vapor conditions. Our measurement of 18±4 ppbv for the 0-30 km H_2O_2 mixing ratio corresponds to water vapor column densities of 15-20 pr-?m for the 50S-20N latitude range and southern summer season (Ls.= 254°) of observation (Smith, 2002).

Figure 2: *The observed 362 GHz H_2O_2 absorption spectrum of Mars (solid line), which has been smoothed to an effective spectral resolution of 1 MHz. The line center offset of -2.45 MHz from zero is the Doppler shift associated with a Mars-Earth relative velocity at the (one week) post opposition period of observation. Synthetic spectra with equivalent 1 MHz spectral resolutions are calculated for Mars H_2O_2 abundances consistent with the Encrenaz et al. (2002) upper limit of 6 ppbv (square symbols) and a best-fit mixing ratio of 18 ppbv (asterisk symbols).*



This discovery of H_2O_2 in the Martian atmosphere appeared in the March issue of Icarus (2004, Icarus, v168, pp116-121) and was issued as a press release on March 1 2004. The release was picked up by a significant number of newspapers, as well as CBS radio. See here for links to some of the press coverage.

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Gerald Moriarty Schieven

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NEXT ISSUE DEADLINE

The deadline for submission of science and/or technical articles for the next issue of this Newsletter is **10 August 2004**. *Please consider submitting a short article/figure of your latest result from the JCMT!* All communications regarding this Newsletter should be sent via email to Gerald Schieven (**g.moriarty-schieven@jach.hawaii.edu**).

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THE LAST WORD

This issue (my ninth) marks the final one for me as editor of the JCMT Newsletter. I am not leaving the JAC (not yet), but it is time for new blood and new ideas for the old e-rag. I would like to thank everyone who provided articles, especially science articles, over the years; I hope all those twisted arms aren't quite so sore anymore. I hope also that the newsletter under my charge has been both informative and entertaining. Many thanks also for all the helpful comments and suggestions.

Gerald H. M. Schieven

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