IRAM Newsletter

Number 27 July 22, 1996

Calendar

September 9th, 1996: Deadline for the submission of observing proposals for the period Nov. 15, 1996 to May 15, 1997.

October 16-18th, 1996: Program Committee Meeting.

Contents

30m Telescope

New e-mail system at IRAM Granada

The e-mail system at IRAM Granada had to be changed. This was necessary because of a change of protocol in the Internet in Andalucia. Visitors to the 30m telescope can receive and send e-mail from the HP workstation `gra-ux1` in Granada (accessible from any computer at the telescope via `telnet gra-ux1`). The e-mail address for visiting astronomers at the 30m telescope is `visitor@iram.es`. Observers at the telescope can send messages from the visitor account on `gra-ux1` using the program `pine`.

Fast computer connection between Pico Veleta and Granada installed

A 2 Mbit/sec radio link has been installed connecting the computer networks at the telescope and in the Granada office. This link replaces the (slow and unreliable) modem connection and makes communication with the outside world faster and easier. Both the TCP/IP protocol (`telnet, ftp`) and DecNet protocol (`SET HOST`) are supported. This means that one can connect to other computers via telnet directly from any Vax or HP workstation at Pico Veleta.

However, connections to computers outside Spain may still be slow during the day. The bottle neck apparently is in Madrid, but there are plans to improve the situation.

Phase-coherent holography at the 30m telescope

In June, first tests with a new dedicated receiver for phase-coherent holography using the 39 GHz beacon signal from the ITALSAT satellite showed very promising results. A first high resolution map (128 x 128 pixels) of the telescope surface could be obtained. See the report by B. Lazareff on page 2.

Summer transport schedule

The road to the 30m telescope is open again. At some points as much as 4 meters of snow had to be removed. The following Table shows the transport times to and from the telescope during summer and autumn (as long as the road is open). If the transport times do not fit your observing schedule at all (*e.g.* observing run starting on a sunday evening), please contact IRAM Granada (Javier Lobato).

Transport to and from the observatory: Summer schedule* (typically May – Nov).

	Departure from Granada Office	Departure from the Telescope
Monday	08:15	10:30 and 17:00(1)
Tuesday	08:15	10:30 and 17:00
Wednesday	(2)	(2)
Thursday	10:00	16:00
Friday	08:15	10:30 and 17:00
Saturday	(2)	(2)
Sunday	(2)	(2)

* Subject to modification.
Note 1: Own transport at 17:00 in case an IRAM car is available.
Note 2: On Wednesday and the weekend no transport is foreseen, but an IRAM car may be available for those observers who know the way. Check first with IRAM Granada (Javier Lobato).

Wolfgang WILD

Coherent holography on the 30m Telescope

For several years, IRAM has been performing holographic measurements of the surface of the 30m telescope, and executing adjustments of the panels (actually, frames) in an effort to improve the surface accuracy and thereby increase the main-beam efficiency and decrease the uncontrolled signal pickup from the error beam.

The method used was the so-called phase retrieval method, where the essential phase information is not measured directly, but retrieved from two or more power pattern measurements performed with the telescope focussed and defocussed. The solution for the phase is obtained by an iterative algorithm.

After a period of significant progress in the early years of the telescope, the accuracy of the surface seems to have reached an asymptotic level of $70\mu m$ (rms, illumination weighted), while an analysis of the method's accuracy, both from theory and from then internal consistency of results, indicates that a measurement accuracy of $25\mu m$ should be obtained.

IRAM has therefore decided 18 months ago to perform measurements by the coherent holography method, where the phase of the signal collected by the main reflector is measured against that of a reference receiver looking directly at the satellite beacon (Italsat), which is radiating at 39 GHz, and is ideally located close to 45^o elevation.

The main contributors to this project were J. Lamb (project management, optics, sensitivity analysis, data acquisition), F. Matiocco (receiver construction), and D. Morris (data reduction), with support from a number of people of the Granada and Grenoble technical staffs.

The first field test took place at the end of June. The secondary mirror was dismounted and the dual receiver was installed at the prime focus. The electronic noise contributes less than 0.5^o rms to the phase noise, which is dominated by atmospheric fluctuations. Some time was spent to sort out interface problems in data acquisition, but eventually a quite promising map was obtained. For the first time a 128×128 map of the reflector was obtained, where individual panels can unambiguously be seen (see Fig. 1, where panel rings can be clearly seen, especially the test panel above and right of center).

A further test is scheduled in September, with several goals :

- reduce the sampling time to 1/4 or 1/8 sec, to observe a 128×128 map in two hours or less;
- track down and eliminate phase jumps occurring every 100s, so far of unknown origin;
- displace 4 panels by a mechanically known amount between two maps, and verify that this displacement is properly measured in the difference between the two maps.

Updates on this project will be given in forthcoming issues of the Newsletter.

Bernard LAZAREFF

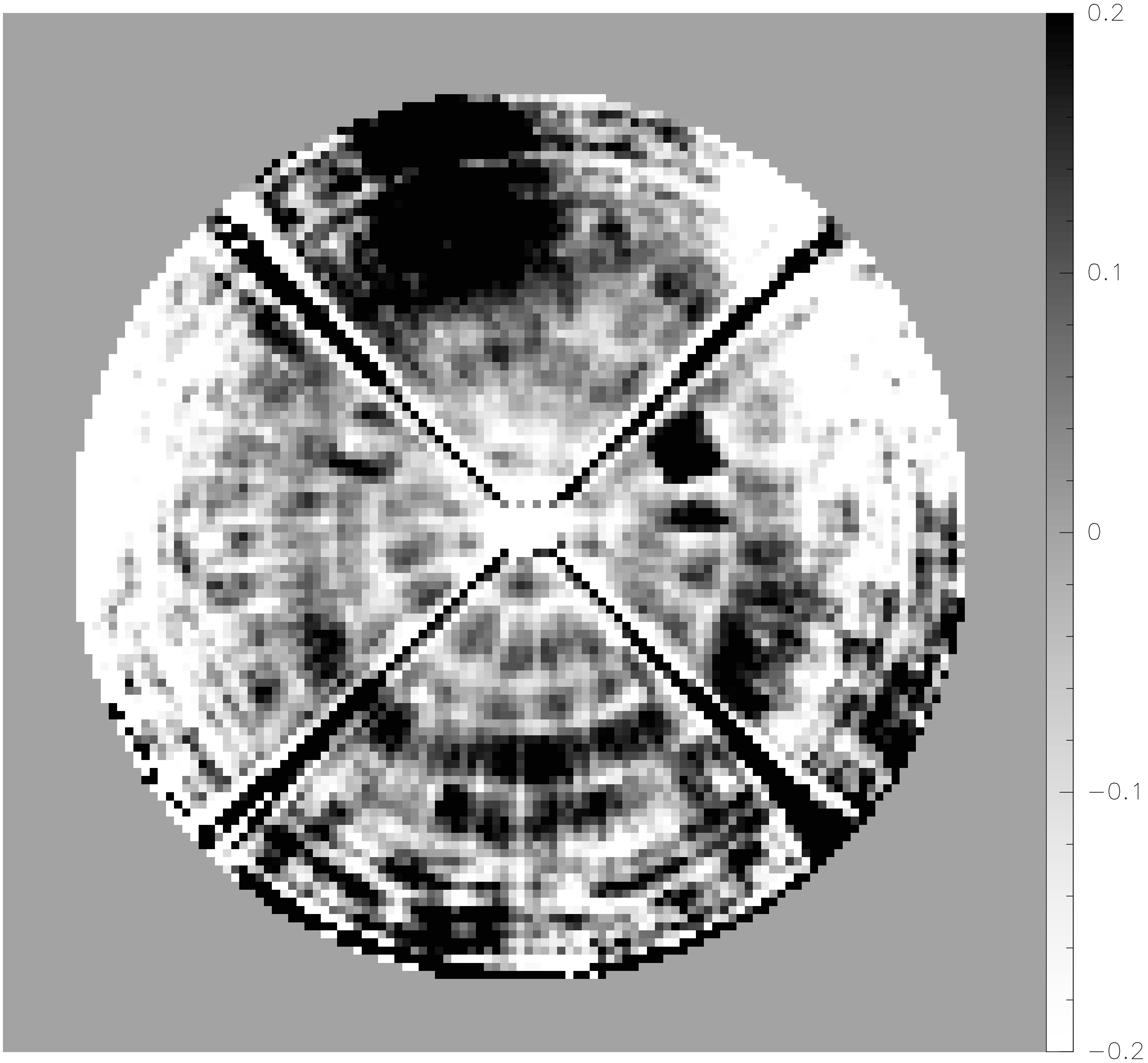

Figure 1: Grey-scale representation of the phase distribution across the aperture, obtained in June with the new coherent holography equipment. The map size is 128×128; this is the most detailed map of the 30m antenna obtained so far. The grey scale contrast has been set high to enhance details. Panel rings are clearly visible. The test panel, displaced on purpose, is visible above and to the right of the center.

Interferometer

Winter Experience

Last winter, the interferometer has been in long baselines configurations (A1 and A2) for longer than expected, because large amounts of snow prevented moving the antennas. As a result, the B1 and B2 configurations could only be scheduled relatively late during the spring, when weather conditions were not very favorable for 1.3mm projects.

Preliminary analysis of the very long baseline data (A-configurations) carried out in Jan-Feb indicates that sub-arcsec angular resolution was indeed achieved, with good phase stability even at 230 GHz on several projects (but unfortunately not all). Since such high angular resolution is very sensitive to weather conditions, we expect better results next winter due to the advent of antenna 5, which will allow long baselines observations to be carried out in a single configuration.

$1.5''$ resolution at 230 GHz (CD array) was routinely achieved during this winter, even on relatively "low" declination sources.

The "active" phase correction system has been useless in winter (the weather was too good !), but became very useful in the spring. Software has been written to optimize its use, and is now available in the standard CLIC package.

Major Changes

The interferometer has been stopped on mid-May for major changes:

- *New Central Computer System*
  All the CAMAC based instrumentation and the VAX computers have been decommissioned. Two Unix-based HP-J200 workstations (one for real-time control and acquisition, one for data reduction which could be used as a backup for the real-time computer) have replaced the VAXes as central computers.
- *New VME-based Pointing Control System*
  Antenna 5 is equipped with a VME-based interface for azimuth and elevation pointing and tracking, as well as for control of the transporter functions. Antennas 1–4, which were originally equipped with CAMAC, have been retrofitted with a similar equipment for pointing and tracking, but the transporter functions have to be operated under manual supervision.

  VME microcomputers in each antenna interact with the HP workstation through an Ethernet link. They receive time information and astronomical coordinates from the central computer, process them to Az/El and supervise the tracking of the source.
- *New IF/LO distribution system*
  To handle one additional antenna, the IF/LO distribution system has been completely dismantled and rebuilt. The new system is ready for 6 antennas.
- *New 5-antenna correlator*
  The 4-antenna correlator has been totally upgraded to handle 5 antennas, with no loss of capabilities. The modification was a major one, since it represents a 60% increase in processing power. Yet, essentially all the original components of the 4-antenna correlator have been re-used.

  The new correlator is equipped with faster microcomputers, and allows atmospheric phase correction at all operating modes.
- *Totally New Acquisition and Control software*
  All the hardware changes have implied to completely re-write the control and acquisition software. Debugging and testing of the software has been actively going on since early June.

  The software is now available for normal operation, but some improvements expected from the faster computing system still remain to be implemented.
- *Commissioning of Antenna 5*
  Antenna 5 is now completed, and has been brought outside for testing. First fringes with 5 antennas were obtained on June 15th. After some pointing tests, an initial adjustment of the surface was attempted. However, since weather conditions were not at their best and also because of the necessity to progress on the software tests, the antenna has so far only be adjusted for operation at 3mm.

  The pointing accuracy is currently of order $4\text{-}5''$ rms, somewhat poorer than for the other antennas, and work is going on to understand the causes of the discrepancy. Antenna efficiency at 3mm is about 24 Jy/K (as compared to 22 Jy/K) for the others). Further surface adjustment will be attempted, but may have to be deferred to next September.
- *New Power Generators*
  New Diesel generators have been installed to match the increase in power required by antenna 5. Recabling of the power distribution of the backend room was also required for the new correlator and computers.

After this very intense activity on the site, the interferometer is now almost ready for normal observations. However, some additional test time will be devoted to the pointing and surface adjustment of antenna 5.

Antenna Maintenance

Antenna 3 was in the hall during the second part of June for major maintenance (specially on the boggies of the transporter), and has now been replaced in the hall by

Antenna 2. Lighter maintenance will be done on antenna 4 by the end of July. Antenna 1 also requires a major maintenance. This will include a new equipment for the control of the antenna transport, which will be interfaced with the VME computer as in antenna 5. This equipment requires major re-cabling (2-3 weeks of work). Antennas 2-3-4 will be similarly upgraded next year.

Observing Projects

38 projects (some proposals correspond to more than one project), were discussed by the last program committee, for a scheduling period starting May 15, 1996, to Nov, 15, 1996. The recommendations are:

Project Status
(A: Accepted, B: Backup if available time, C: Rejected):

Project	Rate	Project	Rate	Project	Rate
G001	C	G002	B	G003	B
G004	A	G005	A	G006	C
G007	B	G008	B	G009	A
G010	A	G011	C	G012	A
G013	A	G014	A	G015	C
G016	A	G017	B	G008	B
G019	C	G020	B	G021	C
G022	C	G023	B	G024	C
G025	A	G026	A	G027	A
G028	C	G029	A	G030	A
G031	B	G032	A	G033	B
G034	A	G035	B	G036	B
G037	B	G038	C		

The A programs will be scheduled in priority. Further time, if it becomes available, will go to the B programs, taking into account scientific merit, crowding in certain right ascension ranges and general aspect of balance. B proposals will only be started in case of available observing time.

B projects which cannot be started will no longer be automatically resubmitted: authors have to resubmit them explicitely.

Because of the major changes induced by the commissioning of antenna 5 on Plateau de Bure, B projects are unlikely to be started. Please resubmit them, unless you have been explicitely notified of their completion. Please refer to the "Call for Proposals" for details.

Stéphane GUILLOTEAU

Call for Observing Proposals on the 30m Telescope

The *next deadline* for the submission of observing proposals for the IRAM 30 m telescope is September 9th, 1996, midnight (24 h). The observing session will extend from Nov. 15, 1996 to May 15, 1997 and cover roughly the 'winter' period at Pico Veleta. Three types of proposals will be considered:

i) proposals at 3 mm, 2 mm and 1.2–1.3 mm wavelength using heterodyne receivers,

ii) proposals at 0.8 mm wavelength using a heterodyne receiver,

iii) proposals at 1.3 mm wavelength using a bolometer. The bolometer will be a 19 channel array belonging to the MPIfR.

Roughly 3000 hours of observing time will be available, which should allow scheduling of several time consuming (e.g. 90–150 h) programmes with emphasis on 1.3 mm observations.

The 30-m telescope efficiency is low at 0.8 mm ($B_{\mathrm{eff}} \simeq 17\%$) and the power radiated in the error beam twice larger than in the main beam. Pointing can also be marginal at this short wavelength in case the atmosphere is unstable.The 0.8 mm proposals should discuss the effect of the error beam and of pointing errors on their observations.

Please, find below some relevant information.

News

The 19-channel MPIfR bolometer, which was installed last winter on the 30-m telescope, will again be available this winter, presumably between December and March. This receiver showed excellent performance during last year's observing run.

The On-the-Fly observing mode (OTF) is implemented for heterodyne observations (still with some limitations concerning data acquisition rate and reduction). In this mode, the telescope beam drifts continuously across the source, while data are dumped every 1s (or 2 s, depending on the number of frequency channels). Any scanning direction can be chosen and successive scans can be concatenated to make a map (like in the bolometer 'mapping' mode). Individual drift scans can have any length; they are interleaved with OFF source reference subscans of any duration. This mode ensures a better homogeneity of the data and can make a much more efficient use of observing time.

Up to 4 receivers can be used simultaneously for OTF observations. The backends can be the filter banks and/or the autocorrelators. OTF observations were carried out successfully since December 1995 on several programs. The large acquisition rate causes data storage and handling problems: although a new version of CLASS has been developed, the software is not yet user-friendly and remains experimental. Because of these shortcomings, the OTF observing mode is still restricted to programs involving an astronomer of the IRAM-Granada team, who should be responsible for the technical aspects and for the data reduction. Please contact Drs. H. Ungerechts (ungerech@iram.es) or W. Wild (wild@iram.es) at IRAM-Granada well before the deadline for more information.

Reminders

Frequency switching is possible. It yields satisfactory baselines within certain limitations (maximum frequency throw of 45 km/s, backends, phase times etc.; for details see [8]). Up to 3 receivers (e.g. 3mm1, 230G1 and 2mm) can be frequency switched simultaneously. Baselines may be better when using one single receiver.

An instantaneous IF bandwidth of 1 GHz is available for the 230G2 receiver. The two 1 MHz filter banks (512 MHz each) can be combined to provide 1 GHz bandwidth. The use of the 1 GHz wide filter bank excludes the simultaneous use of any other backend with the 230G2 receiver (the other receivers are not affected).

Many proposals underestimate the observing time needed to carry out the programme, even under excellent weather conditions. We ask you to pay special attention to this matter *as time underestimation is now a major criterion for proposal rejection.*

A handbook collecting most of the information necessary to plan 30-m telescope observations is available [10].

Finally, to help us keeping up a computerized source list, we ask you to fill in your 'list of objects' as explained below.

Applications

Your applications should be addressed as usual to:

IRAM Scientific Secretariat,
300 rue de la piscine,
F-38406 St Martin d'Hères, France.

All proposals must reach the Secretariat before September 9th, 1996, midnight. (Proposals sent by Fax will be accepted, provided they arrive by that time in a readable form; Fax (33) 76 42 54 69). Except for a duplicate of the source list (see below), no proposal should be sent by e-mail. You (i.e. the Principal Investigator) will receive by return mail an acknowledgement of reception and a proposal number.

To avoid the allocation of several numbers per proposal, send *only one* copy of your proposal, either by mail or by fax. In case your fax reaches us in time, but incomplete or unreadable, we will try our best to contact you (your responsibility, however).

Your proposal will only be evaluated if submitted in the correct format (these forms are available by anonymous ftp from `iram.fr` in directory `dist/proposal`, as well as a Latex style file `proposal.sty`; or with the World Wide Web at URL `http://iram.fr/`). *Do not use characters smaller than 11pt*, which would make your proposal unreadable if we had to fax it to the members of the P.C.

On the title page, you must fill out the line 'special requirements' if you request the polarimeter, 'service observing', or specific dates for time dependent observations (if there are periods when you cannot observe for personal reasons, please specify them here; beware, however, that they could be a motive for proposal rejection!).

We *insist* upon receiving, with proposals for heterodyne receivers, a complete list of frequencies *corrected* for source red shift (to 0.1 GHz, unless your frequencies are confidential). You should specify which receivers you plan to use. *Note that the use of the 2 mm receiver prevents the use of 3mm2 and 230G2, which, otherwise, can be used in parallel with receiver 3mm1 and 230G1 (see below).*

In order to avoid useless duplication of observations and to protect already accepted proposals, we keep up a computerized list of targets. We ask you to fill out carefully your source list. This list must imperatively contain *all the sources (and only those sources)* for which you request observing time. To allow electronic scanning of your source parameters, your list must be typed or printed following the format indicated on the proposal form (please, *do not hand write*). If your source list is long (e.g. more than 15 sources) you may print it on a separate page, *keeping the same format.*

The scientific aims of the proposed programme should be explained in 2 pages of text *maximum*, plus one page of figures and tables. Proposals should be self-explanatory, clearly state these aims, and explain the need of the 30m telescope. The amount of time requested should be carefully estimated and justified (see below); it should include pointing, focussing, and calibration checks and allow for receiver tunings (on average 20 min. per receiver).

A scientific project should not be artificially cut into several small projects but should rather be submitted as one bigger project, even if this means 100–150 hrs.

If time has already been given to one project but turned out to be insufficient, explain the reasons, e.g. indicate the amount of time lost due to bad weather or equipment failure; if the fraction of time lost is close to 100%, don't rewrite the proposal, except for an introductory paragraph. For continuation of proposals having led to publications, please give references to the latter. *In all cases, indicate on the first page whether your proposal is (or is not) the resubmission or the continuation of a previously submitted 30 m telescope proposal.*

Observing time estimates

Observing time estimates must take into account:

- receiver tunings (for heterodyne observations),
- pointing, focus, continuum and line calibrations (be aware that receiver alignment corrections, if needed,

will eventually be counted against your observing time),

- telescope motions when changing sources as well as dead times due to telescope motion and/or data writing between ON and OFF subscans,
- integration time on source and comparison field(s).

The total integration time should be derived using the standard formula:

$$\Delta T_{MB} = \frac{\eta_{\rm F}}{\eta_{\rm B}} \frac{2T_{\rm sys}}{\sqrt{Bt}}$$

where $\eta_{\rm F}$ and $\eta_{\rm B}$ are the telescope forward and main beam efficiencies, $T_{\rm sys}$ is the system temperature above the atmosphere (in the antenna temperature scale), B the channel noise bandwidth, and t the total (ON + OFF) integration time. $T_{\rm sys}$ should be estimated for an 'average' winter humidity for 3mm, 2mm and 1.3mm observations (4 mm of precipitable water, or $\tau_{\rm zenith} = 0.3$ at 230 GHz) and for 'good' winter conditions (1.5 mm of water, or $\tau_{\rm zenith} = 0.3$ at 345 GHz) for 0.8 mm observations.

We ask you to specify in your proposal the parameter values ($T_{\rm sys}, \Delta T_{MB}, B$, total integration time, overheads and dead times) adopted in your calculation of the needed telescope time.

A technical report explaining how to estimate the telescope time needed to reach a given sensitivity level in various modes of observation was published in the January 1995 issue of the IRAM Newsletter [9] [1]. It has been included in the 30-m telescope Manual [10]. *You are asked to follow the guidelines given in this report (or to justify particular requirements) in your proposal.*

Service observing

To facilitate the execution of short (≤8 h) programmes, we propose "service observing" for some easy to observe (e.g. short, single source) programmes *with only one set of tunings.* Observations are made by the local staff. This is a passive way of observing, no direct interaction with the telescope through OBS being possible. For this type of observation, we request an acknowledgement of the IRAM staff member's help in the forthcoming publication. Please, if you are interested by this mode of observing, specify it as a "special requirement" in the proposal form (IRAM will decide which proposals will actually go to that mode).

Programmes accepted for the May 1996 – Nov. 1996 period

A total of 125 proposals were submitted for the deadline of March 1996. 51 proposals were rated "A", 35 "B", the others "C" or "D". All the "A" and about half of the "B" programmes will actually get time on the telescope, some, however, with less time than requested. The telescope schedule is made until end of August; the programme PIs have been or are being notified.

Principal Investigators of accepted proposals receive with the telescope schedule a *Confirmation of Observing Time* form which we ask you to return, properly filled, by Fax to IRAM Granada *and* IRAM Grenoble (Scientific Secretariat, Fax (33) 76 42 54 69, attention Mrs. C. Berjaud). The list of frequencies to be observed (normally, the same as in the proposal) should arrive in Granada at least two weeks in advance. It is also only after we receive your confirmation in Grenoble that we will send out duly signed mission forms to those of you entitled to travel reimbursement.

If you have questions, please contact Mrs. C. Berjaud at IRAM Grenoble.

Relevant Information about the 30 m Telescope

(Please, see additional information in the IRAM Newsletters and in the internal reports listed below).

Receivers

The IF bandwidth of all heterodyne receivers is 500 MHz, except for 230G2 which, coupled to the 1MHz filter bank, has a 1 GHz bandwidth. The following table lists the present possible receiver combinations:

	Receiver Combinations				
Receivers	4-rec	3-rec		2/1-rec	
3mm1	*	*			
3mm2	*		*		
2mm		*		*	
230G1	*	*			
230G2	*		*		
0.8mm SIS			*	*	
Bolo					*

The second 3 mm receiver (3mm2) can be used simultaneously with the 3mm1 receiver and the 230G1 with a high efficiency. Four receiver operation (3mm1+3mm2+230G1+230G2) is possible, but it results in a significant increase in the noise of 230G2.

3 mm SIS receivers

The tuning band of the 3mm1 receiver is 81 – 116 GHz; its receiver temperature is between 100 and 140 K, the image side band rejection is between 25 dB and 30 dB. The tuning band of the 3mm2 receiver is 82 – 116 GHz; its receiver temperature is between 70 and 90 K with the same range of image side band rejection.

[1] electronically available by anonymous ftp at `iram.fr`, directory `dist/newsletter/jan95`, or via the WWW au URL `http://iram.fr/newsletter/`

The high rejection of the USB improves the system temperature and the calibration accuracy, particularly for 115 GHz observations, for which the receiver image side band sees the bright oxygen 118.75 GHz atmospheric line.

It is important to check your calibration on strong reference sources (see IRAM line catalog and updates). Beware also of possible interference between the 'second' 1.3 mm receiver, 230G2, and this receiver when operating at harmonic frequencies (the two receivers receive the same polarization; the interference will be a strong and narrow line).

3mm1 is also used as the standard pointing receiver.

2 mm Receiver

Good and reliable performance over most of the band. Tunable from 129 GHz to 183 GHz with SSB; receiver temperatures of 70 to 150 K (130 to 155 GHz), and 150 to 400 K (155 to 183 GHz).

1.3 mm Receivers

- 230G1: Operating band: 203.4 – 246 GHz. The SSB receiver temperature is 100 – 180 K in the standard reference plane.
- 230G2: The SSB receiver temperature over the nominal tuning range (210–250 GHz) is 100–130 K in the standard reference plane. The upper side band can be rejected by typically $\gtrsim 16$ dB over this range. This receiver can be tuned to 267 GHz, although with a higher noise temperature ($T_{\rm SSB} \sim 600$ K). See the March 1994 Newsletter for more details.

0.8 mm Receiver

The IRAM 345 GHz SIS receiver will be made available for a limited period of time. Its performances are:

Operating band: 330 GHz - 360 GHz, DSB receiver temperature= 100–120 (up to 345 GHz) , 130– 150 K above, Feff= 0.8, Beff=0.17. This receiver works only in DSB mode with an IF of 1.5 GHz. It can be operated either alone or, with some extra losses (+50% in the reference plane), simultaneously with 230G2 and 3mm2.

interferences, error beam

Beware of possible interference of the 230G2 LO into the 3 mm receivers. *The 230G2 receiver cannot be operated with the 2 mm receiver*, since both receivers use the same control box and polarization. Switching from one receiver to the other is not straightforward. Please specify in the proposal form whether you choose to use the 2 mm receiver or 230G2.

At 1.3 mm (and *a fortiori* at shorter wavelengths) a large fraction of the receiver radiation pattern is distributed in an error beam (which can be approximated by two Gaussians of HPW $\simeq 170''$ and $800''$ — see A&A 274, p.144-146 for more details). Astronomers should take into account this error beam when converting antenna temperatures into brightness temperatures. The effect is particularly important at 0.8 mm, where the power radiated in the 'first' error beam $FWHP \simeq 120''$ is twice larger than in the main beam.

The MPIfR Bolometer array

The 19-channel MPIfR bolometer array which was installed at the telescope in February 1996 will be again available this winter. The horns are located at the center and on the sides of two concentric hexagons with beam spacings $\simeq 20''$. Each channel has a sensitivity of $\simeq 70$ mJy s$^{1/2}$ under good weather conditions and a HPBW of $11''$.

The bolometer will normally be operated by wobbling at 2 Hz the secondary mirror in azimuth. As the array if fixed in Nasmyth coordinates, the orientation of the 19 beams with respect to the sky and to the chopping direction changes with elevation. Special software is made available at the telescope for data reduction (NIC [11] and MOPS [12]).

Polarimeter

A polarimeter has been constructed by IRAM for measurements of *circular* polarization. It has been used on the telescope (see e.g. the March 1994 issue of the IRAM Newsletter). The main technical features of the polarimeter are briefly described below.

The polarimeter consists of a dielectric quarter-wave plate working in transmission. It is rotated between two positions at $\pm 45^o$ by a motor, the switching time is $\simeq 0.3s$, and the phase time is adjustable. From the point of view of data acquisition, it functions like other switching devices, i.e. the chopper or the wobbler, and the *difference* between the RCP and LCP intensities is acquired.

The present quarter-wave plate has been designed for 113.3 GHz. Its transmission loss is $\simeq 2\%$, and its cross-polarization below 20 dB. Similar plates could be fabricated for other frequencies if needed. Proposals for projects requiring the polarimeter can be submitted. They should clearly state the degree of technical performance that they demand. Besides the scientific evaluation, the acceptance and scheduling of such proposals will depend on their feasibility as judged from their requirements.

General point about receiver operations

We urge observers to restrict their frequency lists as much as possible and to send them early to Granada and Grenoble. For late arrivals (less than 2 weeks in advance), or a large number of frequencies, there is no guarantee for a prior test of the requested tunings.

Backends

There are 4 types of spectral line backends which can be individually connected to any receiver.

- The 1MHz filterbank, consisting of 4 units with 256 MHz each. The units can be connected to different or the same receivers (giving bandwidths between 256 MHz and 1024 MHz, the latter only usable with 230G2). For example, two receivers could use 512 MHz each, or four receivers 256 MHz each, or combinations. Each unit can be shifted by steps of 32 MHz relative to the center frequency of the connected receiver. If all four units are combined to 1024 MHz and connected to 230G2, no other backend can be connected to 230G2."
- The 100kHz filter bank, consisting of 256 channels of 100 kHz (splittable into two halves movable inside the 500 MHz instantaneous bandwidth, and connectable to two different receivers)
- The autocorrelator: The software treats the autocorrelator as one unit although physically it consists of two identical machines. The following numbers are to be understood for the complete autocorrelator setup. Available resolutions are 10, 20, 40, 80, 320 and 1250 kHz. The bandwidth is between 20 MHz and 2×512 MHz, depending on resolution. The correlator can be split into 8 independent subbands, each of which can be configured individually and connected to the same or different receivers. For the larger bandwidths (i.e. more than one subband of 80 MHz) a problem of platforming may exist (i.e. baselines from the different subbands have slightly different levels).

Pointing / Focussing

Pointing sessions are made every one to two weeks; at present, the fitted pointing parameters yield an absolute pointing accuracy better than $3''$ (r.m.s.). We also try to keep the receivers as closely aligned as possible (to about $2''$, however, alignment can be lost occasionally). Checking the pointing, focus, and receiver alignment is the responsibility of the observers (use a planet for alignment checks). Note that 230 G2 and 230 G1 have foci differing by 0.4 mm. Using both receivers, you should carefully monitor the focus and choose a compromise value. Not doing so may result in broadened beams (e.g. HPW $15''$ and non-gaussian beams on one receiver [1]).

Wobbler

- Beam-throw: from 0 to $240''$ on either side of the source (avoid small amplitudes for line work).
- Standard phase duration: 2 s for spectral line observations.

References

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[2] A Small Users' Guide to NOD2 at the 30m telescope A. Sievers (Feb. 1993)

[3] Thermal behaviour of mm-wavelength radio telescopes
A. Greve, M. Dan, J. Penalver 1992 (IRAM report 233)

[4] Interferometric measurement of tropospheric phase fluctuations at 86 GHz
L. Olmi, D. Downes 1992 (IRAM report 238)

[5] Thermal design and thermal behaviour of Radio Telescope structures
A. Greve 1992 (IRAM report 253)

[6] Astigmatism in reflector antennas: measurement and correction
A. Greve, B. LeFloch, D. Morris, H. Hein, S. Navarro 1993 (IRAM report 289)

[7] Design parameters and measured performance of the IRAM 30-m millimeter radio telescope
J. Baars, A. Greve, H. Hein, D. Morris, J. Penalver, C. Thum 1993 (IRAM report 298).

[8] Frequency switching at the 30m telescope
C. Thum, A. Sievers, S. Navarro, W. Brunswig, J. Peñalver 1995, IRAM Tech. Report 228/95.

[9] Cookbook formulae for estimating observing times at the 30m telescope
M. Guélin, C. Kramer, W. Wild (IRAM Newsletter January 1995)

[10] The 30m Manual: A Handbook for the 30m Telescope W. Wild 1995, IRAM Tech. Report 377/95, also available on WWW pages.

[11] NIC: Bolometer User's Guide
D. Broguiere, R. Neri, A. Sievers 1996, IRAM Tech. Report.

[12] Pocket Cookbook for MOPS software
R. Zylka 1996.

These reports are available upon request (see also previous Newsletters). Please write to Mrs. C. Berjaud, IRAM Grenoble.

Michel GUÉLIN, Wolfgang WILD

Call for Observing Proposals on the Plateau de Bure Interferometer

Observing proposals are invited for the IRAM Plateau de Bure Interferometer (PdBI), for the period Nov. 15, 1996 to May 15, 1997. The deadline for applications is September 9th, 1996. The available frequency range will be 82 GHz to 116 GHz for the 3mm band, and 210-245 GHz for the 1.3 mm band.

Details of the PdBI and the observing procedures are given in the document "An Introduction to the IRAM Plateau de Bure Interferometer" (copies can be obtained from the address below, or from Internet via the World-Wide-Web and NCSA-Mosaic softwares; use IRAM's home page `http://iram.fr/www/iram.html`). Proposers should read this document carefully before submitting any proposal.

Proposals should be sent to

IRAM Scientific Secretariat
Interferometer Observing Proposal
300 Rue de la Piscine
F-38406 Saint Martin d'Hères Cedex
FRANCE

IRAM expects to schedule and complete between 30 to 50 projects in this period, with an elapsed time of at least two months between start and end of any given project. Selection will be based on scientific merit, technical feasibility, and adequacy to the instrument.

For this call for proposal, please note the following:

Proposal Category Proposals should be submitted for one of the 4 categories defined below:

Category 1: Proposals that ask for 3mm data ONLY. 1.3 mm receivers can still be used to provide either phase stability information or purely qualitative information such as the mere existence of fringes. The maximum available baseline length will be about 300 m.

Category 2: Proposals that ask for 1.3mm data ONLY. 3mm receivers will be used for pointing and calibration purposes, but cannot provide any imaging. The maximum available baseline length will be about 200 m.

Category 3: Proposals that ask for dual-frequency observations. The maximum available baseline length will be about 200 m.

Category 4:
Exploratory proposals] Proposals whose scientific interest justifies the attempt to use the PdB array beyond its guaranteed capabilities. This category includes for example long baseline observations (A array at 3mm, B array at 1.3mm), non standard frequencies for which tuning cannot be guaranteed, and more generally all non standard observations. These proposals will be carried out on a "best effort" basis.

The proposal category will have to be specified *on the proposal cover sheet*, and should be carefully considered by proposers.

Backup Projects for the May-Nov period Because of Antenna 5 commissioning and heavy antenna maintenance, backup projects for the last period have very little chances of being scheduled. We urge proposers to re-submit them unless they have explicitly been notified of their effective scheduling.

Configurations Because of the advent of antenna 5, configurations have changed. The configurations now include:

5 Antenna configurations	
Name	Stations
D	W05 W00 E03 N05 N09
C1	W05 W01 E10 N07 N13
C2	W12 W09 E10 N05 N15
B1	W12 E18 E23 N13 N20
B2	W23 W12 E12 N17 N29
A	W27 W23 E16 E24 N29

With 5 antennas, the following configuration sets are available:

Set	Configs	Main purpose
D	D	"Low" resolution at 1.3 mm
CD	D, C2 or C1	3.5″ resolution at 3mm, 1.8″ resolution at 1.3 mm
CC	C1, C2	Slightly higher resolution than CD.
BC	B1, C2	2″ resolution at 3 mm
BB	B1, B2, C2	Better sensitivity than BC
AB	A, B1, B2	1″ resolution at 3 mm, 0.5″ resolution at 1.3mm

There is a possibility of choice between CD and CC arrays when the C2 configuration has been performed for sources in which the resolution choice is unclear. At a higher resolution level, a similar choice between CC and BC or BB is possible.

1.3 mm band All antennas are now equipped with fully operational dual frequency receivers. Experience of the last winter shows that 1.8″ can be easily reached (CD array). Sub-arc-second resolution has been obtained on a few projects, but cannot be guaranteed.

Note that the field of view at 1.3 mm is very restricted (about 20″).

Atmospheric Phase Compensation Software is available to provide real-time atmospheric phase compensation on spectral and continuum data, as well as a-posteriori processing for continuum data. Experiences with antenna 1-4 show a final phase noise below 30 degrees at 230 GHz under good circumstances. However, the performance of antenna 5 has not yet been checked for this purpose.

Dual-frequency operation The 3mm and 1.3mm receivers are aligned to within about $2''$.

Signal to Noise The rms noise can be computed from

$$\sigma = \frac{J_{\rm pK} T_{\rm SYS}}{\eta\sqrt{N_{\rm a}(N_{\rm a}-1)N_{\rm c}TB}} \qquad (1)$$

where

- $T_{\rm SYS}$ is the system temperature in T_r^* scale (150 K below 110 GHz, 300 K at 115 GHz, 500 K at 230 GHz)
- $J_{\rm pK}$ is the conversion factor from Kelvin to Jansky (30 at 3mm, 50 at 1.3mm)
- η is an efficiency factor due to atmospheric phase noise (0.9 at 3 mm, 0.6 at 1.3 mm)
- $N_{\rm a}$ is the number of antennas (5), and $N_{\rm c}$ is the basic number of configurations (with 5 antennas 1 for D, 2 for CD, 3 for BC)
  item T is the integration time per configuration in seconds (3 to 8 hours, depending on source declination)
- B is the channel bandwidth in Hz (500 MHz for continuum, 40 kHz to 2.5 MHz for spectral line, according to spectral correlator setup)

Receivers Below 110 GHz, receivers offer best performances in LSB tuning with high rejection (20 dB): expected system temperatures are (in $T_{\rm R}^*$ scale) 100 to 150 K for the winter time. Above 110 GHz, best performances are obtained with USB tuning, low rejection (4 to 6 dB): expected system temperatures are 250 K at 115 GHz. DSB tuning is possible over the whole frequency range, but the system temperature may degrade significantly.

The 1.3 mm receivers give DSB tuning with typical $T_{\rm REC}$ below 50 K. Expected SSB system temperature are 250 to 350 K. However a relatively narrow resonance significantly degrades the performances near 245 GHz. The guaranteed tuning range is 210-245 GHz, but it may be possible to reach lower frequencies for specific cases. Higher frequencies are not feasible because of limitations in the triplers.

Coordinates and Velocities The interferometer operates in the J2000.0 system. For best positioning accuracy, source coordinates *must* be in the J2000.0 system; position errors up to $0.3''$ may occur otherwise.

Please do not forget to specify LSR velocities for the sources. For pure continuum projects, the "special" velocity `NULL` (no Doppler tracking) can be used.

Coordinates and velocities in the proposal MUST BE CORRECT: A coordinate error is a potential cause for proposal rejection.

Correlator: The correlator has 6 independent units, each being tunable anywhere in the 110-610 MHz band, and providing 4 choices of bandwidth/channel configuration: 160 MHz/64, 80 MHz/128, 40 MHz/256 and 20 MHz/256. For the 40, 80 and 160 MHz bandwidth, the two central channels may be perturbed by the Gibbs phenomenon (depending on continuum strength): it is recommended to avoid centering the most important part of the lines in the middle of the band of the correlator unit.

The 6 units can be independently placed either on IF1 (3 mm receiver) or on IF2 (1.3 mm receiver).

40 kHz resolution: One (and *only one*) of the 6 units has been retrofitted to offer a higher frequency resolution (40 kHz instead of 80 kHz). This is obtained by operating at half clock speed and inserting an anti-aliasing filter of effective bandwidth 8 MHz. Because the filter reduces the input power to the sampler, this unit should be placed near the maximum amplitude of the IF bandpass: band edges must be avoided.

Sun Avoidance: For safety reasons, the sun avoidance circle has been extended to 45 degrees. Please take this into account for your sources *and* for the calibrators.

Mosaics The PdBI has mosaicing capabilities, but the pointing accuracy may be a limiting factor at the highest frequencies. Please contact S.Guilloteau in case of doubts.

Data reduction Proposers should be aware of constraints for data reduction:

- In general, data will be reduced **in Grenoble**. Proposers will not come for the observations, but will have to come for the reduction.
- We keep the data reduction schedule very flexible, but wish to avoid the presence of more than 2 groups at the same time in Grenoble. Please contact us in advance.
- IRAM may consider splitting the data reduction in two phases: intermediate calibration and final mapping. Such a splitting is often necessary for the high resolution images. In such a case, the proposers must be ready to come at IRAM for fast data reduction of the "compact" configurations.
- CLIC is still evolving fast to cope with the evolution of the PdBI array. The newer versions are upward compatible with the previous releases, but the reverse is not true. Observers wanting to finish data reduction at their home institute should obtain an updated version of CLIC, which is now

available. Because differences between CLIC versions may potentially result in imaging errors if new data is reduced with an old package, we insist that observers having a copy of CLIC take special care in maintaining it up-to-date.

Data reduction will be carried out on the dedicated HP workstations.

Local contact: Depending upon the program complexity, IRAM may require an in-house collaborator instead of the normal local contact.

Technical pre-screening: All proposals will be reviewed for technical feasibility in parallel to being sent to the members of the program committee. Please help in this task by submitting technically precise proposals. Scientific justification should be kept within 2 pages. Note that your proposal must be complete and exact: **velocities, position and frequency setup must be exactly specified**.

Non-standard observations:
Please contact S.Guilloteau in case of doubt about non-standard program feasibility.

- An Introduction to the IRAM Plateau de Bure Interferometer.
- IRAM Plateau de Bure Interferometer: Calibration CookBook.
- IRAM Plateau de Bure Interferometer: Mapping CookBook.
- IRAM Plateau de Bure Interferometer: Frequency Setup.
- CLIC: Continuum and Line Interferometer Calibration.

More specialized documents are also available; they are intended for observers on the site (IRAM on-duty astronomers, operators, or observers with non-standard programs):

- IRAM Plateau de Bure Interferometer: OBS Users Guide.
- IRAM Plateau de Bure Interferometer: Amplitude Calibration.
- IRAM Plateau de Bure Interferometer: Flux Measurements.
- IRAM Plateau de Bure Interferometer: Pointing Parameters.
- IRAM Plateau de Bure Interferometer: Trouble Shooting Guide.

All documents can be retrieved on Internet via the World-Wide-Web. IRAM's home page is `http://iram.fr/`

Finally, we would like to stress again the importance of the quality of the observing proposal. The technical preparation of observing proposals is unfortunately often insufficient. In the past, proposals were received which did not even include exact observing frequencies or even source coordinates, or worse, with coordinates with the wrong epoch !... The IRAM interferometer is a powerful, but complex and unique instrument, and proposal preparation requires special care. Information is available in the documentation, and the IRAM staff can help in case of doubts if contacted well before the deadline. Note that the proposal should not only justify the scientific interest, but also demonstrate how the Plateau de Bure interferometer will bring new information.

Stéphane GUILLOTEAU

Report on the first IRAM Key Project: Small–Scale Structure of Pre-Star Forming Regions.

This project is devoted to the analysis of the processes which drive the dissipation of the supersonic non–thermal support of molecular clouds, known to be at the origin of their gravitational stability. One of the outcomes of this energy dissipation is expected to be the formation of thermally supported structures. The formation of dense cores, observed in molecular clouds with an internal velocity dispersion close to thermal, and often associated with extremely young stellar sources, is possibly triggered by the local dissipation of supersonic turbulence.

We have therefore mapped several fields of nearby clouds (d< 150pc) which all contain a starless dense core of small internal velocity dispersion. The maps include the core (of size ~ 0.1 pc) or a fraction of it, and extend over a large area (several arc minutes, or several tenths of pc) of their environment, characterized by a non–thermal velocity dispersion. Maps have been completed in five transitions, ^{12}COJ=1–0 and J=2–1, ^{13}CO J=1–0 and J=2–1 and C^{18}OJ=1–0, at high angular resolution (13" and 24" at high and low frequency respectively, with a sampling of 7.5" which is Nyquist sampling for the low frequency maps) and a velocity resolution of 0.05 km s^{-1}. The spatial resolution of the high frequency maps is therefore $\sim$ 1000 AU.

Between December 1992 and March 1994, 624 hours were scheduled for this project. It was also scheduled as a backup project of the 345GHz receiver run of January 1994 (237 hours) but the efficiency of this period was quite low since only 39.7 hours were used. A total of 338 hours were spent in effective observations. 322 hours were lost for bad weather or zenith optical depth at 230GHz larger than 0.4, and technical reasons. But 92% of this time was lost for bad weather conditions: it means that the weather at Pico veleta degrades very fast and that the limit set on τ(230 GHz) was not a real constraint (either τ(230 GHz)$<$ 0.4 or τ(230 GHz)$>>$ 0.4). On the average, the time spent on the telescope has been twice the observing time, the additional overhead within this observing time due to calibration and tuning of the receivers being 30%.

The data base consists in 2.7 $\times 10^4$ spectra. The final baseline rms noise level ranges between 0.6 and 1.2 K for the ^{12}COJ=1–0 spectra, 0.5 and 0.9 K for the ^{12}COJ=2–1 spectra, 0.3 and 0.5K for the ^{13}CO J=1–0 spectra and 0.3 and 1K for the ^{12}COJ=2–1 spectra.

The data set, because of its size, and the multiplicity of the lines observed, provides several new results, as follows:

(1) despite their low average column density at the parsec scale ($\overline{A}_v \sim 1^m$), all the fields observed appear highly structured in all the lines, including those of ^{12}CO. Unresolved structure is still present in all the fields and all the lines, in the dense cores and in their lower column density environment. It corresponds to size scales < 0.008 pc,

(2) the texture and velocity dispersion of the gas bright in ^{12}CO and weak in ^{13}CO and C^{18}O are significatively different from those of the gas bright in ^{13}CO or C^{18}O. The former exhibits filamentary structure with, in some cases, unresolved transverse dimensions, and aspect ratios $\sim$ 10. Its velocity dispersion is also much larger than that of the latter,

(3) the uniformity of the excitation temperature ratio of the two lowest CO rotational transitions in the three fields, from the brightest to the weakest detected lines, across the whole profiles and for both ^{12}CO and ^{13}CO isotopes, is remarkable,

(4) the optical depths of the ^{12}CO and ^{13}CO lines reach very large values, though most of the line profiles are neither flat–topped nor self–reversed.

We deduce from these well–defined properties that the uniformity of the CO line excitation is a very robust property of non star–forming molecular clouds. The large range of optical depths and line temperatures over which it is met, imposes a line formation mechanism confined to regions smaller than a few 100 AU and denser than $n_{\rm H_2} > 5\times 10^3$cm^{-3} for a kinetic temperature T=20K, yet denser in colder gas. Furthermore, the line shapes impose a weak level of radiative coupling among these regions, a condition met in macroturbulence.

It is interesting to stress the outcomes of this program which are specific to its key–project status:

– *on scientific grounds*

The large size of the maps and the good signal–to–noise level in ^{12}CO have allowed the discovery of a filamentary structure, hard to detect because it is small–scale structure in almost transparent gas. Furthermore such structures are simultaneously small (narrow width) and large scale (long length) and cannot be recognized in either small maps or large scale maps at low angular resolution. It is only the systematic mapping of low brightness and large areas which allowed the detection of such filamentary structures which are thought to play a role in the dense core formation.

Statistical work on the distribution of line centroid velocities and the power law relations is under progress. The statitical noise is considerably reduced due to the large size of the maps.

The signal to noise achieved was a compromise between the dynamic range of the maps and the total time devoted to the project. It is good enough to allow some work to be done on the line shapes and line ratios of individual spectra.

– *on instrumental grounds*

A long term monitoring of the time–dependent variations of the line calibration at the telescope has been achieved. We have taken advantage of the various time scales over which the monitoring was performed to correct for the non–thermal contribution to noise in the line calibration and our method reduces the line calibration error by a factor 1.5 at 2.6 mm and a factor 2 at 1.3 mm.

Six hardware and software problems have been discovered, in particular in the frequency settings, and have now been corrected.

Edith FALGARONE

Observation reports

Chemistry of Protosolar-like Nebulae: Cold Gas component of the DM Tau and GG Tau Disks

Report by: A.Dutrey, S.Guilloteau, M.Guélin
Institut de Radio Astronomie Millimétrique, 300 Rue de la Piscine, F-38406 Saint Martin d'Hères, France

Observing the chemical and molecular composition of the protosolar nebula has, for a long time, been a haunting, albeit unreachable dream. Yet, in some way this old dream is becoming true: lately, astronomers have uncovered protoplanetary disks around a number of low-mass pre-main sequence stars (e.g. T Tauri stars), and, thanks to recent gains in sensitivity at mm wavelengths, we are about to learn the composition of these disks.

The observation of these disks is not easy, due to their small sizes and to confusion with fore-/background gas. It requires to select the nearest possible objects, when they are well detached from their parent cloud. The T Tauri stars DM Tau and GG Tau are in that sense unique since (1) they are located only 140 pc away, in a region devoid of CO emission at the edge of the L 1551 core (2) they are both surrounded by dusty disks, with relatively strong CO and thermal dust emission; the disks have radii of several arcsec, hence are well resolved by mm interferometry; they show the clear signature of Keplerian rotation (Guilloteau & Dutrey 1994, A&A, 291, L23; Dutrey et al. 1994, A&A 286, 149; Guilloteau et al. , 1996 *in preparation*).

DM Tau is one of the oldest T Tauri stars of the Taurus region ($\sim 5 \cdot 10^6 - 10^7$yr), whereas GG Tau is a young binary system (separation $\sim$0.26" in the plane of sky), which has cleared up a large central hole by tidal interaction (inner radius $\sim$ 180 AU and outer radius $\sim$ 800 AU). Comparing the molecular content of two objects originating from the same molecular cloud, but at different evolution paths, may allow to understand better the physico-chemical processes leading to planetary formation.

We have investigated with the IRAM 30-m telescope the molecular content of the DM Tau and GG Tau disks and were able, for the first time, to detect a large variety of molecular species in such objects. These include CO, CS, CN, HCN, HNC, HCO^+, and a first organic molecule, H_2CO (ortho and para). So far, both disks look surprisingly similar. The gas column densities seem quite

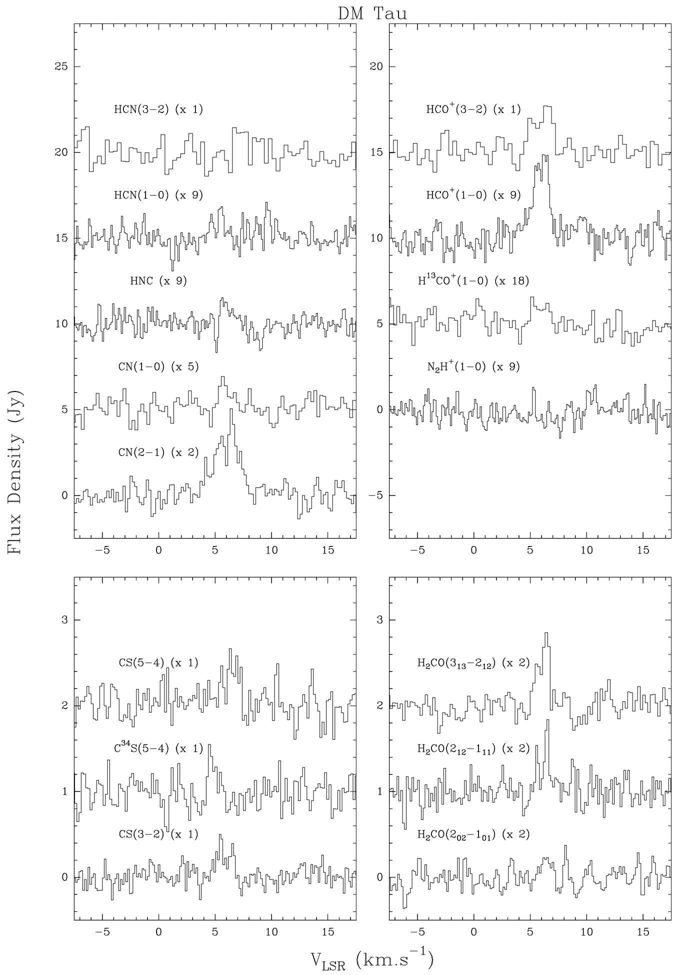

Figure 2: Molecular spectra observed towards DM Tau. Double-peaked profiles, characteristic of a tilted Keplerian disk, are detected for H_2CO, CS, and HCO^+. Like in the case of GG Tau, they have the same width and the same systemic velocity than the ^{13}CO profiles.

large, as indicated by our probable detection of $C^{34}S$ and $H^{13}CO^+$ in DM Tau. Assuming the CS, HCN and H_2CO abundances are similar to those in TMC1, the disk masses derived are between 20 and 100 times lower than those determined from the dust thermal emission, in agreement with our previous results derived from CO and isotopes (Guilloteau & Dutrey *ibid*).

Scientific results

The anatomy of an isolated spiral galaxy: NGC 4414

J. Braine ([1]), N. Brouillet ([2]), A. Baudry ([2])
([1]) IRAM, 300, rue de la Piscine, F-38406 St. Martin

d'Hères
(2) Observatoire de Bordeaux, URA 352, CNRS/INSU, B.P. 89, F-33270 Floirac

Abstract: Our on-going observations of the interstellar medium of NGC 4414 have resulted in CO(1–0) and CO(2–1) detections to very close to the optical edge of the disk. The ^{13}CO lines and thermal dust continuum emission have been detected almost as far out. The variation in the beam-independent CO($\frac{2-1}{1-0}$) line intensity ratio is interpreted in terms of a variation in the CO excitation temperature. Combining the temperature variation with the galactic size-linewidth relation and the virial theorem enables us to estimate how the $N(\mathrm{H_2})/I_{\mathrm{CO}}$ factor varies as a function of galactocentric radius. One then straightforwardly obtains the distribution of the molecular gas. It should be noted that because there is probably little or no star formation and neutral gas in the nucleus of NGC 4414, we avoid problems associated with conditions proper to galactic nuclei but thus make no predictions for these regions.

In order to check the $N(\mathrm{H_2})/I_{\mathrm{CO}}$ function obtained above, we used our ^{13}CO (1–0) and ^{13}CO (2–1) data, in conjunction with the ^{12}CO and assuming the ^{13}CO to be optically thin, to derive absolute ^{13}CO abundances as a function of radius. The resulting abundances are in good agreement with galactic observations. The millimeter-wave thermal emission from dust is a second independent test. While grain cross-sections and, to a lesser extent, dust temperatures are subject to debate, commonly used values yield gas masses quite close to those we estimate from our analysis. Unusually low cross-sections or temperatures and a peculiar variation are required to fit the gas mass resulting from the use of a constant $N(\mathrm{H_2})/I_{\mathrm{CO}}$ ratio. All of our observations support the variation and range of $N(\mathrm{H_2})/I_{\mathrm{CO(1-0)}}$ that we propose here for NGC 4414. It should however be borne in mind that a number of assumptions about molecular clouds have been made and that we have no means of verifying them for the clouds in NGC 4414.

As such an analysis is not yet available for other external spiral galaxies, we have applied our knowledge of the gas and stellar distributions to the question of what controls star formation on large scales. NGC 4414 is an ideal test case because of its inner and outer cutoffs in the HII region distribution and because it has probably not suffered tidal interactions with other galaxies recently. We find that both cutoff radii are well reproduced using the simple Q criterion for gravitational instability.

Chemical inhomogeneities in interstellar clouds: The high latitude cloud MCLD 123.5+24.9

M. Gerin[1,2], E. Falgarone[2], K. Joulain[2], M. Kopp[3], J. Le Bourlot[3], G. Pineau des Forêts[3], E. Roueff[3], P. Schilke[4]

[1]Downs Laboratory of Physics, Caltech, Physics Department, 320-47, Pasadena CA91125, USA.
[2]Radioastronomie Millimétrique, Laboratoire de Physique de l'ENS, 24 rue Lhomond, 75231 Paris Cedex 05, France
[3]DAEC, Observatoire de Paris-Meudon, Place J. Janssen, 92195 Meudon cedex, France
[4]I. Physikalisches Institut der Universität zu Köln, Zülpicher Str. 77, D-50937, Köln, Germany

Abstract: We report on observations designed to disclose the presence of the High Ionization Phase predicted to exist in dark clouds by chemical models (Le Bourlot et al., 1993). In addition to a high neutral carbon abundance, a high CS/SO abundance ratio and a low abundance of molecular ions, such a phase might be characterized by a low D/H fractionation ratio.

In this paper, we present both observational and model results on the sulfur bearing molecules CS and SO, and their most abundant isotopomers, on the molecular ions $\mathrm{HCO^+}$, $\mathrm{H^{13}CO^+}$, $\mathrm{HC^{18}O^+}$ and $\mathrm{DCO^+}$. We have also taken new ^{13}CO and C^{18}O data to improve the determination of the physical conditions at the observed positions. One of the two dark clouds investigated, a core in the high latitude cloud MCLD 123.5+24.9, presents surprinsingly strong CS and C^{34}S lines relative to its column density, together with weak $\mathrm{DCO^+}$ lines. It has also a cold temperature and rather strong CCH and $\mathrm{C_3H_2}$ lines. These observed features are characteristic of the presence of the High Ionization Phase along the line of sight. This cloud core might therefore be a good candidate for further investigation of this new phase of dark interstellar clouds.

Coma correction of a wobbling subreflector

A. Greve, B. LeFloch, J. Peñalver (IRAM)

Abstract: Radio astronomical observations at millimeter wavelengths with Cassegrain telescopes often use on–source off–source measurements with a wobbling subreflector to eliminate the influence of the Earth's atmosphere. The tilt of the subreflector produces the required beam throw, but also a coma–like wavefront deformation noticeable as a degradation of the beam pattern and a reduction of the main beam power. We demonstrate with measurements, made with the IRAM 30–m telescope at 1.3 mm wavelength (230 GHz) of the quasi point–like source Mars and the extended source Saturn, that it is possible to eliminate to large extent this wavefront deformation when using a near–focus corrector, in this telescope conveniently located on the co–rotating Nasmyth mirror.

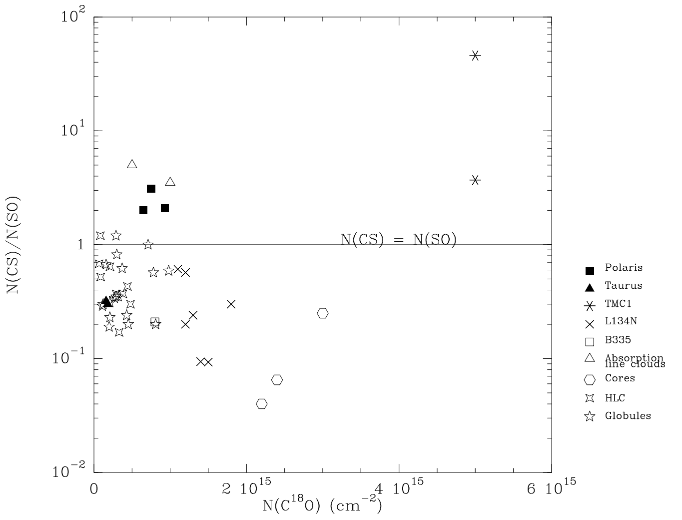

Figure 3: Column density ratio N(CS)/N(SO) as a function of the $C^{18}O$ column density for Polaris (black squares), Taurus (black triangles), TMC1 (asterisks), L134N (crosses), B335 (white square), clouds seen in absorption (white triangles), dark clouds cores (white hexagons), high latitude clouds (starred squares) and globules (stars).

New Preprints

400. The anomalous SiO maser transition $v = 2 J = 2-1$
V. Bujarrabal, J. Alcolea, C. Sanchez Contreras, F. Colomer
1996, *Astronomy and Astrophysics*

401. The molecular envelopes of planetary nebulae
P.J. Huggins, R. Bachiller, P. Cox, T. Forveille
1996, *Astronomy and Astrophysics*

402. High resolution CH_3CN observations towards hot cores
L. Olmi, R. Cesaroni, R. Neri, C.M. Walmsley
1996, *Astronomy and Astrophysics*

403. ^{14}C in AGB stars: the case of IRC+10216
M. Forestini, M. Guélin, J. Cernicharo
1996, *Astronomy and Astrophysics*

404. AGB star envelopes as probes of stellar evolution and time-dependent chemistry
M. Guélin, R. Lucas, R. Neri
1996, *Proc. of the ESO conf. on: Science with Large Millimetre Arrays* ESO, Garching, Dec. 1995

405. CO observations and a new interpretation of the anomalous arms of NGC 4258
P. Cox, D. Downes
1996, *Astrophys. Journal*

406. Chemical inhomogeneities in interstellar clouds: the high latitude cloud MCLD 123.5+24.9
M. Gérin, E. Falgarone, K. Joulain,
M. Kopp, J. Le Bourlot, G. Pineau des Forêts, E. Roueff, P. Schilke
1996, *Astronomy and Astrophysics*

Programs Scheduled on the 30-m Telescope in 1995

June 6 - July 4

Ident.	Title	Freq. (GHz)	Authors
4.95	Confirming the detection of true low-mass protostars	96, 98, 115, 230	Guesten, Wiesemeyer, Fiebig
10.95	Search for new molecular absorptions at high-z		Wiklind, Combes
15.95	Search for molecular absorption in the central tori of QSOs		Wiklind, Combes, Drinkwater, Webster
46.95	A detailed study of molecular outflows from FU Orionis stars	230, 110, 220;109	Eisloeffel, LeFloch, Malbet
73.95	Time monitoring and origin of high velocity SiO maser emission	86	Baudry, Alcolea, Cernicharo, Herpin
31.95	SO_2, SO and OCS in the atmosphere of IO	221, 218, 143, 104	Lellouch, Strobel, Belton, Encrenaz, Gulkis, de Pater, Paubert
168.94	Molecular gas in the dwarf elliptical NGC 185	115, 230, 110, 229	Lo, Lequeux
79.95	A search for CO in Chiron	115, 230	Crovisier, Biver, Bockelee-Morvan, Colom, Lellouch, Despois, Paubert
26.95	Missing mass as cold molecular clouds		Wilson, Mangold, Solomon, Mauersberger, Henkel
24.95	The stability of clumps in L1498	219, 109, 146, 244, 96	Wilson, Gensheimer, Walmsley, Lemme

July 4 - August 1

Ident.	Title	Freq. (GHz)	Authors
19.95	Do the PIGs in M42 contain molecular material ?	113, 226, 110, 219, 146	Rodriguez, Martin-Pintado, Fuente
63.95	A new class of molecular clouds in the galactic center region	86, 91, 130, 214, 220	Martin-pintado, Fuente, de Vicente
75.95	Probing the H_1/H_2 transition layer in PDRS	115, 162, 208, 235, 89	Fuente, Martin-Pintado
35.95	The hot molecular ring around the Sgr B2 star forming cores	91, 147, 220, 102, 222	De Vicente, Martin-Pintado
20.95	Does dense material confine HII regions ?	108, 113, 145, 109, 218	Martin-pintado, Gaume, Rodriguez, de Pree, Fey
14.95	CO observations of H_2O megamaser active galaxies	113, 226, 229	Planesas, Colina, Raluy
44.95	Observational tests of chemical bistability in dense interstellar clouds	115, 230	Gerin, Falgarone, Roueff, Pineau des Forets
43.95	Formation of CO along a dissipation region within a high galactic latitude HI cloud	115, 230	Boulanger, Falgarone, Zagury
74.95	L483 : The birth of a cometary nebula	96, 110, 130, 140, 230	Tafalla, Mardones, Myers, Bachiller, Fuller
23.95	The main molecular Bar of NGC 4321	114, 229	Sempere, Garcia-Burillo, Combes
55.95	Chemical evolution in the outer galaxy	109, 115, 219, 224	Henkel, wouterloot, Mauersberger, Brand, Chin
85.95	H_2O emission from a circumnuclear disk	96, 232	Henkel

August 1 - August 29

Ident.	Title	Freq. (GHz)	Authors
12.95	$C^{17}O$ observations of hot cores	112, 219, 224	Hofner, Walmsley, Wyrowski, Churchwell
56.95	H CO+ and CO+ in photon dominated regions	86, 89, 146, 235	Stoerzer, Sternberg, Kramer
55.95	Chemical evolution in the outer galaxy	109, 112, 219, 224	Henkel, Wouterloot, Mauersberger, Brand, Chin
85.95	H_2O emission from a circumnuclear disk	96, 232	Henkel
71.95	Dense molecular gas and the starburst indicator in galaxies	88, 146, 229, 264	Gao, Solomon, Downes
78.95	Comparison of OH and CO emission in infrared evolved stars		Josselin, Loup, Omont
175.95	Multiline study of the young planetary nebulae NGC 7027	89, 88, 97, 226	Stoerzer, Sternberg, Stutzki, Kramer
33.95	Narrow line emission from a molecular cloud with star formation	98, 109, 110, 147	Brand, Wouterloot
34.95	The $^{12}C/^{13}C$ ratio in the far outer galaxy	104, 109, 110, 209	Wouterloot, Brand
42.95	A search for circumstellar SiO maser in the extraordinary star, U Equ	86	Barnbaum, Omont
175.94	Disk temperature of the planets at 150 and 230GHz	150, 230	Greve, Lefloch, Kramer, Moreno
52.95	Molecular clouds and the age of starburst in Mrk barred galaxies		Davoust, Wozniak
37.95	A search for a new Fe-containing radical of FeCO		Kasai, Kamaguchi
22.95	The density structure of the NGC 1333 spherical shell		Castets, Monin, Langer, Warin

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Ident.	Title	Freq. (GHz)	Authors
72.95	Imaging the jet working surfaces in the RNO 43 outflow	110, 130, 230	Richer, Cabrit, Bally, Bence, Padman
9.95	600AU-scale clumping in the molecular cloud MBM 12	86, 88, 138, 146	Combes, Pfenniger
Δ07.95	CO in the giant arc of the cluster A370 ?		Casoli, Encrenaz, Fort, Boisse, Mellier
64.95	New millimeter methanol masers		Slysh, Kalenskii, Val'tts
84.95	LiCl and LiNC in the circum. clouds, planetary nebulae and protoplanetary nebulae...	84, 106	Lubowich, Turner, Sahai
15.95	Search for molecular absorption in the central tori of QSOs		Wiklind, Combes, Drinkwater, Webster
Δ08.95	PKS 1830	244	Combes, Wiklind
48.95	The ^{12}CO line ratio in nearby starburst galaxies	115, 116	Greve
175.94	Disk temperature of the planets at 150 and 230GHz	150, 230	Greve, lefloch, Kramer, Moreno
84.95	LiCl and LiNC in the circum. clouds, planetary nebulae and protoplanetary nebulae...	84, 106	Lubowich, Turner, Sahai
82.95	Gaseous counterparts of low-mass protostellar dust envelopes	86, 96, 109, 224	Andre, Despois, Blinder
58.95	Chemical study of GG Tau and DM Tau circumstellar disk	87, 85, 168, 236	Dutrey, Guilloteau, Guélin
74.95	L483 : The birth of a cometary nebula	96, 110, 130, 230	Tafalla, Mardones, Myers, Bachiller, Fuller
70.95	^{13}CO emission from molecular complexes in M 33		Viallefond, Guélin, Cox
50.95	A search for circumstellar and interstellar MgCH3	88, 110	Ziurys, Apponi, Guélin
41.95	Probing the infall region of L 1527	100, 146, 244	Myers, Mardones, Wilner, Tafalla
7.95	Search for primordial molecules in Lyman-alpha damped absorbers	107, 116, 160, 143	Melchiorri, Signore, Encrenaz, Maoli et al
62.95	CN as tracer of circumstellar disk structure ?	113, 226	Dutrey, Guilloteau, Guélin, Schuster
80.95	Observation of CO in comet P/Schwassmann-Wachmann 1	115, 230	Crovisier, Biver, Bockelee-Morvan, Colom et al
Δ09.95	Comet C/1995 01 (Hale-Bopp)	115, 230, 236, 168	Crovisier, Biver, Bockelee-Morva, Colom et al

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Ident.	Title	Freq. (GHz)	Authors
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Δ10.95	Calibrated CO spectra of Mrk 273	111, 110	Downes
8.95	Molecular gas in galaxies of Hickson compact groups	115, 230	Menon, Combes, Leon
81.95	A search for volatile molecules in comet P/Schwassmann-Wachmann 1	89, 98, 109, 260	Bockelee-Morvan, Biver, Colom, Crovisier et al.
Δ09.95	Comet C/1995 01 (Hale-Bopp)	115, 230, 236, 168	Crovisier, Biver, Bockelee-Morva, Colom et al
45.95	Investigation of molecular envelopes around T Tauri stars...	109, 110	Schuster, Cabrit, Harris
58.95	Chemical study of GG Tau and DM Tau circumstellar disk	87, 85, 168, 236	Dutrey, Guilloteau, Guélin
74.95	L483 : The birth of a cometary nebula	96, 110, 130, 140, 230	Tafalla, Mardones, Myers, Bachiller, Fuller
175.94	Disk temperature of the planets at 150 and 230GHz	150, 230	Greve, lefloch, Kramer, Moreno
61.95	Kinematics and mass of a remarkable circumstellar disk and the flying ghost nebula	97, 109, 144, 230	Monin, Lefloch, Caux, Boulard
139.94	Observations of a protostellar candidate HH24-MMS	230, 219, 224, 244	Kruegel, Thum
83.95	^{13}CO(1-0) observations of IC 443 G	110	Keene, Phillips, Van Dishoeck
1.95	Molecular observations of OH 231.8+4.2	115, 230, 130, 217	Bujarrabal, Alcolea
2.95	Observations of SiO v=2 J=2-1 maser emission	85, 86, 130, 230	Bujarrabal, Alcolea, Colomer
11.95	Pre-protostellar structure in cloud cores TMC1 and L1498	93	Langer, Velusamy, Kuiper

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Ident.	Title	Freq. (GHz)	Authors
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222.94	Pumping ^{29}SiO and ^{30} SiO maser emission trough infrared line overlaps	85, 128, 214, 257	Gonzalez-Alfonso, Cernicharo
Δ09.95	Comet C/1995 01 (Hale-Bopp)	115, 230, 236, 168	Crovisier, Biver, Bockelee-Morva, Colom et al
58.95	Chemical study of GG Tau and DM Tau circumstellar disk	87, 85, 168, 236	Dutrey, Guilloteau, Guélin
31.95	SO2, SO and OCS in the atmosphere of IO	221, 219, 216, 104	Lellouch, Stroebel, Belton, Encrenaz-T, Gulkis et al.
68.95	Mapping the Cepheus B molecular cloud	109, 110, 220, 230	Guélin, Kramer, Sievers, Ungerechts
Δ12.95	Detection of CO(2-1) line in Cygnus A	109, 218	Mirabel
70.95	^{13}CO emission from molecular complexes in M 33		Viallefond, Guélin, Cox
Δ13.95	Chemistry of protoplanetary disks around GG Tau and DM Tau	250, 270	Dutrey, Guilloteau, Guélin
6.95	CS towards the young stellar object NGC 2264-IRS1	97, 146, 219	Henning, Martin, Van Dishoeck, Helmich
165.95	L 1544 : A collapsing starless core	bolometer	Tafalla, Myers, Bachiller, Mardones, Caselli, Benson
Δ15.95	Separating infall and outflow motions in L484		Bachiller
218.95	A search for CO in Chiron	115, 230	Crovisier, Biver, Bockellee-Morvan, Colom et al.
221.95	Observations of CO and other volatiles in Comet 29P/Schwassmann-Wachmann 1	88, 115, 168, 236	Crovisier, Biver, Bockellee-Morvan, Colom et al.
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Ident.	Title	Freq. (GHz)	Authors
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169.95	Observation of cold and very cold dust in galaxies with Diabolo	Bolometer	Desert, Bernard, Lamarre, de Luca, Pajot et al.
170.95	Anisotropy measure of the cosmic microwave background with Diabolo at the arc minute scale	Bolometer	Desert, Bernard, Lamarre, de Luca, Pajot et al.
171.95	Observations of the hot gas in clusters of galaxies with Diabolo through the Sunyaev-Zel'dovich effects	Bolometer	Desert, Bernard, Lamarre, de Luca, Pajot et al.
239.95	Dust properties of cold cores in molecular clouds : A diabolo study	Bolometer	Giard, Gaertner, Ristorcelli, Serra, et al.
153.95	Two molecular bars in NGC 4321 ?	229, 109	Sempere, Garcia-Burillo, Combes
237.95	Observations of Jupiter after the comet SL9 collision	88, 115, 230, 260	Marten, Moreno, Lellouch, Paubert
195.95	Sulphure chemistry in diffuse molecular clouds	168, 104	Lucas, Liszt
127.95	A study of the kinematic structure of a low mass star forming region HD20075/NGC7023	109, 110, 115, 230	Fuente, Martin-Pintado, Cernicharo, rogers
127.95	Probing the HI/H2 transition layer in PDRs (III)	235, 86	Fuente, Martin-Pintado
87.95	Circumnuclear disks and the H_2O megamaser phenomenon	178, 180, 115, 112	Henkel, Wilson-AS, Braatz, Koekemoer
50.95	A search for circumstellar and interstellar $MgCH_3$	88, 110	Ziurys, Apponi, Guélin
156.95	A search for interstellar/circumstellar FeF and FeCl	143, 165, 210, 93	Ziurys, Allen, Guélin
179.95	Did we detect aluminum 26 in IRC+10216 ?	167, 234, 267	Guélin, Ziurys, Apponi, Cernicharo
185.95	CN and HCO+ in the butterfly NGC 2346	226, 89	Bremer, Neri
Δ16.95	Chemistry of protoplanetary disks around GG Tau and DM Tau	250, 270	Dutrey, Guilloteau, Guélin
157.95	Investigating the origin of high velocity wing emission in the Rosette molecular complex	88, 109, 115, 220	Schneider, Stutzki
68.95	Mapping the Cepheus B molecular cloud	109, 110, 220, 230	Guélin, Kramer, Sievers, Ungerechts
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50.95	A search for circumstellar and interstellar MgCH3	88, 110	Ziurys, Apponi, Guélin
156.95	A search for interstellar/circumstellar FeF and FeCl	143, 165, 210, 93	Ziurys, Allen, Guélin
201.95	Are optical jets associated to high velocity gas in molecular outflows ?	115, 230	Cernicharo, Neri, Reipurth
219.95	Observations of volatile in Comet C/1995 01 (Hale-Bopp) at large heliocentric distances	88, 115, 168, 236	Crovisier, Biver, Bockelee-Morvan, Colom et al.
86.95	Molecular gas in faint blue galaxies at intermediate red shifts	153, 160, 230, 240	Wilson-C, Combes
201.95	Are optical jets associated to high velocity gas in molecular outflows ?	115, 230	Cernicharo, Neri, Reipurth
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164.95	CO(2-1) distribution in a dynamically spectacular ring merger : Arp 118 revisited	112, 224	Gao, Solomon, Downes, Radford
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226.95	^{12}CO J=2-1 observations of G359.93+0.04	230	Echevarria, M-Morris, Figer
163.95	HCN(3-2) observations of ultraluminous IR galaxies	83, 87, 249, 263	Gao, Solomon, Downes, Wild
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The IRAM Newsletter is edited by Robert LUCAS at IRAM-Grenoble (e-mail address: `lucas@iram.fr`).

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	Address:	Telephone:	Fax:
Grenoble	Institut de Radioastronomie Millimétrique, 300 rue de la Piscine, Domaine Universitaire, 38406 St Martin d'Hères Cedex, France	(33) 76 82 49 00	(33) 76 51 59 38
Plateau de Bure	Institut de Radioastronomie Millimétrique, Observatoire du Plateau de Bure, 05250 St Etienne en Dévoluy, France	(33) 92 52 53 60	(33) 92 52 53 61
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E-Mail Addresses:

- IRAM-Grenoble: `username@iram.fr`
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