IRAM Newsletter

Number 36 July 3rd, 1998

Calendar

September 7th, 1998: Deadline for the submission of observing proposals for the period Nov. 15, 1998 to May 15, 1999.

September 14-18, 1998 mm Interferometry Summer School in Grenoble.

October 1st, 1998 Next IRAM Newsletter

Contents

Editorial

Dear Colleagues,

For the last 6 years, the IRAM Newsletter has kept you informed about technical activities, Programme Committee recommendations, and scientific results in press. We would like now to extend its role.

The spectacular progress in sensitivity and resolution made in the last decade and the exciting prospects opened by the MMA/LSA are making of mm-waves a fundamental tool in almost any branch of Astronomy. It is time now to enlarge the European community of mm-wave users and to help non-radio astronomers to gain a critical understanding of the observational results. The mm Interferometer School organized this summer in Grenoble is a first step in this direction. The wish that the IRAM Newsletter contributes also to this goal.

Firstly, we plan to publish at regular intervals 1-2 page articles reviewing exciting results or important decisions in scientific and technical matters having an impact on mm-wave astronomy. We have presented in the last issue the preliminary conclusions of the Arcachon meeting, where the main priorities for Astronomy in France were discussed. We plan in the next issues to publish a review about mm/submm SIS-mixer receivers.

Secondly, we wish to add to the present section of "Scientific Results", which presents abstracts of accepted articles dealing with observations made with the IRAM telescopes, a section entitled "Comments & Upper limits". This latter section would report positive and negative results that you intend or do not intend to publish, as well as comments on papers in press or published. The format is free and the style can be polemical, but the subject should be of interest to the mm-wave observers. The comments and notes submitted for publication in this section will be properly refereed; IRAM reserves the right to accept, edit or reject them. A date of reception and of acceptance will be appended to the accepted contributions. We plan to start in the next issue: please, send your contributions (.tex and .ps files) by email to "guelin@iram.fr".

Michel Guélin

Installation of the #1 Dual-channel Receiver at the 30-m Telescope.

A new, dual-channel receiver has been installed at the 30-m telescope. It is the first of four similar receivers that will be implemented as part of a general refurbishment of the 30-m receiver cabin. For the time being, the #1 dual-channel is installed in the "old" cabin optics, and it replaces 3mm1 and 230G1. The installation and initial commissioning took place between May 25 and June 1.

The successful installation of that new receiver results from the efforts of several groups at IRAM : besides the Receiver group, the SIS, Design/Workshop, and Computer groups provided essential contributions. This receiver, and the design of the future receiver cabin of which it is the forerunner also owe a lot to James Lamb, previously head of the Receiver group.

Main technical features

The new receiver uses basically the same general layout as the current Plateau de Bure receivers. It is built inside a hybrid Infrared Labs cryostat. Such a cryostat is already used at the 30-m for the 3mm2 receiver, which is single-channel. The local oscillators are fed by waveguides to couplers for each channel.

The nominal operating frequency ranges of the two channels, defined essentially by the LO subsytems, are : 83.5–115.5, and 200–255 GHz, respectively. The mixers operate in SSB mode, with a rejection of the USB of, respectively, 12dB and 20dB (typical).

The IF bandwidth is 0.5 GHz for receiver A100 and 1GHz for receiver A230 (recommended nomenclature for the future).

The cold optics comprises two horn-lens assemblies back-to-back, and the two beams are coming out of the cryostat on opposite sides, refocussed by elliptical mirrors, and recombined by a polarization grid (G1). What is new, compared with the Bure receivers, is that grid G1 is followed by a Martin-Puplett diplexer, which allows a single linear polarization coming from the sky to be transformed into two orthogonal polarizations at the respective operating frequencies of the two channels.

The general principle of frequency-dependent polarization transformation is similar to the one currently implemented at the 30-m telescope to allow 4-frequency observing, but, compared with the dichroic grids, the MP diplexer allows to reach relatively large (up to 50mm) optical path differences, and generally to find a setting with low losses for both frequencies; the dichroic grids allowed only small path differences, and one had often to accept a sacrifice on the 3mm optical losses to preserve the 1.3mm receiver temperature.

Do note, however, that for certain frequency ratios, no good compromise can be found, no matter how large the allowed path difference. The worst such ratio is $\frac{5}{2}$, for which the *theoretical* diplexing loss is 5%.

To allow the best optimization of the diplexer, the astronomer should indicate to the operator whether he/she intends to observe in narrow-band mode (up to approx 100 MHz) or in broad-band mode. Please note that this narrow/wide choice is completely disconnected from the narrow/wide choice attached to the use of 230G2 (and now A230), depending on whether one is using or not the 1-GHz wide filterbank.

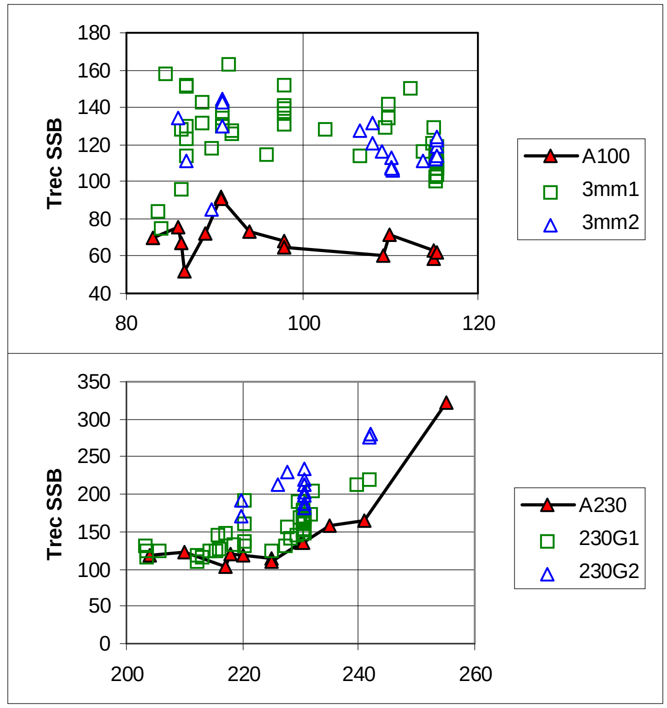


Figure 1: Receiver temperatures (SSB) of the new receivers, measured in the standard reference plane, and compared with those of the "old" receivers. See text for important details.

RF performance

Figure 1 shows the receiver temperature of the new receivers, (the official names of the new receivers are A100 and A230), compared with the previously operating receivers in the same frequency bands. The values for the new receivers were collected during the installation and commissioning period, using the system cold load in the standard reference plane. The tunings were always made for both receivers simultaneously for an arbitrary pair of frequencies, and therefore include the compromise and associated loss in the MP diplexer setting. Three values for A230 were edited out, two because they were obtained at the beginning of the test period when the MP encoder origin was off by 35μm, and one because it was obtained with the 1M filterbank, which has an offset. The tunings were all done automatically under computer control, using the tables prepared in Grenoble, with no further optimization.

The values for the "old" receivers come from calibrations with continuum detectors over the period Jan–May 1998, and were compiled by J.L.Santaren. These values also include diplexing losses.

To summarize, expect typically 70K SSB across the band of the A100 receiver (possibly 10K more if the combination with the A230 frequency is "unlucky", possibly less if measured narrow-band with the autocorrelator backend), and for the A230 receiver, 110K up to 225 GHz, 140K at 230 GHz, 170K at 240 GHz, again give or take 10K depending on the associated frequency for the A100 receiver and on the backend used for the calibration.

We intend to improve the noise performance in the 230 band using smaller area junctions.

The T_{rec} values in the standard reference plane suffer the impact of the optical losses, and do not do full justice to the performance achieved in the laboratory expressed at the dewar window. However, in the context of the Newsletter, they are the index of performance of interest to the end users. The dewar-window T_{rec} values and the breakdown of optical losses will be analyzed in a forthcoming technical report.

Stability

The total power of the four receivers has been recorded during approx 2000 s with 2.5 s integration time, while they were staring at an ambient load. The detected output came from the cable processors. The results are presented in Figure 2.

Alignment, focus, efficiencies

The two channels were co-aligned in focus, focal plane, and aperture plane in Grenoble on the antenna range, and no further adjustment was made on the site.

Measurements performed during limited periods of good atmospheric conditions during the initial commissioning, together with later measurements made by the PV staff, give the following results.
Co-alignment of A100 and A230 : 2.5″
Focus of A230 relative to A100 : +0.2 mm.

The focus shift is consistent with a difference of 150mm (M=27.8) at the Cassegrain focus, measured in Grenoble, and resulting from a deliberate compromise between focus alignment and beam quality.

Receiver	F_{eff}	B_{eff}
A100	0.92	0.76
A230	0.87	0.57

Problems, solutions

Hold time of the dewar

Shortly after installation, it was found out that the liquid He hold time was about one week, compared with more than two weeks in laboratory use. That difference is due to the fact that in the Grenoble laboratory, each CTI350 cold head is fed compressed He gas by a dedicated CTI1020 compressor, while at the 30-m telescope, each CTI1020 serves up to two cold heads; besides, the He lines at the 30-m are longer. Some improvement has been obtained by re-distributing the five receivers in operation over the available three compressors. More to the point, this is not a real problem, since the liquid He refilling of an Infrared Labs dewar takes only a few minutes.

MP motor runaway

The MP diplexer gave more serious worries. Due to the poor design and scarce documentation of the stepper motor controller chip that is part of the hardware used to move the MP mirror, the moving stage ignored and destroyed a limit switch, which, indirectly (details spared to the general reader) caused a jump of 2.000 mm in the encoder origin. Fortunately, the on-site receiver engineer found a short-term workaround. Subsequently, within 48 hours, and through close cooperation between the 30-m staff and the Grenoble receiver and computer groups, the problem was solved and fully diagnosed (in that order). Future MP diplexers will have improved hard- and software to circumvent the controller chip problem.

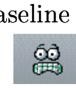
Acquisition software

At the time of installation, a problem appeared with the CLASS-format files acquired using the A230 receiver, with software adapted from the 230G2 receiver. When A230 is operated in "narrow-band IF" mode, the sky frequency scale stored in the header has a positive offset of 256MHz.

Perspectives

The MP diplexer opens the possibility to perform a true measurement of the image gain G_I, an essential ingredient of spectral calibration. Some tests have been made, observing the same line in near-SSB mode and near-DSB mode, and comparing the derived intensities on the T_A^* scale (which should be equal, of course). Preliminary results are encouraging but need to be confirmed by systematic tests.

Status of the receiver cabin upgrade

According to the baseline plan, starting Monday, Sep 1, we will irreversibly  remove most of the existing optics and receivers (M3 and M4 will be spared, however...). Part of the final new configuration will be installed, i.e. the central divider, two dual-channel receivers A/B 100/230, together with the "old" 2mm receiver. The "worst" of the three 100/230 receivers will be in Grenoble for improvements, and will therefore not be available as a backup spare on the site.

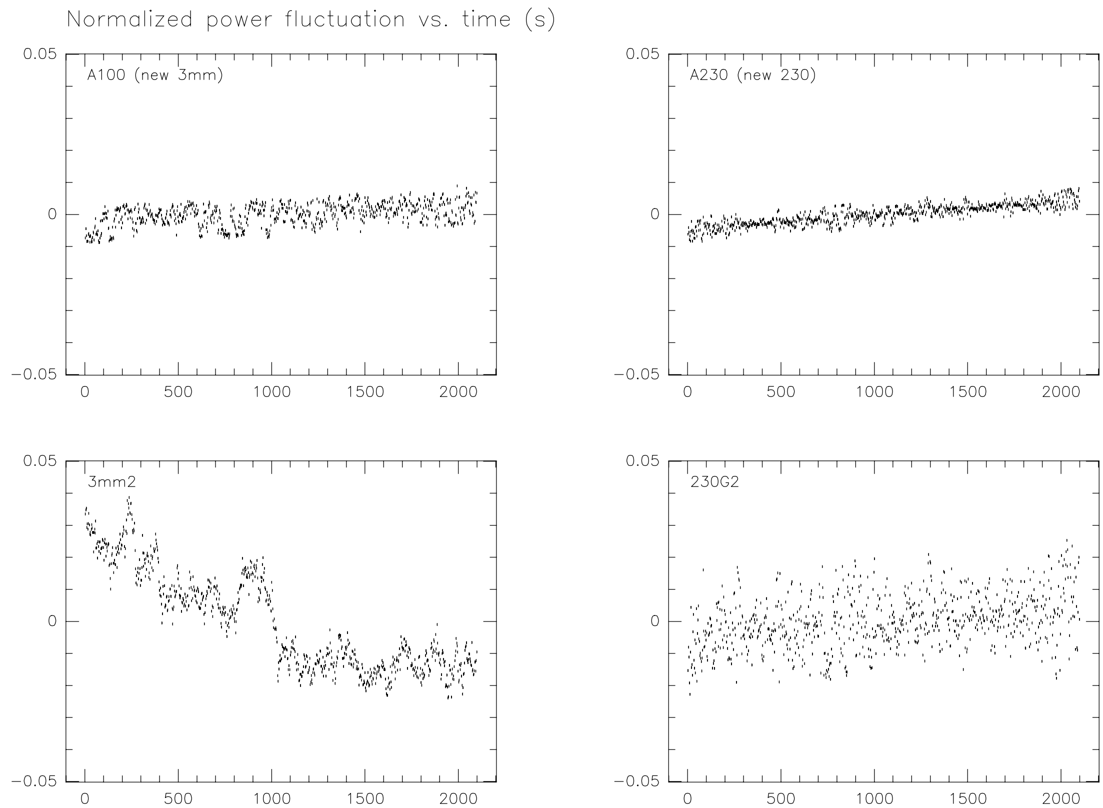


Figure 2: Stability of the total power output of two new and two "old" receivers. The graphs show the fractional deviation of the detected power (normalized to its mean) versus time in s.

At present the second B100/B230 dual channel receiver is undergoing detailed characterization of the mixer performance, and the test assembly of the receiver cabin optics is nearing completion. What remains to be done is the alignment of the optics of the second dual receiver, and, if possible, the RF and optical alignment of the third dual channel (also 100/230).

Implementation of the new dual C/D 150/270 receivers (129–174/245–290 GHz) is foreseen for the summer of 1999.

B.LAZAREFF reporting for the contributing teams.

Observations with DIABOLO at the 30m telescope

We (F.-Xavier Désert from LAOG, Martin Giard from CESR & Alain Benoit from CRTBT) have built a photometer dedicated to the Sunyaev-Zel'dovich effect and other diffuse sources at 2.1 mm. Its name is DIABOLO. The first results obtained with a preliminary version of this instrument (two co-aligned channels, centred at λ 1.2 and 2.1 mm, respectively) were obtained during the winter 1995-6 and are reported in Désert et al 1998 (*submitted to New Astronomy*; see http://www-laog.obs.ujf-grenoble.fr/ ~desert/diabolo/diabolo.html).

The DIABOLO photometer in its current configuration was installed on the 30-m telescope and fully tested in December 1997. It consists of two co-aligned arrays of 3 channels forming an equilateral triangle, operating at λ 1.2 and 2.1 mm, respectively. The spatial channels have a FWHM beam of 20″ and are positionned with an accuracy of 1.5″, r.m.s. Their nominal offset from the telescope axis is 22″. Because the bolometer is located at the Nasmyth focus, the array projection on the sky rotate with elevation. The detectors are cooled down to 100 milliKelvin.

We have mapped with DIABOLO the brightest X-ray cluster (RXJ1347.5-1145 – see Schindler et al, AA, 317, 646) at λ 1.2 and 2.1 mm, and detected its SZ signature at 2.1 mm with a S/N ratio $\simeq$ 10. For this type of observations, the subtraction of the 1.2 mm channel output from that of the 2.1 mm channel offers a powerful way to decrease the sky noise.

We think that the instrument can now be used by experienced radioastronomers external to our team, and encourage the 30-m telescope users to apply, via the IRAM Program Committee. Observers will be helped by the DIABOLO team members on a shared risk & benefit basis. Please contact F-X. Désert (see address below) well before the September 7th, 1998 deadline if you intend to request telescope time with this instrument.

In the normal observing mode, drift scans at constant elevation are made across the target source, while the secondary mirror is nutated in azimuth (typical rate: 1 Hz, beamthrow: 180″). The sensitivity achieved in good weather conditions on the sky is given:
– for a point source (using only one pointed bolometer): 230 and 86 mJy $s^{-0.5}$, i.e. roughly 4 and 1.3 mJy (1σ) in one hour;
– for an extended source (averaging all 3 bolometers): 220 and 250 μK_{RJ} in one hour, i.e. 0.4 and 0.16 MJy/sr. At 2.1 mm y_{SZ} or $\frac{\Delta T}{T}$ of 1.6×10^{-4} can be achieved per sky pixel.
At 2.1 mm, a factor of $\simeq$ 1.3 of improvement can be achieved for some programs by subtracting the 1.3 mm channel output from the 2.1 mm output.

The total observing time, including dead-time, pointing, focussing, skydips, and photometry calibrations, is about the double of these integration times.

The raw data will be prereduced with a custom-made software (based on IDL) which yields uncalibrated FITs-format maps.

Although it is less sensitive at 1.2 mm than the MPIfR diffraction-limited bolometer array, DIABOLO is well suited for studies of the SZ effect, of microwave background anisotropies, and of the cold dust properties. The 1.2 mm and 2.1 mm bands are optimized for the SZ effect and measurements of dust temperatures of the order of 15 K or lower.

Francois-Xavier Désert
Laboratoire d'Astrophysique, Observatoire de Grenoble, BP 53, 414 rue de la piscine, 38041 Grenoble Cedex 9 FRANCE Tel: (+33) 4 7663 5512, Fax : (+33) 4 7644 8821 email: Francois-Xavier.Desert@obs.ujf-grenoble.fr

Call for Observing Proposals on the 30-m Telescope

Summary

The *next deadline* for the submission of observing proposals for the IRAM 30m telescope is September 7th, 1998, 24:00 h. The scheduling period extends from Nov. 15, 1998 to May 15, 1999, covering roughly the winter period at Pico Veleta. Three types of proposals will be considered:

1. proposals using the observatory's standard heterodyne receivers at wavelengths of 3, 2 and 1.3 mm.
2. proposals using a 0.8 mm heterodyne receiver.
3. proposals using a 1.3mm bolometer. The bolometers are provided by the MPIfR and have arrays of 19 or 37 pixels.
4. proposals using a 2mm bolometer, DIABOLO, owned by the Observatoire de Grenoble.

Roughly 2800 hours of observing time will be available, which should allow scheduling of a few longer programmes (of the order of 100 hours), with emphasis on 1.3 mm observations.

In view of the considerable cost and overhead involved in the operation of non–standard receivers, the 2mm bolometer and the 0.8mm heterodyne receiver will only be scheduled if there is sufficiently strong demand for these instruments.

The main news, proposal formalities, details of the various receivers, and observing modes are described below.

What is new ?

The pair of heterodyne receivers, called `3MM1` and `230G1`, which are served in transmission by the main polarization grid, were replaced at the end of May by new generation receivers (see report by B. Lazareff in this newsletter). These new receivers are located in the same dewar (labelled A), and they are now designated as A100 and A230, according to their location in dewar A and their nominal center frequencies in GHz.

IRAM plans a complete refurbishment of the receiver cabin of the 30m telescope. This work is scheduled for September and October and includes a new layout of the Nasmyth optics and new generation receivers at all frequencies together with their associated LO and IF systems. The decision to actually go ahead with this plan will be made mid July, based on the state of readiness of various critical hardware components. Please refer to the IRAM web pages for more up–to–date information.

The most likely scenario, as perceived at the time of writing, is that the refurbishment of the receiver cabin will go ahead as planned. Apart from the new generation receivers A100 and A230 already in place, there will then also be available the old `2MM` receiver which will be retro–fitted into the new Nasmyth optics. There will therefore always be one receiver available for each of the three principal atmospheric windows.

Construction of a second new generation dewar, hosting receivers B100 and B230, is well advanced. These receivers (orthogonally polarized with respect to and simultaneously usable with A100 and A230) may also be installed in time for the winter scheduling period. However, since the performance of the B–receivers will not be known in time, proposals for 3mm and 1.3mm observations, notablely calculation of integration times, should be based on only one receiver at each wavelength. Proposals which for whatever reason absolutely need two receivers at the same frequency band, either at 3mm or 1.3mm, cannot be accepted for this winter.

The bolometer observations are tentatively scheduled in two sessions, one before the end of the year, the second one early next year. This arrangement should help to optimize the observations for sources at different sidereal times. The MPIfR 19–pixel array is planned to be available for both sessions. The 37–pixel array which experienced considerable spiking in some of last winter's observations is undergoing several modifications. It will not be available for the first session.

Some improvements of the telescope surface were made recently, resulting in slight improvements of efficiencies and beam quality. From last winter's observations at 345 GHz estimates of $\eta_A \simeq 0.12$ and $\eta_B \simeq 0.20$ were derived [16]. Observations in the 345 GHz window are clearly among the most difficult ones at the 30m telescope, due to fast variations of pointing and focus, particularly during daytime, and a dominant error beam. Proposals for the 0.8mm receiver should address these issues.

Applications

Valid proposals consist of the official cover page, up to two pages of text describing the scientific aims, and up to two more pages of figures, tables, and references. The official cover page, in postscript or in Latex format, may be obtained 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/`. In case of problems, contact the secretary, Cathy Berjaud (e–mail: `berjaud@iram.fr`). *Do not use characters smaller than 11pt*, which could make your proposal illegible when copied or faxed. For the same reasons, also avoid sending figures with grey scale maps. Applications should be addressed to:

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

All proposals must reach the Secretariat before September 7th, 1998, 24:00 h. Proposals sent by Fax ((33/0) 476 42 54 69) will be accepted, provided they arrive in a readable form. Except for a duplicate of the source list (see below), no proposal should be sent by e–mail. 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 is incomplete or unreadable, we will try our best to contact you (your responsibility, however).

On the title page, you must fill out the line 'special requirements' if you request either spectral line on-the-fly observations, or the polarimeter, service or remote 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 such personal restrictions could make your observations difficult or impossible to schedule.

We insist upon receiving, with proposals for heterodyne receivers, a complete list of frequencies corrected for source redshift (to 0.1 GHz) Also specify on the cover sheet which receivers you plan to use.

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 up to two pages of figures, tables, and references. 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 . It should include all overheads (see below).

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 hours.

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* of a previously rejected proposal or the *continuation* of a previously accepted 30m telescope proposal. In case of a resubmission, state very briefly in the introduction why the proposal is being resubmitted (e.g. improved scientific justification).

Reminders

A handbook ("The 30m Manual") collecting most of the information necessary to plan 30-m telescope observations is available [10]. The report entitled "Calibration of spectral line data at the IRAM 30m telescope" explains in detail the applied calibration procedure. Both documents can be retrieved through the IRAM Granada web pages (http://www.iram.es). A catalog of well calibrated spectra for a range of sources and transitions (Mauersberger et al. [13]) is very useful for monitoring spectral line calibration.

The On-the-Fly observing mode (OTF) is available for heterodyne observations since more than two years. Considerable progress was made in making the control of the observations and the data reduction user friendly. Documentation is available on the web (http://www.iram.es). Due to the complexity of the OTF observing mode we advise proposers without a demonstrated experience of this technique on the 30m telescope to contact, or involve in their proposal, an astronomer with such experience. David Teyssier of the Granada staff (e–mail: `teyssier@iram.es`) serves as the principal contact in OTF matters.

Frequency switching is available. There is still little experience of frequency-switching with the new-generation receivers A100 and A230. With the "old" receivers, it yields satisfactory baselines within certain limitations (maximum frequency throw of 45 km/s, backends, phase times etc.; for details see [8]). At present, up to 3 receivers can be frequency switched simultaneously. Baselines are ordinarily flatter when using one single receiver.

Many proposals underestimate the time needed to carry out their observations, even under excellent weather conditions. We ask you to pay special attention to this matter as a serious time underestimate may be considered as evidence for insufficient proposal preparation.

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

Observing time estimates

Observing time estimates must take into account:

- integration time on source and comparison field(s), including overheads for ON/OFF telescope motions, deadtime for device switching and data transfer.
- pointing, focus, continuum and line calibrations
- telescope slew motions
- receiver tunings (for heterodyne observations),

For bolometer observations, integration time estimators are available in the NIC software [11]. For heterodyne observations, the total integration time should be derived using the standard radiometer 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 in Hz, and t the total (ON + OFF) integration time in seconds. For 3, 2, and 1.3mm observations, $T_{\rm sys}$ should be estimated for *average* winter conditions (4 mm of precipitable water, or $\tau_{\rm zenith} = 0.3$ at 230 GHz). Proposals for 0.8mm should adopt *good* winter conditions (1.5 mm of water, or $\tau_{\rm zenith} = 0.4$ at 345 GHz).

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[1] of the IRAM Newsletter [9]. 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 using precisely laid–out instructions by the principal investigator. For this type of observation, we request an acknowledgement of the IRAM staff member's help in the forthcoming publication. If you are interested by this mode of observing, specify it as a "special requirement" in the proposal form. IRAM will decide which proposals can actually go to that mode.

Remote observing

The technical implementation of remote observing, where the remote observer is actually controlling the telescope very much like on Pico Veleta, was described in the last Newsletter. A series of practical tests is currently being made from Grenoble, so far with encouraging results. We expect this observing mode to be available next winter in Grenoble for technically easy projects by experienced 30m users. They should note "remote observing" as a special requirement in the proposal cover sheet.

Technical Information about the 30m Telescope

This section gives all the technical details of observations with the 30m telescope that the average user will have to know. See also the concise summary of telescope characteristics published on the IRAM web pages.

Heterodyne Receivers

The optics in the receiver cabin, in its present as well as in its future layout, allows simultaneous observations with up to 4 heterodyne receivers. Table 1 lists the combinations expected to be available next winter. A100 and A230 refer to the new generation receivers centered at 100 and 230 GHz, respectively, and housed in Dewar A which is served in reflection by the future beam divider. The new generation receivers B100 and B230 are planned to

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

be available as a backup. The `2MM` and `0.8MM` receivers refer to the same SIS receivers as installed last winter.

Table 1: Receiver combinations expected for next winter.

	receiver combinations			
receivers	4–Rx	3–Rx		1–Rx
A100	*	*	*	
A230	*	*	*	
2mm		*		
B100	*			
B230	*			
0.8mm			*	
bolometers				*

The new generation receivers A100 and A230

These receivers, housed in dewar A admit beams which are, in Nasmyth coordinates, horizontally polarized.

The tuning band of the new A100 receiver (replacing the old `3MM1` (H polarization) receiver) is 83.5 – 115.5 GHz; its IF bandwidth is about 500 MHz. SSB receiver noise temperature is 80 K or less over the entire band; the image side band rejection is at least 20 dB.

The new A230 receiver (replacing the old `230G1`) can be tuned between 200 and 255 GHz. SSB receiver noise temperatures range between 100 K near 220 GHz and 300 K at the highest frequencies. At 230.5 GHz, values near 150 K were measured. Image band rejection is of the order of 10 dB, the IF bandwidth is $\sim$ 1 GHz at 3 dB[2].

Both receivers can be tuned entirely from the control room. Note however that little experience in operating the receivers exists at the time of writing. For more details see the report elsewhere in this newsletter.

A100 replaces receiver `3MM1` as the standard pointing receiver.

The new generation receivers B100 and B230

These receivers will be housed in dewar B admitting (in Nasmyth coordinates) vertically polarized beams. These receivers whose performance is not yet known will be installed primarily to provide a backup for dewar A, but they will be made available to the observer as much as possible. Note that the "old" receivers `3MM2` and `230G2` will have to be decommissioned if the receiver cabin is rebuilt this autumn.

2mm Receiver

Good and reliable performance over most of the band. Tunable from 129 GHz to 183 GHz with SSB; instantaneous IF bandwidth is 500 MHz. Receiver temperatures ranges from 70 to 150 K (130 to 155 GHz), and 150 to 400 K (155 to 183 GHz). Plans exist to retrofit this old receiver into the new cabin layout.

[2]Note that the 1 GHz bandwidth can presently be used only with the 1 MHz filterbank in 1GHz mode

0.8mm Receiver

Depending on the number of requests and the advice from the Program Committee, the IRAM 345 GHz SIS receiver already in operation last winter will be made available for a limited period of time. Its characteristics are:

- Operating band: 330 GHz - 360 GHz
- Image sideband rejection 4–6 dB
- Receiver temperature= 100 K (up to 345 GHz), 130–150 K above 345 GHz
- IF bandwidth is circa 1 GHz
- Feff = 0.75, Beff = 0.20.

It can be operated either alone or, with some extra losses, simultaneously with A100 and A230. The rejection of the image sideband reduces the contribution of the atmosphere to the system noise temperature and significantly lowers the latter. Although system temperatures lower than 500 K were recorded last winter with precipitable water vapour below 1mm, we ask you to adopt the more conservative value of 1.5 mm of H_2O, or $\tau_{zenith} = 0.4$ at 340 GHz, in your integration time calculations (see Fig. C.1 of the 30-m telescope manual). The values in the four last columns/lines of Table 4.3 of the 30-m telescope manual) should then be replaced by:

Freq(GHz)	pwv[mm]	τ	T^*_{sys}	$T^*_{\mathrm{A,rms}}$
340	1.5	0.4	720	0.059

for 10 min integration at an elevation of 50° in a 1 MHz bandwidth.

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.

Polarimeter

Polarimeters have been constructed by IRAM for measurements of *circular* polarization. They have already been used on the telescope (see e.g. the March 1994 issue of the IRAM Newsletter).

In case you are considering observations of circular polarization, please contact IRAM (preferentially B. Lazareff or C. Thum) to discuss what might actually be possible this winter.

The MPIfR Bolometer arrays

The 19–pixel MPIfR bolometer array which was used at the telescope last winter will be again available. The horns are located at the center and on the corners 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 37–pixel array has an additional hexagonal ring of horns, but is otherwise very similar to the 19-pixel array. The 37-pixel array was also used at the telescope last winter successfully, but several technical imperfections, notably excessive spiking, make some modifications necessary. It will therefore not be available before early next year.

The bolometers are used with the wobbling (typically at a rate of 2 Hz in azimuth) secondary mirror. The orientation of the beams on the sky changes with hour angle due to parallactic and Nasmyth rotation, as the array is fixed in Nasmyth coordinates. Special software is made available at the telescope for data reduction (NIC [11] and MOPS [12]).

It is planned to have two bolometer sessions, one near the beginning of the winter scheduling period, the second one probably early next year. The 37–pixel array will not be available for the first session. Observers are invited to express their preference for one or the other observing session, based on sidereal time considerations and/or array size.

The 2mm bolometer

DIABOLO which currently employs two linear arrays of 3 pixels, centred respectively at λ 1.2 mm and 2.1 mm, respectively, is designed for detection of weak and somewhat extended sources. The instrument which was used successfully at the 30m telescope last winter, is described by X. Désert elsewhere in this newsletter. The level of integration of the instrument into the 30m telescope's standard control and acquisition system is minimal, however, complicating the use of this instrument. Obervers interested in using DIABOLO should contact X. Désert at the Observatoire de Grenoble for arranging some form of collaboration.

Efficiencies and error beam

The telescope efficiencies (main beam and aperture efficiency) are given in Appendix A of "The 30m Manual" and the IRAM newsletter No. 18, (November 1994). A one–page summary of the telescope system is on the web (http://www.iram.es/Telescope/systsumm.ps).

At 1.3 mm (and a fortiori at shorter wavelengths) a large fraction of the power pattern is distributed in an error beam which can be approximated by two Gaussians of FWHP $\simeq 170''$ and $800''$ (see [16, 1] for 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 in the first error beam of FWHP $\simeq 120''$ is twice larger than in the main beam.

The aperture efficiency depends somewhat on the elevation, particularly at shorter wavelengths. This gain/elevation effect is evaluated in [15].

Backends

There are 3 types of spectral line backends which can be individually connected to any receiver.

- The 1 MHz 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 maximum bandwidth of 1 GHz is available for only one receiver, naturally one having a 1 GHz wide if bandwidth like A230. Conncetion of the filterbank in 1 GHz mode presently excludes the use of any other backend with the same receiver.
  Other configurations of the 1 MHz filterbank include a setup in 2 units of 512 MHz connected to two different receivers, or 4 units connected to up to four different receivers. Each unit can be shifted in steps of 32 MHz relative to the center frequency of the connected receiver.
- The 100 kHz filterbank, consisting of 256 channels of 100 kHz. It can be split into two halves, each movable inside the 500 MHz if bandwidth, and connectable to two different receivers.
- The autocorrelator backend with up to 2048 channels. Available nominal resolutions are 10, 20, 40, 80, 320 and 1250 kHz. Nominal bandwidths range from 20 MHz to 2 $\times$ 512 MHz, depending on resolution. The correlator can be split into 8 independent subbands, each of which can be configured individually, shifted inside a 500 MHz IF band, and connected to the same or different receivers. For the larger bandwidths (i.e. more than one subband of 80 MHz) there is often a problem of platforming, i.e. baselines from the different subbands have slightly different power levels.

Pointing / Focusing

Pointing sessions are made every one to two weeks; at present, the fitted pointing parameters yield an absolute rms pointing accuracy of better than $3''$ [14]. 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). Systematic (up to 0.4 mm) differences between the foci of various receivers were noted in the past and may well persist, even with the new generation receivers. In such a case the foci should be carefully monitored and a compromise value be chosen. Not doing so may result in broadened and distorted beams ([1]).

Wobbling Secondary

- Beam–throw is $\leq 240''$ depending on wobbling frequency.
- Standard phase duration: 2 sec for spectral line observations, 0.25 sec for continuum observations.

References

[1] Appendix I: Error beam and side lobes of the 30 m telescope at 1.3 mm, 2 mm and 3 mm wavelength in: Molecular Spiral Structure in Messier 51, S. Garcia-Burillo, M. Guélin, J. Cernicharo 1993 Astron. Astrophys. **274**, 144-146.

[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 1993, IEEE Trans. Ant. Propag. AP–40, 1375

[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 1994, IEEE Trans. Ant. Propag. AP–42, 1345

[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, Proc. IEEE 82, 687

[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 http://iram.fr/newsletter/jan95/jan95.html)

[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.

[13] Line Calibrators at $\lambda = 1.3$, 2, and 3mm. R. Mauersberger, M. Guélin, J. Martín–Pintado, C. Thum, J. Cernicharo, H. Hein, and S.Navarro 1989, A&A Suppl. 79, 217

[14] The Pointing of the IRAM 30m Telescope A. Greve, J.–F. Panis, and C. Thum 1996, A&A Suppl. 115, 379

[15] The gain–elevation correction of the IRAM 30m Telescope A. Greve, R. Neri, and A. Sievers 1998, A&A Suppl., in print

[16] The beam pattern of the IRAM 30m Telescope A. Greve, C. Kramer, and W. Wild 1998, A&A Suppl., in print

These reports are available upon request (see also previous Newsletters). Please write to Mrs. C. Berjaud, IRAM Grenoble (e–mail: `berjaud@iram.fr`).

Clemens Thum, 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 November 15, 1998 to May 15, 1999. The deadline for applications is September 7th, 1998, midnight (24 hr). Proposals sent by fax will be accepted, provided they arrive by that time in a readable form.

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.

Details of the PdBI and the observing procedures are given in the document "An Introduction to the IRAM Plateau de Bure Interferometer". A copy can be obtained from the address below or from Internet via the World-Wide-Web (use IRAM's home page at `http://iram.fr`). 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

Proposal templates may be obtained by anonymous ftp from `iram.fr` in directory `dist/proposal`, as well as the Latex style file `proposal.sty`; or from Internet via the World-Wide-Web at http://iram.fr/proposal/proposal.html. In case of problems, contact the secretary, Cathy Berjaud.

Do not use characters smaller than 11pt, which could make your proposal illegible when copied or faxed. For the same reasons, also avoid sending figures with grey scale maps. In case your proposal reaches us in time, but is incomplete or unreadable when copied, we will try our best to contact you. Proposals sent by e-mail, however, will *not* be accepted. The Principal Investigator will receive an acknowledgement of receipt and the proposal number.

The scientific aims of the proposed programme should be explained in 2 pages of text *maximum*, plus up to two pages of figures, tables, and references. Proposals should be self-explanatory, clearly state these aims, and explain the need of the Plateau de Bure interferometer.

In all cases, indicate on the first page whether your proposal is (or is not) the *resubmission* of a previously rejected proposal or the *continuation* of a previously accepted proposal. In case of a resubmission, state very briefly in the introduction why the proposal is being resubmitted (e.g. improved scientific justification).

For this call for proposals, please note the following points.

Backup Projects for the May-Nov. 1998 period

Because of heavy antenna maintenance, not all the backup projects for the summer period will be scheduled. *We urge proposers to re-submit them* unless they have explicitly been notified of their effective scheduling.

Proposal category

Proposals should be submitted for one of the four categories:

1.3mm: Proposals that ask for 1.3mm data *only.* 3mm receivers will be used for pointing and calibration purposes, but cannot provide any imaging.

3mm: 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.

dual freq.: Proposals that ask for dual-frequency observations.

special: Exploratory proposals: proposals whose scientific interest justifies the attempt to use the PdB array beyond its guaranteed capabilities. This category includes for example non-standard frequencies for which tuning cannot be guaranteed, non-standard configurations 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.

Configurations

Standard configurations for the winter period are:

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

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.

Finally, enter ANY in the proposal form if your project doesn't need any particular configuration.

Receivers

All antennas are equipped with fully operational dual frequency receivers. The available frequency range will be 82 GHz to 116 GHz for the 3mm band, and 210 to 245 GHz for the 1.3 mm band. The 3mm and 1.3mm receivers are aligned to within about 2″.

Below 110 GHz, receivers offer best performances in LSB tuning with high rejection (20 dB): expected system temperatures are (in T_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_{REC} below 50 K. Expected SSB system temperatures are 250 to 350 K. 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.

1.3mm band observations

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. Experience shows that a final phase noise below 30 degrees at 230 GHz is obtained under good circumstances.

Signal to Noise

The rms noise can be computed from

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

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 (25 at 3mm, 45 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 (1 for D, 2 for CD, 3 for BC)
- 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)

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 R. Neri in case of doubts.

Data reduction

Proposers should be aware of constraints for data reduction:

- In general, data should 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

A local contact will be assigned to every proposal which does not involve an in-house collaborator. Depending upon the programme 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 programme committee. Please help in this task by submitting technically precise proposals. Note that your proposal must be complete and exact: **the velocities, position and frequency setup must be exactly specified**.

Non-standard observations

Please contact R.Neri, R.Lucas, or S.Guilloteau in case of doubt about non-standard program feasibility.

The documentation for the IRAM Plateau de Bure Interferometer includes documents of general interest to potential users:

- 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.

Roberto NERI

Scientific results

EXTENDED COLD DUST EMISSION AT 1.3 mm FROM EVOLVED STARS

C.Sánchez Contreras[1,2], J.Alcolea[1], V.Bujarrabal[1] and R.Neri[3]

[1]Observatorio Astronómico Nacional (IGN), Apartado 1143, E-28800 Alcalá de Henares, Spain

[2] Departamento de Astrofísica, Facultad C. Físicas, Universidad Complutense, E-28040 Madrid, Spain

[3] IRAM, 300 rue de la Piscine, F-38406 St Martin d'Hères, France

We have performed maps of the 1.3 mm continuum emission from a sample of 16 evolved stars. We have detected emission from a total of 11 objects, two of which are new detections at this wavelength: M 1-92 and, tentatively, M 1-91. 4 objects in the sample, the bipolar nebulae M 2-9, OH 231.8+4.2, NGC 7027 and CRL 2688, show extended emission in the direction of their symmetry axis up to distances from the central star $\sim 10^{17}$ cm. We argue that most of this radio emissio is arising from cold dust present in the bipolar lobes. Extended emission has not been found in the direction perpendicular to the nebular axis (except probably for NGC 7027), therefore the equatorial torus/disk of dust probably present in this type of objects is not extended enough to be detected by our observations. The 1.3 mm emission map of NGC 7027 shows an extended structure elongated approximately in the equatorial plane. This component extends up to a distance from the nebula center of about 15″, and we think it could correspond to the outer region of the circumstellar disk of dust observed at shorter wavelengths in this source. In cases were extended components have been found, we estimate, assuming simplifying hypotheses, the temperature and mass of the dust. In the sources M 2-9, OH 231.8+4.2 and CRL 2688, the cold dust mass is $\sim 2\ 10^{-3}\ M_\odot$, while NGC 7027 seems to have a larger dust content, $\sim 10^{-2}\ M_\odot$. For M 2-9 and OH 231.8+4.2 the uncertainty factors of our estimations have values between 2 and 3.5. For CRL 2688 the errors can be as high as a factor 10, and for NGC 7027 the dust mass given could just be a lower limit. In all the well studied cases, the cold dust component represents a large fraction of the total dust mass in the envelope ($\gtrsim$ 50%) and is probably composed by relatively big grains (radii larger than 1 μm). We caution that the analysis of radio continuum emission can be very uncertain when not enough data on extent and spectral flux distribution exist.

To appear in A&A. Preprints can be obtained from sanchez@oan.es

KINEMATICS OF THE GAS IN A BARRED GALAXY: DO STRONG SHOCKS INHIBIT STAR FORMATION?

Abstract: Denis Reynaud([1]) and Dennis Downes([1])
([1]) Institut de Radio Astronomie Millimétrique, F-38406 Saint Martin d'Hères, France

We present new CO(1–0) maps of the barred spiral galaxy NGC 1530 with a resolution of 5″.3, obtained by adding short spacing visibilities from the IRAM 30m telescope to data from the IRAM interferometer. The improvement in sensitivity is spectacular, allowing us to detect with high signal-to-noise the extended CO lanes along the bar of the galaxy. These molecular gas lanes, which are density waves or shocks created by the barred potential, show a remarkable kinematic pattern. We find 50 to 100 km s^{-1} outward motions upstream of the lanes, and 70 to 150 km s^{-1} inward motions in and downstream of the lanes. The intensity of the shocks is greatest near the central CO concentration, and decreases to zero at the ends of the bar. We compare these kinematic features with a map of the Hα distribution that traces young stars. Star formation is very intense around the nucleus of the galaxy and at the ends of the bar. It is weak halfway between these extremities. In general, the HII regions are downstream of the CO lanes. The star formation is probably inhibited in the lanes at the places where the shocks and the shear are too strong. There may be a maximum threshold of 80 to 170 km s^{-1} for the relative velocity of any cloud entering the density wave, above which the cloud cannot form stars.

Accepted by Astronomy & Astrophysics.
e-mail : reynaud@iram.fr

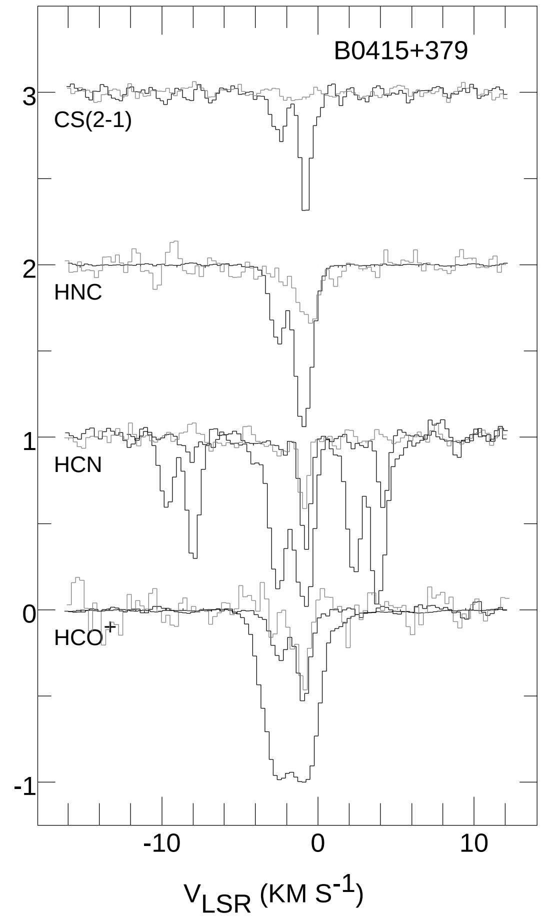


Figure 3: H^{12}C^{16}O$^+$, H^{13}CO$^+$ (×5), H^{12}C^{14}N, H^{13}C^{14}N (×7), H^{14}N^{12}C, and ^{12}C^{32}S (J=2-1) absorption spectra toward B0415+379=3C111 (solid lines) with H^{12}C^{18}O$^+$ (×27.5), H^{12}C^{15}N (×10), H^{14}N^{13}C (×15) and C^{34}S overlaid (shaded).

Interstellar isotope ratios from mm-wave molecular absorption spectra

Abstract: R. Lucas([1]), H. Liszt([2])
([1])Institut de Radioastronomie Millimétrique, 300 Rue de la Piscine, F-38406 Saint Martin d'Hères, France
([2])National Radio Astronomy Observatory, 520 Edgemont Road, Charlottesville, VA, USA 22903-2475

We have measured galactic λ3mm absorption spectra of HCO$^+$, HCN, HNC, and CS toward compact extragalactic continuum sources in order to derive the isotopic abundance ratios ^{12}C/^{13}C, ^{14}N/^{15}N, ^{16}O/^{18}O, and ^{32}S/^{34}S in local diffuse clouds. For carbon, our data confirm recent results for the local ISM: we find ^{12}C/^{13}C $= 59\pm2$. For nitrogen, we find ^{14}N/^{15}N $= 237(-21,+27)$ consistent with the Solar value of 270, but substantially smaller than the values inferred from HCN emission in dense clouds. For sulfur we find ^{32}S/^{34}S $\approx 19 \pm 8$ consistent with the Solar value of 23. We also find one striking individual anomaly:

toward 3C111 (B0415+379), $H^{12}CN/H^{13}CN = 170 \pm 50$ in one kinematic component (Fig. 3). We attribute this to the fractionation of ^{13}C into ^{13}CO which may be so great that HCN is starved for ^{13}C.
*Preprints:*http://iram.fr/ lucas/papers/isotopes.ps.gz

New Preprints

474. Vigorous Star Formation Hidden By Dust in a Galaxy at $z = 1.4$
A. Cimatti, P. Andreani, H. Röttgering, R. Tilanus
1998, *Astronomy and Astrophysics*

475. Astronomical Detection of the Cyanobutadiynyl Radical C_5N
M. Guélin, N. Neininger, J. Cernicharo
1998, *Astronomy and Astrophysics*

476. The Gain-Elevation Correction Of The IRAM 30-M Telescope
A. Greve, R. Neri, A. Sievers
1998, *Astronomy and Astrophysics*

477. Rotating Nuclear Disks and Extreme Starbursts In Ultraluminous Galaxies
D. Downes, P.M. Solomon
1998, *Astrophys. Journal*

478. Extended Cold Dust Emission At 1.3 MM From Evolved Stars
C. Sanchez Contreras, J. Alcolea, V. Bujarrabal, R. Neri
1998, *Astronomy and Astrophysics*

479. Kinematics Of The Gas In A Barred Galaxy: Do Strong Shocks Inhibit Star Formation?
D. Reynaud, D. Downes
1998, *Astronomy and Astrophysics*

Vacant Position

We invite applications for the position of
'Station Manager'
at IRAM-Granada. This position will be open early in 1999.

The IRAM-Granada station comprises the Pico Veleta Observatory as well as the Granada offices and laboratories.

The Pico Veleta Observatory with its 30m-diameter mm-wavelength telescope, its complement of receivers, backends and computers is operated as a facility which is open to astronomers from France, Germany and Spain, and from the worldwide astronomical community, on a competitive basis.

The IRAM-Granada station has a total staff of 27, including astronomers, telescope operators, engineers and technicians, and a small administration.

The successful candidate should have several years of experience as an astronomer and strong technical interests.

The working language at IRAM-Granada is English. The interaction with the Spanish authorities does, however, require a good knowledge of the Spanish language. While this is not a necessary condition, it will be one of the criteria on which the selection will be made.

Applications, including a CV, a list of publications and references, should be addressed to the IRAM Headquarters at :

IRAM
attn. M. Grewing
300, rue de la Piscine
F-38406 St.Martin d'Heres
FRANCE.

They should reach IRAM before September 15th, 1998.

The IRAM Newsletter is edited by Michel GUÉLIN at IRAM-Grenoble (e-mail address: `guelin@iram.fr`).
In order to reduce costs we are now sending paper copies of this Newsletter to astronomical libraries only. The IRAM Newsletter is available in electronic form:

- by using the World Wide Web: from the IRAM home page (`http://iram.fr/`), click on item "Newsletter" and follow the links...
- by means of an anonymous `ftp` account, opened at IRAM for Internet users. To access those files, please connect through `ftp` to `iram.fr` (or `193.48.252.22`) and read the `README` file. Several subdirectories are available:

Directory	Contents
`/dist/newsletter`	Recent issues of this Newsletter (one subdirectory per issue)
e.g. `/dist/newsletter/jul95`	jul95.ps is the Postscript file for the July 1995 issue.
`/dist/doc`	Documentation on IRAM telescopes and software
`/dist/proposal`	Proposal forms and Latex files to aid proposal preparation
`/dist/soft`	distribution files for reduction software

- by means of an electronic mail file server installed at IRAM (on the Alpha machine IRAM04). This file server is a file distribution service that uses electronic mail facilities to deliver files. To communicate with it you should send a message to the electronic address:
  `newsserv@iram.grenet.fr`
  For instance, to obtain a copy of the May 1992 issue, just send the one line message:
  `SENDME MAY92.PS`
  to the above electronic address. You will receive later a mail message containing the IRAM Newsletter in Postscript code. Please discard all the e-mail header information with a text editor, and send the file to a Postscript laser printer.
  More information may be obtained by sending the one line message:
  `HELP`
  Note that this file server also contains Postcript files of the proposal forms and of Plateau de Bure documentation.

We also compile a list of e-mail addresses of IRAM users (e.g., in order to send warning messages when the Newsletter is available, but also to provide fast information, if needed). If you feel your address should be on this list, please send the one line message:

`SUBSCRIBE NEWSSERV` *your name*

to the following e-mail address:
`newsserv@iram.grenet.fr`
Both addresses are valid on Internet, EARN-Bitnet and EAN .... Please keep M. Guélin informed of any problem you may encounter.

IRAM Addresses:

	Address:	Telephone:	Fax:
Grenoble	Institut de Radioastronomie Millimétrique, 300 rue de la Piscine, Domaine Universitaire, 38406 St Martin d'Hères Cedex, France		
	from abroad:	33 476 82 49 00	33 476 51 59 38
	from France:	0 476 82 49 00	0 476 51 59 38
Plateau de Bure	Institut de Radioastronomie Millimétrique, Observatoire du Plateau de Bure, 05250 St Etienne en Dévoluy, France		
	from abroad:	33 492 52 53 60	33 492 52 53 61
	from France:	0 492 52 53 60	0 492 52 53 61
Granada	Instituto de Radioastronomía Milimétrica, Avenida Divina Pastora 7, Núcleo Central, 18012 Granada, España	(34) 958 22 88 99	(34) 958 22 23 63
Pico Veleta	Instituto de Radioastronomía Milimétrica, Estación Radioastronómica IRAM-IGN del Pico Veleta, Sierra Nevada, 18012 Granada, España		
	starting April 15:	(34) 958 48 20 02	(34) 958 48 11 48

E-Mail Addresses:

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

The `username` is generally the last name of the person to be contacted.