IRAM Newsletter

Number 11 September 14, 1993

Contents

Calendar of IRAM Meetings

- **Special IRAM S.A.C. Meeting**
  September 28th, 1993
  Location: Grenoble Contact: M.Grewing

- **SIS User Meeting**
  November 4/5th, 1993
  This meeting is intended for all SIS junction fabrication and receiver groups. Current activities and future projects will be discussed.
  Location: Grenoble Contact: Thomas Lehnert

- **IRAM User Meeting**
  December 6/7th, 1993
  This meeting is intended to discuss the current telescope status (30m and PdBI) and the plans for future developments. There will also be an opportunity to highlight recent scientific results, either in the form of short oral presentations or in a limited number of posters. In connection with the User Meeting one or two workshops will be organized.
  Location: Grenoble Contact: M.Grewing

New People

Pico Veleta Station Manager

We are pleased to announce the appointment of Wolfgang Wild as Station Manager for the 30-m telescope and the Granada site. Wolfgang was previously Astronomer on duty at the SEST telescope in La Silla. Wolfgang's active role over the past three years in the operation of the SEST telescope, and his dual background in astronomy and instrumentation, are strong assets for his new position in IRAM.

Albert Greve deserves the warm thanks of the community for his efficient management and the improvements he brought to the operation of the 30-m telescope over the past two and a half years. He is returning to the Grenoble site, but will keep an active role in the improvement of the surface accuracy of the 30-m telescope.

Head of Receiver Group

We are pleased to announce the appointment of James Lamb as Head of the Receiver Group in Grenoble. James Lamb was previously Senior Electronics Engineer with NRAO in Tucson. He designed various millimeter receiver systems and was in charge of the MMA antenna design group. He also worked on the development of closed-cycle cryocoolers and on optical design methods. James fills a long-standing void in the organigram at a time when is IRAM about to build and implement a new generation of receivers on the PdB interferometer and on the 30-m telescope.

Bernard LAZAREFF

Interferometer

Maintenance

In July-August, the regular 4-antenna operation had to be interrupted, to allow for major maintenance of the antennas, including the installation of a motorized translation of the subreflector designed for better adjustment, especially at high frequencies. At this occasion the SIS receiver on Antenna 2 was replaced. We used this long 3–antenna period (6 weeks) to perform mostly detection or snapshot projects. Mapping projects resumed by August 20.

Data Reduction

Two problems may affect the versions of CLIC possibly present in other institutes:

- A bug was found to be present in CLIC since May 26, 1993. The RF passband calibration had been introducing a phase offset in channel mode (subbands L01 to L06), and in frequency mode (all subbands), while the continuum subbands (C01 to C06) were not affected in channel mode. The offset was happily compensated for by subsequent phase calibration, as long as the RF passband was applied in the same mode to both the source and the phase calibrator. However the offset does appear in the following case: the RF passband is applied in channel mode to the spectral subbands for the source, while the phase calibration has been computed using the continuum subbands. Please contact R. Lucas if you have doubts on calibrations done using a recent version of CLIC (later than May 26).
- A bug was present in the HP Fortran compiler that has been in use in Grenoble, impairing the floating point values during the conversion from VAX to EEEI representations. Fortunately it did not affect the systematic data sorting done on the Plateau.

New versions of GreG, GRAPHIC, ASTRO, CLASS and CLIC will soon be available. They will enable the use of color graphics and bitmap displays, using X-windows.

Stéphane GUILLOTEAU

Receiver development activities

Dual-frequency receiver for PdBI.

A prototype receiver (3mm+1.3mm) using a commercial Infrared Laboratories hybrid cryostat is undergoing tests. The fully configured receiver, including optical windows, waveguide LO inputs, and IF amplifiers, has a Helium consumption that corresponds to 20-day hold time from the 5-liter reservoir. Initial problems with the vibration level have been solved after requesting modifications from the cryostat manufacturer.

2mm Mixer.

Preliminary tests for the first inductively compensated Nb junctions for the 2mm band have been performed. The results are encouraging, and, at this preliminary stage, show that a much flatter noise curve has been achieved than with uncompensated junctions, giving a significant improvement at the high end (170 GHz) of the band.

1.3mm Mixer.

A new series of designs of inductively compensated Nb junctions for the 1.3mm band has been made. These junctions have been successfully fabricated by the SIS group, and testing has begun. A particular design with relatively large area junctions shows good noise performance over 200–250 GHz *without applying a magnetic field.* This is an important point in view of the planned use in a multi-beam array. Besides, one of the main goals of this redesign has been met : with a symmetric tuning structure, the photon steps are not split as in the first design.

VME-based remote tuning system.

Prototype hardware and software have been tested together. A few hardware bugs have been corrected, and the boards are now in volume production with outside subcontractors.

Bernard LAZAREFF

Electronic mail

The numeric addresses of IRAM-Grenoble on P.S.I. and on Internet have been modified (see the last page of this Newsletter). SPAN is no more available at IRAM-Grenoble. The ftp anonymous connection has been interrupted for a short period during the summer (please excuse this inconvenience), but is now again available (`iraux2.grenet.fr`).

Call for Proposals for the 30-m Telescope

The *next deadline* for the submission of observing proposals for the IRAM 30 m telescope is *Monday, October 4th, 1993* . Three types of proposals will be considered:

- proposals at 3 mm, 2 mm and 1.3 mm wavelength using heterodyne receivers (to be scheduled between January 1994 and May 15th 1993);
- proposals at 0.8 mm wavelength using an heterodyne receiver (to be scheduled in January or February 1994). The receiver will be the IRAM SIS 345 GHz receiver which was tested at the telescope last spring. This receiver can be operated simultaneously with 230G1 and the 3mm SIS receiver.
- proposals at 1.3 mm wavelength using the MPIfR 7-channel bolometer array [11] (to be scheduled in March 1994).

We intend to switch soon from 4 to 6 month observing sessions: a 'summer' session from mid-May to mid-November and a 'winter' session from mid-November to mid-May. As a transition to this new schedule, which was recommended by the SAC and endorsed by the IRAM Council, the coming observing session will be 4.5 month long and will extend from January 1st to **May 15th**, 1994.

Roughly 1500 h of observing time will be available for proposals using 3 mm, 2 mm and 1.3 mm heterodyne receivers, 150 hours for proposals using the 0.8 mm SIS receiver and 400-500 hours for proposals using the bolometer array. As the accepted 0.8mm programmes can only be carried out under extremely dry weather conditions which are impossible to predict many months in advance, we plan to apply a special scheduling procedure which is explained in detail below (page 5).

Observing proposals

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 should have *reached* the Secretariat by *Monday, October 4th, 1993* , midnight. (Proposals sent by Fax will be accepted, provided they arrive by that time in a readable form; FAX (33) 76 51 59 38). 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 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 (cf. model enclosed; these forms are also available by anonymous ftp from `iraux2.grenet.fr` in directory `dist/proposal`, together with a Latex style file). Do not use characters smaller than 11pt, which would make your proposal unreadable if we had to fax it, e.g. to the members of the P.C.

On the title page, you must fill out the line 'special requirements' if you request '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 redshift (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 use of the second 1.3 mm receiver 230G2, which, otherwise, can be used in parallel with receiver 230G1 (see below).*

If your source list is long (e.g. more than 15 sources), we would appreciate if you could send us a duplicate by e-mail to one of the following addresses:

- berjaud@iram.grenet.fr
- berjaud@iramfr51.bitnet
- psi%0208038080590::berjaud (*Note the new PSI number*)

this will help us to keep up a computerized source list.

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 the scientific aims, and explain the need of the 30 m telescope. The amount of time requested should be carefully estimated and justified (receiver performance is summarized 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 many small projects but should rather be submitted as one bigger project even if this means 100 hrs, or even 150 hrs. Especially for projects that use the 1.3 mm receiver which can almost only be done during the winter period this approach is advisable.

If time has already been given to the 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 form whether your proposal is (or is not) the resubmission or the continuation of a previously submitted 30 m telescope proposal.*

Service observing

To facilitate the execution of short ($\leq$8 h) programmes, we propose "service observing" for some easy to observe (e.g. single source) programmes *with only one set of tunings.* The observing will be made by the IRAM staff, according to a pre-submitted observing plan (forms will be given when proposals are accepted). 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). If you are located in Spain, France, or Germany, we will try to e-mail you, via IBERPAC, TRANSPAC, etc..., the `spectra.30m` files in quasi real-time; this excludes any intervention in the execution of the programme (see below for more details, page 6).

Programmes for the September 1993 – December 1993 period

Eighty-nine 30m telescope proposals were submitted for the deadline of June 1993. 29 proposals were rated "A", 23 "B", the others "C" or "D". About half of them will actually get time on the telescope, some, however, with less time than requested. The telescope schedule until mid-October is made; the programme PIs have been or are being notified. The November and December schedule will be published shortly. The bolometer programmes will be scheduled in the first half of December.

Principal Investigators of accepted proposals receive with the telescope schedule a *Confirmation of Observing Time* form which we ask you to return by Fax, properly filled, to IRAM Granada *and* IRAM Grenoble (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 reception in Grenoble of this form that we will send duly signed mission forms to those of you entitled to travel reimbursement.

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

Note that the telephone number and FAX number of the Pico Veleta Observatory (i.e. the telescope site) are: Tel: (34) 58-48-02-11 Fax: (34) 58-48-08-60

Relevant Information about the 30 m Telescope

Receivers

The following table lists the possible receiver combinations:

	Receiver Combinations						
Receivers	3-Rx			2-Rx			1-Rx
3mm-SIS	*	*	*				
Cont-3mm				*	*	*	
2mm		*		*			
230G1	*	*	*				
230G2	*				*		
0.8mm-SIS			*			*	
Bolo							*

3 mm Continuum Receiver

A cooled 2-channel receiver, operating in 1-channel mode with a Millitech Schottky mixer, is installed in line with the 4th mirror, behind the polarization rotator. This receiver can be used simultaneously with either the 2 mm receiver, the 230G2 receiver, or a guest receiver (see table).

The Continuum receiver can only be used for pointing. Continuum sources of $\geq$ 0.8 Jy (at 86 GHz) can be used for pointing checks; there are approximately 120 continuum sources catalogued. The Continuum receiver is normally aligned within $2''$ of the other receivers.

3 mm SIS receiver

(tuning band: 85 - 116 GHz).

This receiver has been equipped with a new Nb junction mixer in August 1992. Its performances on the telescope are summarized in Fig. 1. The SSB receiver temperature is 110K at 115 GHz, and 70–100 K below 100 GHz. *Note that the IF frequency of this receiver is 1.5 GHz, and not 3.9 GHz as for the 1.3 mm and 2 mm receivers.* When tuned for the CO 115.27 GHz line in the LSB, the oxygen 118.75 GHz falls in the USB: system temperatures are lower therefore when using a large (> 10dB) USB rejection. Some results on this receiver performances are described in ref. [15].

It is important to check your calibration on strong reference sources (see IRAM line catalog and updates [1, 10, 15]). 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).

2 mm Receiver

Good and reliable performances over most of the band (see Fig. 2). Tunable from 130 GHz to 180 GHz (SSB receiver temperatures of 80 K between 130 and 150 GHz, 150 K at 160 GHz and increasing to 300-500 K between 165 and 180 GHz).

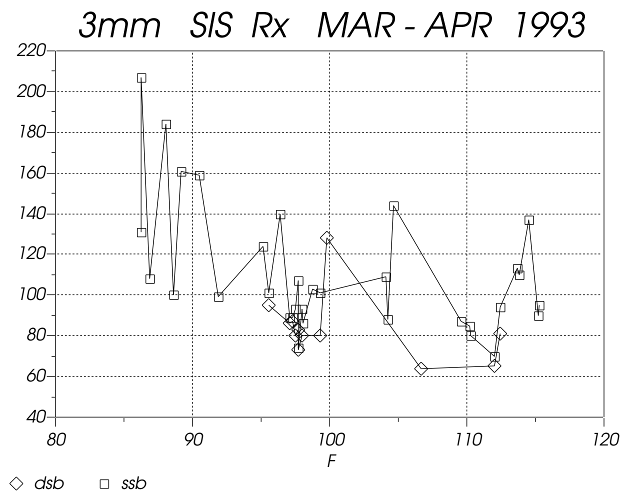

Figure 1: Performance of the 3mm SIS receiver

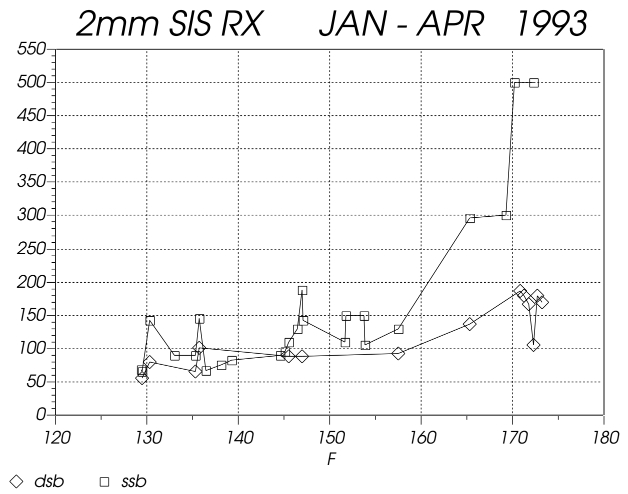

Figure 2: Performance of the 2mm SIS receiver

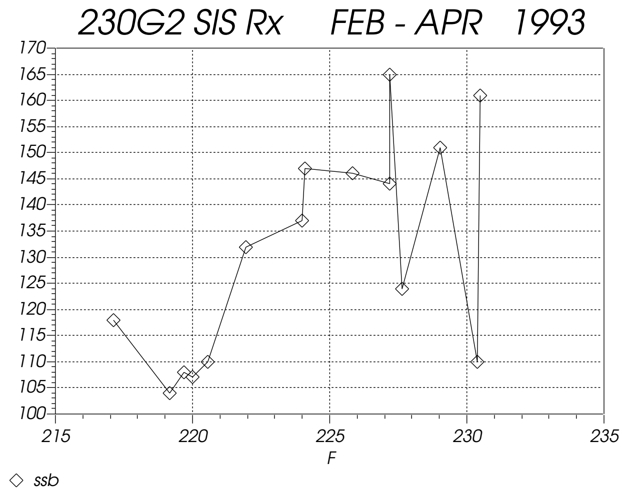

Figure 3: Performance of the 230 G2 SIS receiver

1.3 mm heterodyne Receivers

- 230G1:

  Operating band: 210 – 255 GHz in LSB (improved performances when rejecting the USB) and up to 267 GHz in the USB. Between 215 and 235 GHz, the SSB receiver temperature is around 110 K. The DSB receiver temperature is 250 K at 266 GHz.

- 230G2:

  Operating band 215 – 235 GHz. Good performances over most of this band; USB rejection ($\geq$ 10 dB) possible (see Fig. 3). SSB temperature between 220 and 230 GHz is $\simeq$140 K.

The two 1.3 mm receivers and the 3 mm SIS RX can be used simultaneously. Beware, however, of possible interference of 230G2's LO into the 3 mm RX. *The 230G2 RX cannot be operated with the 2 mm receiver*, since both receivers use the same control box. Switching from one RX to the other is not straightforward and will not be made upon request in real time. Please specify in the proposal form whether you choose to use the 2 mm RX or 230G2.

At 1.3 mm (and *a fortiori* at shorter wavelengths) a large fraction of the power radiated by the receiver horn 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.

0.8 mm SIS Receiver

(tuning band 330–360 GHz).

The IRAM 345 GHz SIS receiver will be made available for a couple of weeks. The expected performances are:

- DSB receiver temperature: 100–120 K (up to 345 GHz), 130–150 K above
- Forward efficiency: 0.8
- Beam efficiency: 0.17

This receiver works only in DSB mode with an IF of 1.5 GHz.

We plan an 0.8 mm observing session in January/February 1994. Programs will be accepted for a total *net* observing time of up to ten days. These must all be projects that clearly need *extremely good weather conditions*. A prime time project with N hours observing time will be scheduled three times N hours. It is the responsibility of the PI of a "good weather project" to consider a given atmospheric condition suitable for his project or else, wait for a second or third occurence of his time slot. In case that the weather conditions are considered insufficient, backup programs will be executed, which require less stringent atmospheric conditions (operating at lower frequencies, or/and away from the atmospheric absorption lines). Thus two groups of observers will have to be present at the telescope during the special scheduling period of a total duration of one month.

The MPIfR 7-channel Bolometer array

The MPIfR 7-channel 1.3 mm bolometer [11] will be available in March to external users for a period of 3 weeks. The seven horns are located at the corners and center of a hexagon with a corner-to-corner spacing corresponding to 20″. Each channel has a sensitivity of $\simeq$ 90 mJy $s^{1/2}$ under very good weather conditions and a HPBW of 12″.

This bolometer is normally operated by wobbling at 2 Hz the secondary mirror in azimuth. As the array is fixed in Nasmyth coordinates, the orientation of the 7 beams with respect to the sky and to the chopping direction changes with elevation. A special software will be made available at the telescope and in Granada for data reduction [17].

The IRAM 1.2 mm single-channel bolometer will normally not be available during this session.

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) there is no guarantee for a prior test of the requested tunings.

Remote observing / Service observing

The telescope is controlled by the operator, assisted by the astronomer on duty, in the local as well as in the remote observing modes. The operator tunes the receivers (at least during night time) and is in charge of the supervision of the telescope; he has to leave occasionally the control room. During this time the astronomer on duty takes over. Remote observations thus require two persons at the telescope and are only possible for a limited number of hours. For safety reasons, direct access to the OBS/OBSINP telescope control programmes from outside is not allowed, except from IRAM Granada.

Remote observing using OBS/OBSINP is possible from the downtown Granada IRAM office, while keeping close contact with the operator/astronomer-on-duty via e-phone or other means. The RED data are on display. Short (few hours) proposals can be carried out this way by *experienced* observers. This mode of observation should be requested at least 2 weeks in advance.

"Service observing", with the PI staying at his home institute, is also possible upon request for some programmes (of less than 8 hours, with only one set of tunings and few sources or positions observed). Observations are made by the local staff (operators helped by astronomer on duty or by a member of the investigator's institute present at the telescope for his own observations). We will try to send you the `spectra.30m` data-files and the two pages of the OBS monitor if your computer allows it (Spain, France or Germany only, so far). 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.

Backend

The spectral backend consists of 6 parts which can be individually connected to any receiver. See the 30-m Telescope Status for more details.

- The *1_1MHz* filterbank, consiting of 512 channels of 1 MHz (can be split into two halves and connected to two different receivers);
- The *2_1MHz* filterbank, consisting of 512 channels of 1 MHz (not splittable);
- The *100kHz* backend, consisting of 256 channels of 100 kHz, splittable into two halves movable inside the 500 MHz instantaneous bandwidth, or connectable to two different receivers; one of the halves can be connected to a spectrum expander with expansion ratios: 2, 4 and 8.
- The 500 channel *AOS*: bandwidth 500 MHz; actual spectral resolution 1.5 MHz.
- The *1_AUTO* autocorrelator, consisting of 2048 channels (total band available: 20 MHz, 40 MHz, 80 MHz, 160 MHz) or 1024 channels (total band: 320 MHz, 500 MHz). Can be split into several bands and connected to two different receivers.
- The *2_AUTO* autocorrelator, identical to *1_AUTO*.

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 by unknown reason). Check of the pointing and alignment is the responsability of the observers (use a planet for alignment checks). Normally, the focus position can be monitored with the 3 mm Continuum receiver. Note that 230 G2 and 230 G1 have foci differing by 0.5 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 [15]).

Wobbler

Beam-throw: from 0 to 240″ on either side of the source (avoid small amplitudes for line work).

Phase duration: (standard) 0.5 s for continuum, 2 s for line.

Calibrated spectral lines

We are continuing a number of line calibrations at the higher frequencies (2 mm and 1.3 mm, similar to the Mauersberger et al. catalog) and calibrations for red-shifted CO lines. These calibrations are made with precisely known rejections (see e.g. [2,10]).

References

[1] Receiver tests of the December 1990 technical period M. Guélin, H. Hein, S. Liechti, J. Cernicharo (Jan. 1991)

[2] Receiver tests during the April 1991 technical period S. Liechti, M. Guélin, H. Hein, A. Greve (June 1991)

[3] Thermal effects on the azimuth and elevation encoders J. Cernicharo, J. Penalver (Sept. 1991, IRAM report 232)

[5] Antenna test measurements at 350 GHz with the MPIfR Bolometer E. Kreysa, H. Steppe, C. Thum, J. Baars, R. Chini, A. Greve, G. Haslam, A. Sievers (Sept. 1991)

[6] Test of the 43 GHz receiver H. Steppe, A. Greve, H. Hein, T. Kampf, C. Kompe, A. Schmidt (Sept. 1991)

[7] Gain elevation curve and aperture efficiencies for the IRAM 30 m telescope H. Steppe, R. Mauersberger, A. Greve, D. Morris (Sept. 91).

[8] Test of a 345 GHz open structure SIS receiver at the IRAM 30 m telescope H. Rothermel, A. Greve, H.Hein, B. Lazareff (Nov 91)

[9] Meteorological conditions measured at the IRAM 30-m telescope A. Greve, J. Penalver, W. Brunswig, B. LeFloch (Dec 1991)

[10] IRAM 30-m telescope receiver tests in December 1991 S. Liechti, M. Guelin, M. Carter, H. Hein, S. Navarro, B. LeFloch, A. Greve (Feb 1992)

[11] Bolometer array test E. Kreysa, G. Haslam (May 1992 Newsletter)

[12] A facility bolometer for the 30m telescope C. Thum, E. Kreysa, D. John, H.P. Gemuend, W. Brunswig, A. Greve, G. Haslam, R. Lemke, H.P. Reuter, M. Ruiz, A. Sievers, H. Steppe (Aug. 1992; see also May 1992 Newsletter)

[13] Holography of the 30 m telescope in July 92 D. Morris, A. Barcia, J. Garrido, H. Hein, G. Butin, A. Greve (Sept 92)

[14] Surface precision of the 30 m telescope D Morris, A. Greve (Sept 92)

[15] Receiver tests during the August 1992 period M. Carter, J.Y. Chenu, H. Hein, S. Navarro, A. Greve, M. Guelin (Sept 92)

[16] Appendix I: Error beam and sidelobes 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. Guelin, J. Cernicharo 1993 Astron. Astrophys. 274, 144-146.

[17] A bolometer array data reduction cookbook A. Sievers (Feb. 1993)

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

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

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

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

[22] 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).

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

Call for Proposals for the Plateau de Bure Interferometer

Observing proposals are invited for the IRAM Plateau de Bure Interferometer (PdBI), for Jan 1, 1994 to **May 15**, 1994. The deadline for applications is *Monday, October 4th, 1993* . The available frequency range will be 82 GHz to 116 GHz.

Details of PdBI and operations are given in the document "An Introduction to the IRAM Plateau de Bure Interferometer". 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 10 to 20 projects in this period, with an elapsed time of 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:

- Number of Antennas *All the new projects will be carried on with 4 antennas.* However some projects (detection experiments, or size determinations), may benefit of 3–antenna time.
- Configurations The exact configurations scheme is given in the "Interferometer" section of this Newsletter. The "CD" (compact) array is obtained with 3 configurations, and the "BC" (high resolution) array with 4 configurations, with two configurations in common.

  We insist that authors specify and CAREFULLY justify the requested configuration choice.

  Many proposals have been received with insufficient noise estimates. In many cases, a better result can be obtained using lower angular resolution. As a guideline, remember that above 113 GHz, no high resolution maps have yet been produced... Combination of all configurations (BCD, 5 configurations in total), is possible, but must be even more justified.
- Coordinates and Velocities
  The interferometer will now operate 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.
- Correlator
  The correlator has 6 independent units, each being tunable anywhere in the 130-610 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 at band center.
- Receivers
  All receivers can be tuned in lower sideband with USB rejection of 5-8 dB. In this mode system temperatures (T_r^*) below 150 K for A #2 and A#3, and 180 K for A#1 (Trec 45 and 55 K respectively), are normally reached below 100 GHz. Higher rejections offer no gain in sensitivity. Accordingly, observations are preferentially done in LSB. If you want a double-sideband tuning (e.g. to observe one spectral line in each band), please specify it.

  This LSB tuning is not possible above 113 GHz: these frequencies are available only in upper sideband.
- 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.
  - CLIC has been modified to handle the new correlator data. The new version is upward compatible with the previous, 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.

  Data reduction will be carried out on the dedicated HP workstation.
- Local contact
  Depending upon the program complexity, IRAM may

request an in-house collaborator instead of the normal local contact.

– Technical pre-screening
  All proposals will be reviewed for technical feasibility before in addition to 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.

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"

These documents, in the form of compressed Postscript files, are available by anonymous ftp from `iraux2.grenet.fr` in directory `dist/doc`.

Scientific Results

The clouds of M 82: I. HCN in the South-West part

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Abstract: High sensitivity, high angular and spectral resolution interferometric observations of the HCN(1-0) line in the South-West inner part of the starburst galaxy M 82 are presented. The feature interpreted by Nakai et al. (1987) as a molecular ring is resolved into a clumpy substructure where the clumps have sizes and masses comparable to Galactic Giant Molecular Cloud complexes. The combination of our data with other observations strongly suggests a picture of the interstellar medium in M 82 as a huge photodissociation/photoionization region with embedded tiny, hot, dense molecular cores. Although the absence of supernova remnants towards the molecular peaks seems to contradict massive star formation, we argue that star formation does take place inside the molecular clumps.

Of particular interest is a peculiar massive object close to the center which is spatially coincident with a 12.4μm peak and coincident or very close to the radio recombination line center of M 82. Diffuse emission to the South of the plane, already present in other observations, is detected.

From T Tauri Stars to Protostars: Circumstellar Material and Young Stellar Objects in the ρ Ophiuchi Cloud

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Abstract: We present the results of a 1.3-mm continuum survey for cold circumstellar dust, conducted with the IRAM 30-m telescope on a sample of over a hundred young stellar objects (YSOs) in or near the ρ Ophiuchi molecular cloud. To correlate the millimeter results with other source properties, we have used the IR classification of Wilking, Lada, & Young, but revising it critically to take into account factors such as heavy extinction. We find a sharp threshold in millimeter flux density at an infrared spectral index $\alpha_{IR}(2.2 - 10\mu\mathrm{m}) \simeq -1.5$, which is also visible in the IRAM 30-m survey of Taurus-Auriga T Tauri stars by Beckwith et al. We show that this threshold is well correlated with a disk opacity transition at $\lambda \simeq 10\ \mu$m, and can be used to set a physical boundary between Class III and Class II IR sources. At a detection sensitivity of $\sim$ 20–30 mJy/beam (3σ) at 1.3 mm, less

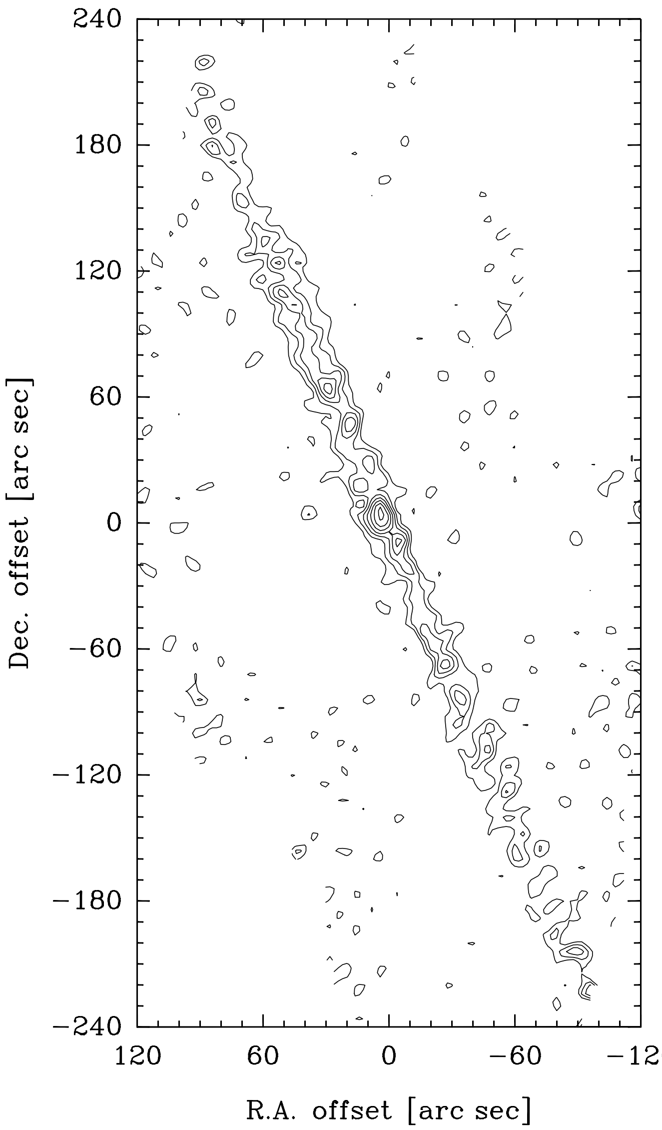

Figure 4: The λ 1.3 mm continuum image of NGC 891, obtained with an angular resolution of 12" (HPBW). Contours are 8 mJy/beam (2σ) to 56 mJy/beam, in steps of 8 mJy/beam. The peak value is 58 mJy/beam. The emission contours follow closely the dark dust lane which runs along the major axis of this almost perfectly edge-on galaxy. Offsets are in arcsec, with respect to $\alpha = 2^h 19^m 24.3^s, \delta = 42°07'17'', 1950.0$. This is the first high resolution map of the λ 1.3 mm dust emission from the disk of an non-interacting spiral.

than 15 % of the Class III IR sources, but as much as 60 % of the Class II sources and 70–90 % of the Class I sources, are detected. Statistical studies show that the peak 1.3-mm fluxes of deeply embedded Class I sources, currently referred to as "protostars", and of "classical" T Tauri stars (Class II sources), are comparable within a factor of 2 at the angular resolution of the telescope (12″ FWHM, or a linear diameter $\sim$ 2,000 AU). Maps of the millimeter emission are consistent with the presence of unresolved disks around Class II sources and of resolved, extended envelopes around Class I sources. Therefore, the difference between Class I and Class II YSOs lies mainly in the *spatial distribution* of their circumstellar dust. Converting the integrated millimeter fluxes derived from our maps into masses, we find that: (*i*) $\sim$ 30 % of the Class II sources have masses larger than the "minimum mass solar nebula" ($\sim 0.01\ M_\odot$); (*ii*) the envelopes of Class I sources contain more circumstellar material than Class II disks, consistent with Class I sources being younger than Class II sources, but (*iii*) their total circumstellar masses are not large ($\leq 0.1\ M_\odot$). This suggests that the central object has already accumulated most of its final stellar mass at the Class I stage. By contrast, a very strong 1.3 mm emission is found toward two deeply embedded outflow sources (IRAS 16293 and VLA 1623) which remain undetected below 25 μm. These latter sources belong to a new class of YSOs ("Class 0") introduced by André, Ward-Thompson, & Barsony, which are surrounded by significantly larger amounts of circumstellar material ($\sim 0.5\ M_\odot$ or more), still to be accreted by the central protostellar core. Class 0 YSOs appear to be significantly younger, and therefore at an earlier protostar stage, than Class I sources.

1.3 mm emission in the disk of NGC 891: Evidence of Cold Dust

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to be published in Astronomy and Astrophysics

Abstract: Using the IRAM 30-m telescope equipped with the MPIfR 7-channel bolometer array, we have mapped the λ 1.3 mm continuum emission of NGC 891, an edge-on Sb galaxy similar to the Milky Way. This emission is 7 times stronger along the major axis than the CO 2–1 line averaged over the 50 GHz bolometer passband, and 9 times stronger than the warm dust emission expected from the IRAS data.
The λ 1.3 mm dust emission correlates remarkably well with the CO emission and poorly with HI emission, at least up to $\pm$7 kpc (150″) from the center. It arises mostly from cold dust (T$\leq$20K) associated with molecular clouds. The H_2 mass, calculated using Galactic values of the dust absorption cross section, is $\sim$ 3 times smaller than the H_2 mass derived from the CO luminosity and

Strong et al's (1988) 'standard' Galactic CO to H_2 conversion factor. It is about equal to the HI mass inside a 7 kpc radius. The mass of gas associated with the cold dust is ~ 20 times the mass of gas associated with warm dust.

1.25mm continuum observations of very high redshift QSOs

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Abstract: We report the results of 1.25mm continuum observations with the IRAM 30m telescope in February 1993 of four radio-quiet QSOs, one intermediate and five radio-loud, flat spectrum QSOs with high redshifts. Five of the QSOs have redshifts greater than 4. Three of the four radio-loud QSOs are detected. In the case of the radio loud quasars the 1.25mm flux is lower than that expected based on extrapolating the continuum based on the 20cm to 6cm spectral energy distribution and implies a steepening of the radio continuum from a median spectral index of $+0.3$ towards the canonical steep spectral index -0.7. One of the radio-quiet QSOs, BR1202−0725 at z=4.69, is detected with a flux of 10.5±1.5mJy. This corresponds to a rest wavelength of 220 microns and under the assumption that this emission is due to thermal emission from dust and temperature of the dust is $T_{\rm D} = 80$K, the inferred dust mass is $\sim 10^9 M_\odot$. The observed flux is similar to that of the high luminosity IRAS source F10214+4714. We discuss the detectability of thermal dust-like spectra and show that for a typical dust spectrum with $T_{\rm D} = 80$K the detectability increases with redshift beyond a redshift of 1.

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297. From T Tauri stars to protostars : Circumstellar material and young stellar objects in the ρ Ophiuchi cloud
P. André, T. Montmerle
1993 *Astrophysical Journal*

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