IRAM Newsletter

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Contents

Calendar

September 12th, 2002 17:00h (MET):
Deadline for the submission of observing proposals for the period Nov 15, 2002 to May 15, 2003

September 30th – October 5th, 2002
Third IRAM Millimeter Interferometry School in Grenoble

October 4th, 2002
IRAM Executive Council Meeting in Madrid, Spain

October 15th –16th, 2002
Program Committee meeting in Grenoble

Personnel Changes

IRAM Granada

Sergio MARTIN (martin@iram.es) will start his PhD Thesis at IRAM Granada in July, he will also participate in assisting visiting astronomers on Pico Veleta.

Axel WEISS (aweiss@iram.es) is the responsible for the pooled (flexible) observations at the 30-m telescope. In addition he will be the local contact for the Mambo I and II bolometers.

The contact person for our Heterodyne Receiver Array HERA will be Albrecht SIEVERS (sievers@iram.es). The contact for any issues related to the VESPA spectrometer remains Gabriel PAUBERT (paubert@iram.es).

Rainer MAUERSBERGER

IRAM Grenoble

In July, Dieter NÜRNBERGER has left the astronomer's group for a postdoc position at ESO Chile. Stephane CLAUDE and Philippe NOUVEL have left the IRAM receiver group in August. We wish them all the best for their future careers, and thank them for the years of good collaboration.

After her successful diploma, Melanie KRIPS has returned to IRAM in August to work on her thesis, and to do service observations as an astronomer on duty on the Plateau de Bure.

Michael BREMER

IRAM web pages

As many members of the IRAM user community have noticed, there are currently two IRAM Grenoble web sites: the old, official http://iram.fr and the new http://www.iram.fr. This site includes in its http://www.iram.fr/IRAMES structure a mirror of the IRAM Granada web site http://www.iram.es/IRAMES, which is updated twice per day. On its turn, the Granada server mirrors the http://www.iram.fr/IRAMFR pages in its http://www.iram.es/IRAMFR pages.

The status of the new IRAM Grenoble pages is such that the site is in most aspects equivalent or more complete than the old one. In one important point, however, the new site is still behind: in the matter of CGI scripts which are essential for on-line forms such as the Grenoble proposal submission facility and the Grenoble mirror of the 30-m telescope time estimator.

Although we are confident that we can solve the remaining problems before the proposal deadline, we prefer to delay the change from **iram.fr** to **www.iram.fr** until after September 12th, 2002 17:00h (MET) to avoid last-minute problems with the submission facility.

For these reasons, please use the 30-m time estimator following the links on the spanish web site http://www.iram.es/IRAMES , and submit your proposal(s) with the submission facility on the old Grenoble site http://iram.fr/submission/submission.html . If you encounter problems with the new pages, do not hesitate to contact the webmaster (bremer@iram.fr).

Michael BREMER

News from the 30m Telescope

Mobile Phones at Pico Veleta Observatory

Test measurements by our engineers Juan Peñalver and Salvador Sánchez revealed that mobile phones interfere with our backends. This interference occurs not only while the phones are in use but also when on standby. We therefore request that visitors switch off their mobile phones while in the control building, the telescope building or close to the observatory. A detailed report will follow in one of our next newsletters.

HERA Users Manual updated

An updated (but still not fully completed) HERA Manual can be found at `http://www.iram.es/IRAMES/-otherDocuments/manuals/HERA_manual_v15.pdf`

Unix data reduction

In each of the project accounts there is now a link to a file data.30m which contains the reduced spectral data of all backends including the 4MHz backends and the on-the-fly spectral line maps. There is no need to copy the spectra.30m files from the VAX computers anymore, except if continuum data are required.

IRAM Granada Web site

The web area concerning the Pico Veleta observatory has been completed and can be found under `http://www.iram.es/IRAMES` (an alternative link to this site is `http://granada.iram.es/IRAMES`) Please make a bookmark and update you links if you find it interesting.

Rainer MAUERSBERGER

Remote Observing from Madrid

A new station for remotely observing with the IRAM 30m telescope has been set up at the Observatorio Astronomico Nacional (OAN at Madrid) in the old observatory building south of the Retiro park near the center of the city. A first sucessful test run was made last August together with Javier Alcolea (OAN). Communication with the 30m telescope is currently possible only via Internet. An ISDN line is planned as an alternative later this year. After some more tests, equipment with documentation, printers, and communication tools the remote observing station is expected to be fully available sometime early next year. Astronomers in the Madrid area who plan to use this new station for their observations with the 30m telescope should contact Javier Alcolea (j.alcolea@oan.es).

Walter BRUNSWIG

News from the PdBI

Maintenances and improvements during summer

The maintenance of the antennas is on schedule and should finish (hopefully) by the end of September. The antennas 1, 2, 4 and 6 have been thoroughly revised and the third is currently in the hall. Antenna 5 will be the last to enter maintenance. A complete check-up of each antenna was carried out on the mechanical level (engines, main reflector control, etc.) and on the electrical level (wire tightening, control of the sensors, etc). Apart from traditional maintenance, certain antennas underwent particular operations, for example the change of the secondary reflectors of antennas 1 and 4 by a new mirror in aluminium and a repaired aluminium mirror, respectively. On antenna 6, the overall sealing was improved. In spite of its recent commissioning, the surface of this antenna shows some degradations on its painted panels. After analysis, it seems that the silicon joints ensuring the panel sealing modified the paint chemically. A close monitoring of the panels is thus foreseen. Lastly, some strongly degraded carbonfiber/hostaflon panels of antenna 4 were painted at the SITEL Company and re-installed (essentially contiguous panels to the quadrupods with specially cut-out sections, of which we do not have spares). In parallel to the maintenance of the antennas, a number of operations were launched which are still on-going. The main items are:

- The rehabilitation of the gallery connecting the hall to the upper cable car station. This will facilitate the transport of goods when the reconstructed cable car starts its service as a freight elevator between St. Etienne en Devoluy and the Plateau de Bure.
- The installation of a centralized fire detection for all parts of our buildings.
- The revision of our electrical system and the change of the high voltage cell towards remote control, which will improve the security during operations.
- The installation of an optical fiber network between the correlator and the antennas. This operation will allow to increase the observing bandwidth in preparation for the next receiver generation.
- A feasibility study of a possible extension of the EAST tracks. A geophysical study is under way which shall determine if obstacles (caves, unstable grounds) are present between the station E24 (192 m from the NS/EW crossing) out to a future E72 (576 m from the crossing).
- maintenance of buildings (Painting, sealing, etc).

All in all, the observatory is having a quite busy summer season.

Bertrand GAUTIER

Figure 1: Transport of the VLBI Terminal by helicopter

Preparation of the PdBI as VLBI station

The transport of the elements of the VLBI station (Maser and Recorder) was carried out mid-July. Taking into account the value and sensitivity of these elements, particular precautions were taken in order to ensure their safety during the transfer operations. After the tests in the IRAM Grenoble laboratories, the recorder was put back into its original casing and then transported to the lower cable car station under control of M.Torres. The maser was conveyed to the same point by J.M.Torre from the CERGA. A professional conditioner then created a double shock-proof packing around these two devices, thus protecting them from buffeting which could occur during the transport by helicopter. The recorder, not being able to support a tilt by more than 20° from the vertical below the helicopter, made it necessary to wait several days for sufficiently calm weather conditions for this delicate operation. On July 23th, the transfer could be carried out under perfect conditions (Fig 1). The cases were then transported inside the hall and carefully unpacked before setting up the recorder and the maser at their designated place in the correlator room (Fig. 2). A preliminary control of the devices showed that everything was operational. J.M.Torre carried out the start-up of the maser on Monday, July 29th. The current of the ionic pump is stable, and the drift of the Maser presently under study. All seems ready for the preliminary tests, which will take place in a few weeks.

Bertrand GAUTIER

Figure 2: The VLBI terminal at its final destination.

Proposal Submission to IRAM Telescopes

The next deadline for submission of observing proposals on IRAM telescopes, both the interferometer and the 30m, is

September 12th, 2002 17:00h (MET) (UT + 2 hours)

The scheduling period extends from Nov 15, 2002 to May 15, 2003, covering roughly the winter period at our observatories.

Given the success of the web–based submission facility, we strongly suggest to use this medium, but please avoid last minute submissions when the network could temporarily be congested. Instructions are found on our web page

http://iram.fr/submission/submission.html

The submission facility will be opened about three weeks before the proposal deadline, but form pages and proposal preparation tools are available now.

As an insurance against network congestion or failure, we still accept proposals submitted by

- fax to number: (33/0) 476 42 54 69
- ordinary mail addressed to:
  IRAM Scientific Secretariat
  300, rue de la Piscine
  F-38406 St. Martin d'Hères, France

Proposals sent by e–mail are not accepted. Proposals containing grey scale plots should exclusively be submitted through the web facility in order to avoid deterioration of image quality in the copying. Color plots will be printed/copied in grey scale. If the proposers want their color plots to be passed on to the program committee, the **entire proposal** must be sent in by ordinary mail in **12 copies**.

Soon after the deadline the IRAM Scientific Secretariat sends an acknowledgement of receipt to the Principal Investigator of each proposal correctly received, together with the proposal registration number. To avoid the allocation of several numbers per proposal, send *only one* copy of your proposal. Note that the web facility allows cancellation and modification of proposals before the deadline. In the case that we notice formal problems with a proposal sufficiently before the deadline, we will make an effort to contact the principal investigator and solve the problem together.

Roberto NERI and Clemens THUM

Call for Observing Proposals on the 30m Telescope

Summary

Proposals for three types of receivers will be considered for the coming winter semester:

1. the 9 pixel heterodyne receiver array, HERA, operating at 1.3 mm wavelength
2. a 1.2mm bolometer array with at least 37 pixels
3. the observatory's set of four dual polarization heterodyne receivers centered at wavelengths of 3, 2, 1.3, and 1.1 mm.

Roughly 2800 hours of observing time will be available, which should allow scheduling of a few longer programmes (of the order of 100 hours). Emphasis is on observations in the 1mm window, but lower frequency observations may be scheduled as marginal weather backup.

What is new ?

The 1.3mm HEterodyne Receiver Array, **HERA** was successfully used in several projects during the past semester. In its present form, HERA has 9 pixels separated by 24″ and arranged in a center–filled square. HERA will be available again for the coming winter semester with extended backend capabilities (fully operational VESPA and probably (see below) a set of nine low resolution filterbanks of 1 GHz bandwidth each. HERA proposals for extragalactic (or other wide bandwidth) observations are therefore invited, in addition to the higher spectral resolution proposals using VESPA.

The correlator upgrade project, VESPA (**VE**rsatile **S**pectral and **P**olarimetric **A**nalyser), is fully completed. This powerful backend can now be used with HERA where up to nominally 2 000 spectral channels per pixel are available, or with (a suitable subset of 4 of) the eight standard Observatory receivers where up to 12 000 spectral channels (typically 3 000 per receiver) can be connected. Spectral resolutions range from 3.3 KHz to 1.25 MHz. Bandwidths are in the range from 10 to 512 MHz.

We plan to have at least one of the bolometer arrays, **MAMBO–1** (37 pixels) or **MAMBO–2** (117 pixels), installed at the telescope. Several upgrades of MAMBO–2 are planned during the summer. Depending on the sensitivity improvements achieved, one or both arrays will be available this winter.

Experience with **flexible scheduling** during last winter was mostly positive. The success rate of the strongly weather–sensitive projects with a high scientific priority was clearly improved. This winter, we plan to continue this observing mode. A suitable mix of proposals with high and moderate demands on atmospheric quality will be pooled together and observed by a team of qualified observers in several sessions. The total duration of these sessions depends on the overall demand on pooled time, the recommendations of the program committee, and on the availability of qualified observers. Although priority will be given to high frequency proposals in general terms, lower frequency weather tolerant proposals are encouraged, since these programs have good chances to be scheduled as backups in such pools. Participation in these pooled observations is voluntary, and IRAM will contact the principal investigators of those accepted proposals which could be scheduled in this way. In order to speed up this process, candidate pool participants (either with a very weather–sensitive or as a weather–tolerant proposal) are invited to mention their preference in the proposal and to mark "Pooled obs" on the cover sheet.

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 from the IRAM 30m web page at URL `http://iram.fr/PV/veleta.html`. In case of problems, contact the secretary, Cathy Berjaud (e–mail: `berjaud@iram.fr`). Do not use characters smaller than 11pt. This could render your proposal illegible when copied or faxed.

On the title page, you must fill in the line 'special requirements' if you request either polarimetric observations, 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.

We insist upon receiving, with proposals for heterodyne receivers, a complete list of frequencies corrected for source redshift (to 0.1 GHz) and precise positions. If in very special cases the proposers do not feel to be in a position to give this information, they should take up contact with the scheduler. The proposers should also specify on the cover sheet which receivers they 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, J2000 coordinates are preferred.

This list *must 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 (no hand writing, please). 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 carefully 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 the 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 a 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 proposal cover page whether your proposal is (or is not) a *resubmission* of a previously rejected proposal or a *continuation* of a previously accepted 30m telescope proposal. In both cases we request that you describe very briefly in the introductory paragraph (automatically generated header "Proposal history: ") why the proposal is being resubmitted (e.g. improved scientific justification) or is proposed to be continued (e.g. last observations wiped out by bad weather).

Reminders

A handbook ("The 30m Manual") collecting most of the information necessary to plan 30m 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 web pages in Granada (http://www.iram.es) and Grenoble (http://iram.fr). 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 powerful On-the-Fly observing mode (OTF) is available for heterodyne observations. Documentation is available on the Granada web page. 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 the astronomer on duty well in advance of the observations.

Frequency switching is available for both HERA and the observatory's standard SIS receivers. This observing mode is interesting for observations of narrow lines where flat baselines are not of strong concern, although the spectral baselines with HERA are among the best known in frequency switching. Certain limitations exist with respect to maximum frequency throw ($\leq$ 45 km/s), backends, phase times etc.; for details see [8].

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

This matter needs special attention as a serious time underestimate may be considered as a sure sign of sloppy proposal preparation. 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/or line calibrations
- ▷ telescope slew motions
- ▷ receiver tunings (for heterodyne observations),

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 30m telescope Manual [10].

In order to facilitate the rather complex calculation of observing time we strongly recommend the easy–to–use **Time Estimator** on our web pages. The tool gives sufficiently accurate estimates of the total observing time and handles the vast majority of both heterodyne and bolometer observing modes. In its version 2.4, it includes HERA. Extensive on–line help is provided. Questions can be addressed to Axel Weiss (aweiss@iram.es). *Proposers are asked to use this tool whenever applicable.*

If very special observing modes are proposed which are not covered by the Time Estimator proposers must give sufficient technical details so their time estimate can be reproduced. In particular, the proposal must give values for $T_{\rm sys}$, spectral resolution, antenna temperature of the signal, the signal/noise ratio which is aimed for, all overheads and dead times, and the resulting observing time.

Proposers should base their time request on normal winter conditions, corresponding to 4mm of precipitable water vapor. Sometimes, conditions may be degraded due to anomalous refraction. The observing efficiency is then reduced and the temperature calibration is more uncertain than the typical 10 percent. If exceptionally good transmission or stability of the atmosphere is requested which may be reachable only in near perfect winter conditions, the proposers must clearly say so in their time estimate paragraph. Such proposals will however be particularly scrutinized.

Service observing

To facilitate the execution of short ($\leq$8 h) programmes, we propose "service observing" for some easy to observe 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

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

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

This observing mode where the remote observer actually controls the telescope very much like on Pico Veleta, is available from the downtown Granada office, from MPIfR in Bonn, from ENS in Paris (often restricted to nighttime hours), and from IRAM in Grenoble. This observing mode is available to projects without any particular technical demands and to experienced 30m users. The prospective remote observer should note "remote observing" as a special requirement in the proposal cover sheet.

After time has been awarded to a remote proposal, the P.I. is requested to give sufficient detail to the Station Manager (mauers@iram.es) on how the remote observer can be contacted. Please note that IRAM is not responsible for the remote stations in Paris or Bonn.

Remote observers affiliated with the MPIfR or other institutes near Bonn should contact F. Bertoldi (bertoldi@mpifr-bonn.mpg.de) or D. Muders (dmuders@mpifr-bonn.mpg.de) at MPIfR for a short introduction to the remote observing station. Remote observers in the Paris area may contact D. Teyssier (teyssier@lra.ens.fr) for arrangements. Remote observers in or near Grenoble contact C. Thum (thum@iram.fr) or H. Wiesemeyer (wiesemey@iram.fr) at IRAM. Observers visiting the 30m might opt to do some of their observing from Granada if it eases their travel constraints. In this case, a Granada astronomer should be contacted as soon as possible, arrangements on very short notice may not always be possible.

Technical Information about the 30m Telescope

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

HERA

The **HE**terodyne **R**eceiver **A**rray is available again next winter. The 9 pixels are arranged in the form of a center–filled square, and are separated by 24″. Each pixel has a diffraction limited (11″ at 230 GHz) and linearly polarized beam (horizontal in the Nasmyth cabin). A derotator optical assembly can be set to keep the 9 pixel pattern stationary in the equatorial or horizontal system. Receiver characteristics are listed in Tab. 1, and a detailed user manual is available on our web page.

Frequency tuning of HERA, although fully under remote control and automatic, is substantially more complicated than for the observatory's other SIS receivers. Although the tuning is currently known for only a few frequencies, HERA proposals for any frequency within the nominal tuning range of 210 – 276 GHz are nevertheless invited, but we cannot guarantee at this moment that these proposals can actually be done. In any case, HERA observers should send the list of their frequencies to Granada as early as possible.

HERA can be connected to two sets of backends (9 identical sections each):

▷ the upgraded autocorrelator VESPA with the following combinations of nominal resolution (KHz) and maximum bandwidth (MHz): 20/40, 40/80, 80/160, 320/320, 1250/640 (see also the on–line documention).

a low spectral resolution (4 MHz channel spacing) filter spectrometer covering the full IF bandwidth of 1 GHz.

The filterspectrometer is expected to be shipped to the telescope later this year and may be ready only later during the winter semester.

HERA is operational in two basic spectroscopic observing modes: *(i)* raster maps of areas typically not smaller than 1′, in position, wobbler, or frequency switching modes, and *(ii)* on–the–fly maps of moderate size (typically 2′ – 10′). Other observing modes are conceivable and/or under test, but they may not be ready this winter. HERA proposers should use the web–based time estimator on the Granada web page. For details about observing with HERA, contact Karl Schuster (schuster@iram.fr), the HERA project scientist, or Albrecht Sievers, the astronomer now in charge of HERA (sievers@iram.es).

The Observatory Heterodyne Receivers

Four dual polarization SIS receivers are available at the telescope for the upcoming observing season. They are designated according to the dewar in which they are housed (A, B, C, or D), followed by the center frequency (in GHz) of their tuning range. Their main characteristics are summarised in Tab. 1. All receivers are linearly polarized with the E–vectors, before rotation in the Martin–Puplett interferometers, either horizontal or vertical in the Nasmyth cabin. Up to two of these dual polarization receivers can be combined for simultaneous observations in the four ways depicted in Tab. 1. Note that they cannot be combined with HERA. Also listed are typical system temperatures which apply to normal winter weather (4mm of water) at the center of the tuning range and at 45° elevation. All receivers are tuned by the operators from the control room. Experience shows that it normally takes about 15 min to tune four such receivers.

Table 1: Heterodyne receivers available for the winter 2002/03 observing season. Performance figures are based on recent measurements at the telescope. T^*_{sys} is the SSB system temperature in the T^*_A scale at the nominal center of the tuning range, assuming average winter conditions and 45° elevation. g_i is the rejection factor of the image side band. ν_{IF} and $\Delta\nu_{IF}$ are the IF center frequency and width. Note that the 8 standard receivers can be combined in 4 different ways.

receiver	polar–ization	combinations 1	2	3	4	tuning range GHz	T_{Rx}(SSB) K	g_i dB	ν_{IF} GHz	$\Delta\nu_{IF}$ GHz	T^*_{sys} K	remark
A 100	V	1		3		80 - 115.5	45 - 65	> 20	1.5	0.5	120	
B 100	H	1			4	81 - 115.5	60 - 85	> 20	1.5	0.5	130	
C 150	V		2		4	129 - 183	70 - 115	15 - 25	4.0	1.0	200	
▷ D 150	H		2	3		129 - 183	60 - 150	8 - 17	4.0	1.0	200	
A 230	V	1		3		197 - 266	85 - 185	12 - 17	4.0	1.0	420	1
B 230	H	1			4	197 - 266	95 - 160	12 - 17	4.0	1.0	420	1
C 270	V		2		4	241 - 281	125 - 290	10 - 20	4.0	1.0	900	2
D 270	H		2	3		241 - 281	130 - 300	9 - 13	4.0	1.0	900	2
HERA	H					210 - 276	110 - 380	~ 10	4.0	1.0	400	1, 3

1: noise increasing with frequency.
2: performance at $\nu < 275$ GHz; noisier above 275 GHz.
3: so far only few frequencies available, see text.

General point about receiver operations

As tuning of the single pixel/dual polarization receivers is now considerably faster and more reproducible than before, we do not normally require anymore that observers send a list of frequencies to Granada before their observations. Only in case that a frequency is close to a limit of the tuning range or is otherwise peculiar, we still recommend to check with a Granada receiver engineer at least two weeks before the observations. **HERA observers** however are requested to send their frequencies as soon as their project gets scheduled.

Polarimeter

An IF polarimeter is available for observations of compact sources. The instrument is designed for narrowband (40 MHz) line and continuum polarimetry. It takes the IF signals from two orthogonally polarized receivers as input and it generates 4 signals from which spectra of all four Stokes parameters can be derived. Data reduction software using CLASS enhanced with a graphical user interface is now available. Please contact H. Wiesemeyer (wiesemey@iram.fr). A preliminary description of the instrument is available on the web at URL `http://iram.fr/~thum.html`. Polarimetry proposals are invited with the restriction that the target sources be not larger than the main beam.

The RF polarimeter based on switching a quarter wave plate is still available. Interested observers please contact IRAM (preferentially B. Lazareff or C. Thum) to discuss what might actually be possible this winter.

A potentially promising variant of IF polarimetry where the cross correlation is made digitally in VESPA, is investigated. Contact C. Thum for the current status.

MPIfR Bolometer arrays

The 37–pixel MAMBO–1 array consists of 3 concentric hexagonal rings of horns centered on the central horn. Spacing between horns is $\simeq 20''$. Each pixel has a HPBW of $11''$ and a sensitivity of $\simeq 30$ mJy s$^{1/2}$. This figure applies for "normal bolometric conditions" (pwv 4mm and a stable atmosphere, i.e. no clouds, little turbulence, high elevation, application of skynoise reduction alogrithms). Often, such bolometric conditions are only found after sunset and before noon.

The 37–pixel array (MAMBO–1) was used extensively at the telescope last winter with good success. The 117 pixel array (MAMBO–2) which undergoes a few upgrades this summer, may also be available. Depending on the relative sensitivity of the two arrays for observations of compact and extended sources, separate sessions may be scheduled for (mainly) ON/OFF and (mainly) mapping proposals. Proposers of mapping observations should base their time request conservatively on MAMBO–1. If MAMBO–2 should become available, the program committee may suggest to adjust appropriately the time allocation for these proposals.

The arrays are mostly used in two basic observing modes, ON/OFF and mapping.[2] Experience of last winter shows that the ON/OFF reaches typically an rms noise of ~ 1.5 mJy in 10 min of total observing time (about 200

[2] see also the Technical report by D. Teyssier and A. Sievers on a fast mapping mode (IRAM Newsletter No. 41, p. 12, Aug. 1999).

sec of ON source integration time) under normal bolometric conditions. Up to 30 percent lower noise may be obtained in perfect weather. In this observing mode, the noise integrates down with time as $t^{\frac{1}{2}}$ to rms noise levels below 0.3 mJy.

In the mapping mode the telescope is scanned in azimuth, the direction of the wobbler throw, in such a way that all pixels see the source once. A typical single map covering 4×3 arcmin with a scan speed of $4''$/sec and a raster step of $4''$ in elevation takes about 60 min of telescope time. Under normal bolometric conditions and assuming effective skynoise suppression, an rms of $2 - 4$ mJy is thus reached in the inner $2' \times 1'$. Maps may be co–added to reach lower noise levels. Mosaicing is also possible to map larger areas. Attempts to reach map noise levels below 1 mJy are still fraught with poorly understood problems and require sophisticated data reduction. If such observations are proposed, the proposers must indicate how they plan to reach this demanding goal.

Another note of caution: mapping of extended sources cannot rely on the skynoise reduction algorithm (simple subtraction of correlated sky-noise) presently available, and the noise level reached may be at least twice as high as that quoted above.

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 MOPSI[12]). Time estimators for planning ON/OFF or mapping observations are also available [11, 17].

Bolometer time requests should be based on normal winter conditions, like requests using SIS receivers, and the web–based time estimator is again strongly recommended. If exceptionally low noise levels are requested which may be reachable only in a perfectly stable winter atmosphere, the proposers must clearly say so in their time estimate paragraph. Such proposals will however be particularly scrutinized.

Efficiencies and error beam

Extensive work during the last years in measuring and setting the telescope surface has resulted in significantly improved aperture and beam efficiencies which have increased nearly by a factor of 2 at the highest frequencies accessible to the telescope (see note by U. Lisenfeld and A. Sievers, Newsletter No. 47, Feb. 2001). The current numbers are shown in Table 2. The variation of the coupling efficiency to sources of different sizes can be estimated from plots in Greve et al. [16].

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] for details). Astronomers should take into account this error beam when converting antenna temperatures into brightness temperatures.

Table 2: Forward and main beam efficiencies, η_F and η_{mb}, and beam width θ_b.

frequency [GHz]	θ_b ["] [1])	η_F	η_{mb} [2])
86	29	0.95	0.78
110	22	0.95	0.75
145	17	0.93	0.69
170	14.5	0.93	0.65
210	12	0.91	0.57
235	10.5	0.91	0.51
260	9.5	0.88	0.46
279	9	0.88	0.42

[1]) fit to all data: θ_b ["] = 2460 / frequency [GHz]
[2]) based on a fit of recently measured data to the Ruze formula: $\eta_F = 1.2\epsilon \exp(-(4\pi R\sigma/\lambda)^2)$
with $\epsilon = 0.69$ and $R\sigma = 0.07$

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

Backends

The following four spectral line backends are available which can be individually connected to any single pixel receiver and/or HERA.

The 1 MHz filterbank consists of 4 units. Each unit has 256 channels with 1 MHz spacing and can be connected to different or the same receivers giving bandwidths between 256 MHz and 1024 MHz. The maximum bandwidth is available for only one receiver, naturally one having a 1 GHz wide IF bandwidth. Connection 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 of 256 MHz width connected to up to four (not necessarily) 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 consists of 256 channels of 100 KHz spacing. It can be split into two halves, each movable inside the 500 MHz IF bandwidth, and connectable to two different receivers.

The upgraded correlator VESPA, the new (**VE**rsatile **SP**ectrometer **A**ssembly) can be connected either to HERA, or to a subset of 4 single pixel receivers, or to a pair of single pixel receivers for polarimetry. The many VESPA configurations available in these connection modes are best visualised on a demonstration program which can be downloaded from the Grenoble web page at URL http://iram.fr/PV/veleta.html. Connected to a set of 4 single pixel receivers VESPA typically provides up to 12 000 spectral channels (on average 3 000 per receiver). Up to 18 000 channels are possible in special configurations. Nominal spectral resolutions range from 3.3 KHz to 1.25 MHz. Nominal bandwidths are in the range 10 — 512 MHz. When VESPA is connected to HERA, up to 18 000 spectral channels can be used with the following typical combinations of nominal resolution (KHz) and maximum bandwidth (MHz): 20/40, 40/80, 80/160, 320/320, 1250/640.

The 4 MHz filterbank currently consists of two units. An extension to a total of 9 units is expected to be completed during the winter semester. Each unit has 256 channels (spacing of 4 MHz, spectral resolution 6.2 MHz) and thus covers a total bandwidth of 1 GHz. The 9 units are designed for connection to HERA, but they can also be used with the single pixel spectral line receivers which are equipped with a 1 GHz bandwidth (i.e. to all but the A100 and B100 receivers). At the present time, a 4 MHz filterbank cannot be used simultaneously with the autocorrelator or the 100 KHz filterbank on the same receiver.

A new on–line calibration routine automatically writes calibrated spectrometer data, including the 4 MHz filterbanks, to the linux machines. The routine, although still experimental, works for all observing modes, including On–the–Fly. A logical link named "data.30m" pointing to this file of calibrated spectra is made available in all newly created project accounts.

Pointing / Focusing

Pointing sessions are normally scheduled twice per week; at present, the fitted pointing parameters yield an absolute rms pointing accuracy of better than $3''$ [14]. Receivers are closely aligned (within $< 2''$. 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. At 2 Hz, the maximum throw is $90''$
- Standard phase duration: 2 sec for spectral line observations, 0.25 sec for continuum observations.

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[5] Thermal design and thermal behaviour of Radio Telescope structures
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J. Baars, A. Greve, H. Hein, D. Morris, J. Peñalver, C. Thum 1993, Proc. IEEE 82, 687

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[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. 132, 413

[16] The beam pattern of the IRAM 30m Telescope
A. Greve, C. Kramer, and W. Wild 1998, A&A Suppl. 133, 271

[17] A Time Estimator for Observations at the IRAM 30m Telescope
D. Teyssier 1999, IRAM/Granada Technical Note (http://iram.fr/PV/veleta.html)

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 and Rainer MAUERSBERGER

Call for Observing Proposals for the Plateau de Bure Interferometer

Conditions for the next winter session

Despite the fact that we still rely on ground transport and transport by helicopter, we are confident that we can support at least three configuration changes this winter. We therefore ask investigators to submit proposals for all four of the primary configurations of the six antenna array. The D, C and B configurations have already been scheduled last winter. With the A configuration, the Plateau de Bure Interferometer will offer anew the possibility to carry out high resolution observations. The A configuration provides an angular resolution of $0.6''$ at 230 GHz for targets at $\geq 30°$ declination.

A preliminary configuration schedule for the winter period is outlined below. Please note that the more compact configurations (C and D) will be available only at the end of January at the earliest. The scheduling priority will later be adapted according to pressure in right ascension ranges and may further be changed during the winter period depending on weather conditions. The *configuration schedule should be taken as a guideline*, in particular when astronomical targets are requested that cannot be observed during the entire winter period (45° sun avoidance circle).

Conf	Scheduling Priority Winter 2002/2003
B	November – December
A	December – January
C	February – March
D	March – April

When the atmospheric conditions are not good enough at 1.3mm, 3mm projects will be observed: last winter, 20-30% of the time was found to be poor at 1.3mm, but was excellent at 3mm. We therefore invite proposers to submit a significant number of proposals also for observations at 3mm.

Finally, we would like to draw attention to the fact that we have started discussions with the CDS about the publication of summary tables with detailed information on PdB proposals. As a further step to making the interferometer results available as widely as possible, we are discussing the introduction of proprietory periods for which the data will be protected before becoming available in an archive.

Call for Proposals

Under normal operating conditions, IRAM schedules and completes between 40 to 60 projects during the winter period, with an elapsed time of at least two months between start and end of any given project. Selection is 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 the World-Wide-Web at `http://iram.fr/PDBI/bure.html`). Proposers should read this document carefully before submitting any proposal.

Proposal templates `"proposal.tex"` as well as the Latex style file `"proposal.sty"` are available by anonymous ftp from `iram.fr` (in the directory `dist/proposal`), or from the Internet via the Web at `http://iram.fr/proposal/proposal.html`. In case of problems, contact the scientific secretary, Mrs Cathy Berjaud (`berjaud@iram.fr`).

Do not use characters smaller than 11pt, which could make your proposal illegible when duplicated or faxed. For the same reasons, also avoid sending figures with grey scale maps by fax. In case your proposal reaches us in time, but is incomplete or unreadable when copied, we will try our best to contact you. The Principal Investigator will receive by return mail 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 their 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 either a 30m telescope or PdBI proposal. In case of a resubmission, state very briefly in the introduction why the proposal is being resubmitted (e.g. improved scientific justification, observational restrictions).

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

Proposal category

Proposals should be submitted for one of the five categories:

`dual freq.`: Proposals that ask simultaneously for observations at 3mm and 1.3mm.

`1.3mm`: Proposals that ask for 1.3mm data only. 3mm receivers will be used for pointing and calibration purposes, but the scientific goals of the proposal rely on the 1.3mm receivers.

`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.

`time filler`: Proposals that have to be considered as background projects to fill in periods where the atmospheric conditions do not allow mapping, or eventually, to fill in gaps in the scheduling, or periods when only a subset of the standard configurations will be available. These proposals will be carried out on a "best effort" basis only.

`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 the tuning cannot be guaranteed, and more generally all non-standard observations. These proposals will be carried out on a "best effort" basis only.

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

New configurations for six antennas

New configurations are now available that take full advantage of the sixth antenna.

The six antennas can now be arranged in four primary configurations, instead of the six for the 5-antenna array (the 5-antenna array configurations will still be used during the summer antenna maintenance). The configurations for the winter period will be:

Conf	Stations					
D	W05	W00	E03	N05	N09	N13
C	W12	E10	E16	N02	N09	N20
B	W12	E04	E23	N07	N17	N29
A	W27	W23	E16	E23	N13	N29

- `D` alone is best suited for deep integration and coarse mapping experiments. This configuration provides both the highest sensitivity and the lowest atmospheric phase noise. It is slightly more extended than the 5-element D configuration: the beam is smaller, but slightly more elliptical.
- `C` provides a fairly complete coverage of the uv-plane (low sidelobe level) and is well adapted to combine with D for low angular resolution studies ($\sim$3.5″ at 100 GHz, $\sim$1.5″ at 230 GHz) and with B for higher resolution ($\sim$2″ at 100 GHz, $\sim$0.9″ at 230 GHz). C alone is also well suited for snapshot and size measurement experiments.
- `B` in combination with A already provides slightly higher angular resolution ($\sim$1.5″ at 100 GHz). Short baselines have been included to facilitate calibration (less decorrelation) and give some sensitivity to extended structure, although this is clearly not the primary goal of the AB configuration. It is mainly used for relatively strong sources.
- `A` alone is well suited for mapping or size measurements of very compact objects. It provides a resolution of 1.1″ at 100 GHz, $\sim$0.5″ at 230 GHz. In addition, because it contains long, intermediate and some short baselines, it could still be used in a tapered mode when a project is observed in marginal weather conditions despite some loss of sensitivity (for backup projects).

The four array configurations can be used in different combinations to improve on angular resolution and sensitivity. Mosaicing is usually done with D or CD, but the combination BCD can also be requested for high resolution mosaics. Enter ANY in the proposal form if the scientific goals can be reached with any of the four configurations or their subsets.

Please consult the documentation on the Plateau de Bure configurations for further details.

Receivers

All antennas are equipped with fully operational dual frequency receivers. The available frequency range will be 82 to 116 GHz for the 3mm band, and 205 to 245 GHz for the 1.3 mm band. The 3mm and 1.3mm receivers are aligned to within about 2″.

Below 105 GHz, receivers offer best performances in LSB tuning with high rejection (20 dB): expected system temperatures are 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.

The 1.3 mm receivers have DSB tuning with typical T_{REC} below 50 K. Expected SSB system temperature are 250 to 350 K. The guaranteed tuning range is 205–245

GHz, but it may be possible to reach some lower frequencies. Higher frequencies are not feasible on all antennas because of limitations in the triplers.

Signal to Noise

The rms noise can be computed from

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

where

- $T_{\rm SYS}$ is the system temperature (150 K below 110 GHz, 200 K at 115 GHz, 400 K at 230 GHz)
- $J_{\rm pK}$ is the conversion factor from Kelvin to Jansky (22 Jy/K at 3mm, 35 Jy/K at 1.3mm)
- η is an efficiency factor due to atmospheric phase noise (0.9 at 3 mm, 0.8 at 1.3 mm)
- $N_{\rm a}$ is the number of antennas (6), and $N_{\rm c}$ is the basic number of configurations (1 for D, 2 for CD, 2 for BC, and so on)
- 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 the spectral correlator setup)

Investigators have to specify the one sigma noise level which is necessary to achieve each individual goal of a proposal, and in particular for projects aiming at deep integrations.

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 new correlator has 8 independent units, each being tunable anywhere in the 110–680 MHz band, and providing 7 different modes of configuration (characterized in the following by couples of total bandwidth/number of channels). In the 3 DSB modes (320MHz/128, 160MHz/256, 80MHz/512 – see Table) the two central channels may be perturbed by the Gibbs phenomenon depending on the continuum strength. When using these modes, it is recommended to avoid centering the most important part of the lines in the middle of the band of the correlator unit. In the remaining modes 160MHz/128, 80MHz/256, 40MHz/512, 20MHz/512) the two central channels are not affected by the Gibbs phenomenon and, therefore, these modes should be preferred for spectroscopic studies.

Spacing (MHz)	Channels	Bandwidth (MHz)	Mode
0.039	1×512	20	SSB
0.078	1×512	40	SSB
0.156	2×256	80	DSB
0.312	1×256	80	SSB
0.625	2×128	160	DSB
1.250	1×128	160	SSB
2.500	2×64	320	DSB

Note that 5% of the passband are left out at the low-frequency and at the high frequency ends of each subband. The 8 units can be independently placed either on the 3mm or 1.3mm receiver.

Sun Avoidance

For safety reasons, the sun avoidance circle has been extended to 45 degrees. Please take this into account for your sources *and* 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 may 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.
- In certain cases, proposers may have a look at the uv-tables as the observations progress. If necessary, and upon request, more information can be provided. Please contact us if you are interested in this.
- CLIC is still evolving to cope with upgrades 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 the most recent version of CLIC. Because differences between CLIC versions may potentially result in imaging errors if new data are 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 A or B rated proposal which does not involve an in-house collaborator. He will assist you in the preparation of the observing procedures and provide help to reduce the data. Assistance is also provided before a deadline to help newcomers in the preparation of a proposal. 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 addition to the scientific review by the programme committee. Please help in this task by submitting technically precise proposals. Note that your proposal must be complete and exact: the source position and velocity as well as the requested frequency setup must be correctly given.

Non-standard observations

If you plan to execute a non-standard program, please contact R.Neri or R.Lucas to discuss the feasibility.

Documentation

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

- An Introduction to the IRAM PdBI.
- IRAM PdBI: Calibration CookBook.
- IRAM PdBI: Mapping CookBook.
- IRAM PdBI: 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 PdBI: OBS Users Guide.
- IRAM PdBI: Amplitude Calibration.
- IRAM PdBI: Flux Measurements.
- IRAM PdBI: Pointing Parameters.
- IRAM PdBI: 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 IRAM interferometer is a powerful, but complex instrument, and proposal preparation requires special care. Information is available in the documentation and at http://iram.fr/PDBI/bure.html. 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

Transatlantic VLBI observations at 129 GHz and 147 GHz

In the IRAM Newsletter of August 2001 (No. 49) we have reported on the 2 mm (147 GHz) VLBI experiment made in March and April 2001 on the 3100 km long baseline between the Metsähovi 14-m telescope (MET, Finland) and the IRAM 30-m telescope on Pico Veleta (PV, Spain). We detected the sources 3C279 and 3C273 with a signal-to-noise ratio of SNR $\sim$ 10. The angular resolution (mainly in North-South direction) was $\sim$ 140 μarcsec (see A&A 2002, **390**, L 19). The success of this observation stimulated a test observation on longer transatlantic baselines, reviving for this purpose the Kitt Peak (KP) telescope for VLBI observations and equipping the Heinrich Hertz Telescope (HHT) with a 2 mm receiver, a VLBI terminal, and a maser. Last but not least, a crew had to be collected to run the observations at the 5 participating observatories.

In April 2002, the teams of the Haystack Observatory (USA), the Steward Observatory (USA), NRAO-Tucson (USA), the MPIfR (Germany), the Onsala and SEST Observatory (Sweden and Chile), the Metsähovi Observatory (SF), and IRAM have made VLBI observations at 129 GHz between KP – HHT – PV and at 147 GHz between KP – HHT – SEST – MET – PV. The observations at 129 GHz concentrated on SiO maser line emission, the 147 GHz observation on continuum emission from AGNs. The maser VYCMa was detected on the 200 km long baseline between KP– HHT, the sources 3C 279, 3C 273 and NRAO150 (marginal) were detected on the 8500 km long baseline between KP – HHT – PV with SNRs of 10 to 40. 3C 279 was again detected between MET – PV, while unfortunately no fringes were found to SEST. The highest angular resolution, though only in the direction East–West of the USA and Europe baseline, is 18 μarcsec.

At present the data are being completely reduced for publication. First results were presented at the 6th EVN

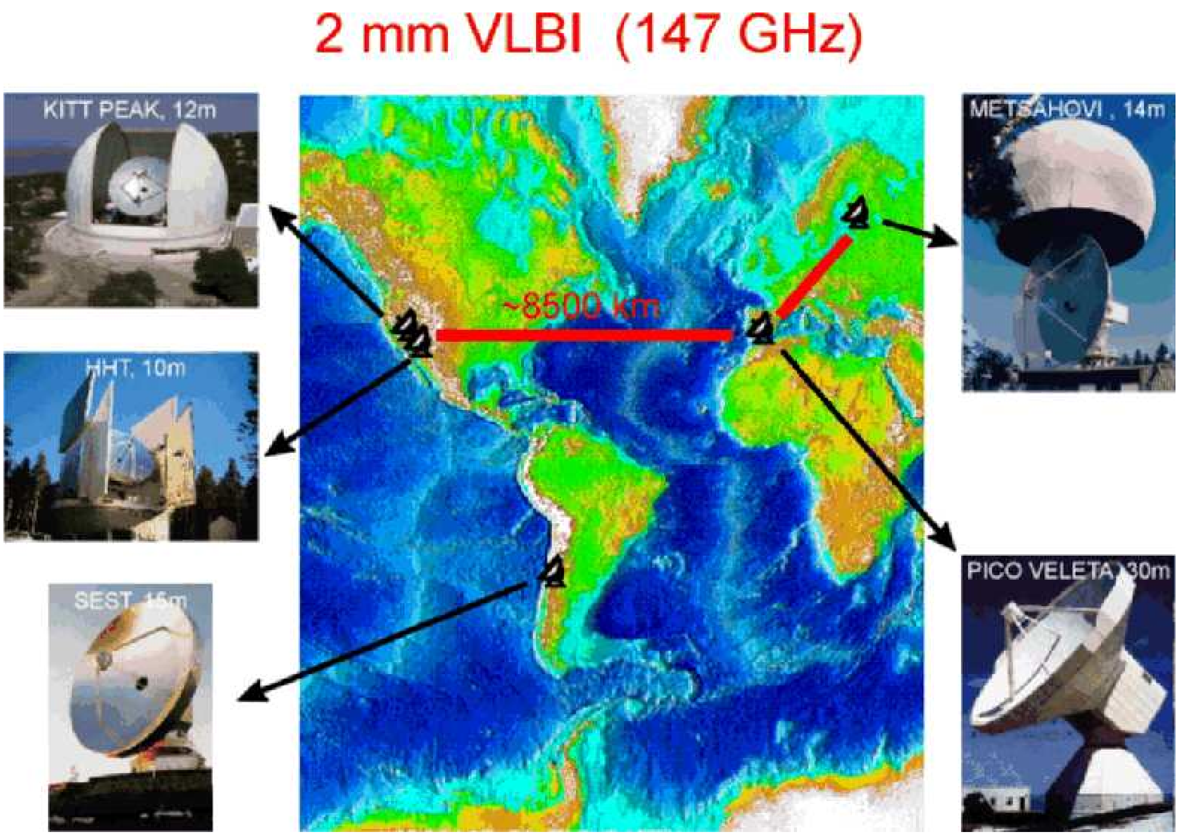

Figure 3: World map with mm wavelength telescopes from: MPIfR Press Information 07/02(1), 12-July-2002

Symposium held in Bonn, June 2002 (see the conference proceedings). A colourful press release can be found on the MPIfR website (Fig. 3).

Albert GREVE,
on behalf of the international VLBI team.

Sideband separation mixer for ALMA Band 7

Following the design described in ALMA Memo 316 [1], and using two double side band (DSB) mixer units designed by Navarinni et al. [2], a sideband separation mixer for ALMA Band 7 has been built and tested at IRAM (Fig. 4,5).

An image rejection better than 10 dB has been obtained across the Band 7 (Fig. 6). The single side band (SSB) T_{rec} was measured for two intermediate frequency (IF) bandwidths (Fig. 7, 8. These tests were performed with a mixer IF impedance transformer that is not fully optimized for the 4-8 GHz ALMA required band. Further tests will include mixers with better noise temperature and a full 4-8 GHz IF.

It is interesting to note that the system proved to be quite simple to operate, i.e. not any more difficult than a DSB mixer.

References:

[1] S. M. X. Claude, C. T. Cunningham, A. R. Kerr, and S.-K. Pan, Design of a Sideband-Separating Balanced SIS Mixer Based on Waveguide Hybrids, ALMA Memo No. 316

[2] A. Navarrini, D. Billon-Pierron, I. Peron, B. Lazareff, "Design and characterization of a 225-370

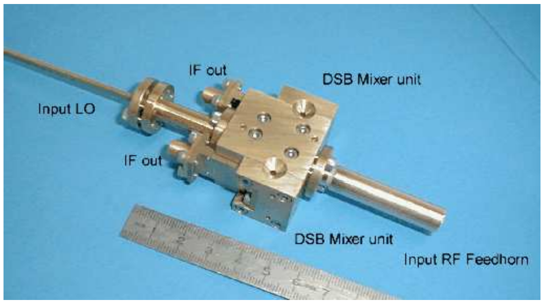

Figure 4: Assembled 2SB Mixer

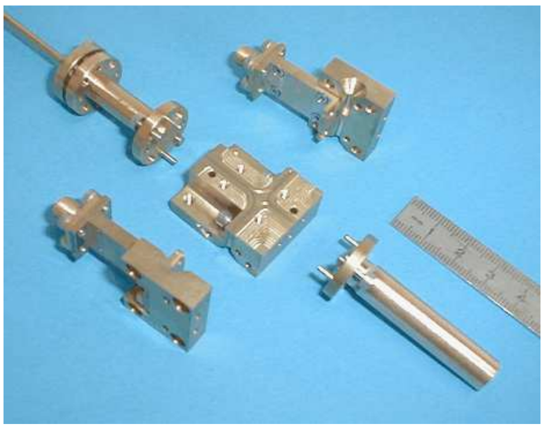

Figure 5: Open 2SB Mixer

GHz DSB and a 247-360 GHz SSB waveguide SSB mixers",Proceedings of the 26th. International Conferenceon Infrared and Millimeter Waves, Toulouse, FRANCE, 10/09/2001- 14/09/2001

Stephan CLAUDE

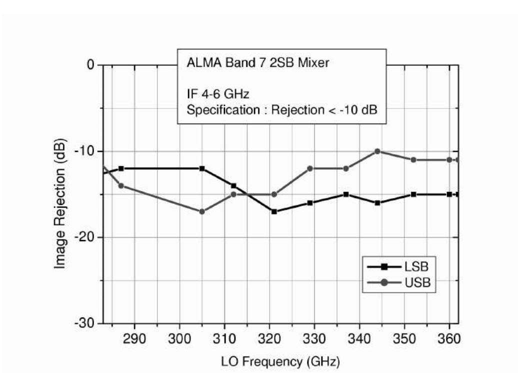

Figure 6: Sideband rejection for LSB and USB tuning

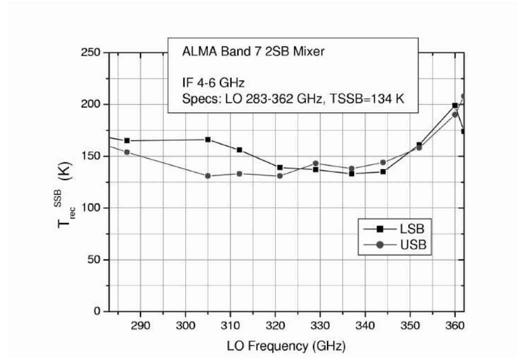

Figure 7: SSB T_{rec}, for an IF of 4-6 GHz

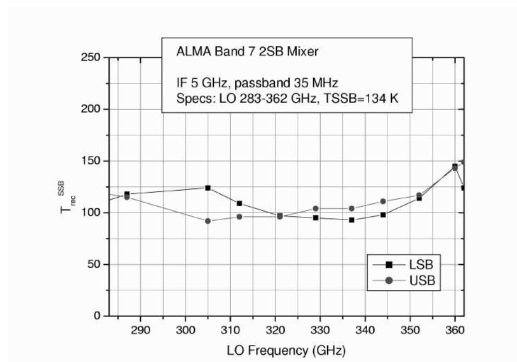

Figure 8: SSB T_{rec}, for an IF of 5 GHz

Scientific Results in Press

MOLECULAR LINE STUDY OF THE VERY YOUNG PROTOSTAR IRAM 04191 IN TAURUS: INFALL, ROTATION, AND OUTFLOW

A. Belloche(1), P. André(1), D. Despois(2), S. Blinder(2,3)
(1)Service d'Astrophysique, CEA/DSM/DAPNIA, C.E. Saclay, F-91191, Gif-sur-Yvette Cedex, France, (2)Observatoire de Bordeaux (INSU/CNRS), B.P. 89, F-33270 Floirac, France, (3)Division of Nuclear Medicine, Vancouver Hospital and Health Sciences Center, Vancouver, B.C., Canada

Abstract:
We present a detailed millimeter spectroscopic study of the circumstellar environment of the low-luminosity Class 0 protostar IRAM 04191 + 1522 in the Taurus molecular cloud. Molecular line observations with the IRAM 30m telescope demonstrate that the $\sim$ 14000 AU radius protostellar envelope is undergoing both extended infall and fast, differential rotation. Radiative transfer modeling of multitransition CS and $C^{34}S$ maps indicate an infall velocity $v_{\rm inf} \sim 0.15$ km s^{-1} at $r \sim 1500$ AU and $v_{\rm inf} \sim 0.1$ km s^{-1} up to $r \sim 11000$ AU, as well as a rotational angular velocity $\Omega \sim 3.9 \times 10^{-13}$ rad s^{-1}, strongly decreasing with radius beyond 3500 AU down

to a value $\Omega \sim 1.5$–3×10^{-14} rad s^{-1} at $\sim$ 11000 AU. Two distinct regions, which differ in both their infall and their rotation properties, therefore seem to stand out: the inner part of the envelope ($r \lesssim 2000 - 4000$ AU) is rapidly collapsing and rotating, while the outer part undergoes only moderate infall/contraction and slower rotation. These contrasted features suggest that angular momentum is conserved in the collapsing inner region but efficiently dissipated due to magnetic braking in the slowly contracting outer region. We propose that the inner envelope is in the process of decoupling from the ambient cloud and corresponds to the effective mass reservoir ($\sim 0.5\, M_\odot$) from which the central star is being built. Comparison with the rotational properties of other objects in Taurus suggests that IRAM 04191 is at a pivotal stage between a prestellar regime of constant angular velocity enforced by magnetic braking and a dynamical, protostellar regime of nearly conserved angular momentum. The rotation velocity profile we derive for the inner IRAM 04191 envelope should thus set some constraints on the distribution of angular momentum on the scale of the outer Solar system at the onset of protostar/disk formation.

Accepted for publication in A&A

^{12}CO mapping of the low-metallicity BCD galaxy Mrk 86

A. Gil de Paz([1,2]), S. A. Silich([3,4]), B. F. Madore([1,5]), C. Sánchez Contreras([2]), J. Zamorano([6]), and J. Gallego([6])
([1])NASA/IPAC Extragalactic Database, California Institute of Technology, MS 100-22, Pasadena, CA 91125, ([2])Jet Propulsion Laboratory, California Institute of Technology, MS 183-900, Pasadena, CA 91109, ([3]) Instituto Nacional de Astrofísica, Óptica y Electrónica, AP 51, Luis Enrique Erro 1, Tonantzintla 72000, Puebla, Mexico, ([4]) Main Astronomical Observatory, National Academy of Sciences of Ukraine, 03680 Kiyv-127, Golosiiv, Ukraine, ([5]) The Observatories, Carnegie Institution of Astronomy, 813 Santa Barbara Street, Pasadena, CA 91101, ([6])Departamento de Astrofísica, Universidad Complutense de Madrid, Av. Complutense s/n. E-28040 Madrid, Spain

Abstract:
We have mapped the ^{12}CO J=1-0 and J=2-1 line emission in Mrk 86, one of the most metal-deficient Blue Compact Dwarf galaxies so far detected in ^{12}CO. The ^{12}CO emission is distributed in a horseshoe-like structure that follows the locus of the most recent star formation regions. The minimum in molecular-line emission corresponds to the position of an older, massive nuclear starburst. The H_2 mass of the galaxy (in the range 0.4-5$\times10^7$ M$_\odot$) and its morphology have been compared with the predictions of hydrodynamic simulations of the evolution of the interstellar medium surrounding a nuclear starburst. These simulations suggest that the physical conditions in the gas swept out by the starburst could have led to the formation of the ring of molecular gas reported here. This result provides an attractive scenario for explaining the propagation (in a galactic scale) of the star formation in dwarf galaxies.

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IRAS 05358+3543: Multiple outflows at the earliest stages of massive star formation

H. Beuther([1]), P. Schilke([1]),F. Gueth([1,2]), M. McCaughrean([3]), M. Andersen([3]), T.K. Sridharan([4]) and K.M. Menten([1])
([1])Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, 53121 Bonn, Germany, ([2])Institut de Radio Astronomie Millimétrique, 300 rue de la Piscine, 38406 Saint Martin d'Hères, France, ([3])Astrophysikalisches Institut Potsdam, An der Sternwarte 16, 14482 Potsdam, Germany, ([4])Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, MS 78, Cambridge, MA 02138, USA

Abstract:
We present a high-angular-resolution molecular line and millimeter continuum study of the massive star formation site *IRAS* 05358+3543. Observations with the Plateau de Bure Interferometer in CO 1–0, SiO 2–1 and H^{13}CO$^+$ 1–0 reveal at least three outflows which cannot be separated in single-dish data. Observations at millimeter and submillimeter wavelengths from the IRAM 30 m telescope and the CSO provide additional information on the region. The most remarkable feature is a highly collimated (collimation factor $\sim$ 10) and massive ($>$ 10 M$_\odot$) bipolar outflow of $\sim$ 1 pc length, which is part of a quadrupolar outflow system. The three observed molecular outflows forming the *IRAS* 05358+3543 outflow system resemble, in structure and collimation, those typical of low-mass star-forming regions. They might therefore, just like low-mass outflows, be explained by shock entrainment models of jets. We estimate a mass accretion rate of $\sim$ 10^{-4} M$_\odot$/yr, sufficient to overcome the radiative pressure of the central object and to build up a massive star, lending further support to the hypothesis that massive star formation occurs similarly to low-mass star formation, only with higher accretion rates and energetics. In the millimeter continuum, we find three sources near the center of the quadrupolar outflow, each with a mass of 75–100 M$_\odot$. These cores are associated with a complex region of infrared reflection nebulosities and their embedded illuminating sources. The molecular line data show that SiO is found mostly in the outflows, whereas H^{13}CO$^+$ traces core-like structures, though likely with varying relative abundances. Thermal CH_3OH comprises both features and can be disentangled into a core-tracing component at the line center, and wing emission following the outflows. A CO line-ratio study

(using data of the $J = 1-0, 2-1$ & $6-5$ transitions) reveals local temperature gradients.

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THE MOLECULAR ENVIRONMENT OF NGC 3603
I. SPATIAL DISTRIBUTION AND KINEMATIC STRUCTURE

Dieter E.A. Nürnberger([1,2]), Leonardo Bronfman([3]), Harold W. Yorke([4]) and Hans Zinnecker([5])
([1])Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Am Hubland, 97074 Würzburg, Germany, ([2])Institut de Radio-Astronomie Millimétrique, 300 Rue de la Piscine DU, 38406 St. Martin-d'Hères, France, ([3])Departamento de Astronomía, Universidad de Chile, Casilla 36-D, Santiago, Chile, ([4])Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, U.S.A., ([5])Astrophysikalisches Institut Potsdam, An der Sternwarte 16, 14482 Potsdam, Germany

Abstract:
We present CS (2–1) and CS (3–2) observations of the molecular gas associated with the Galactic starburst template NGC 3603, over an area of $5'.8 \times 16'.7$, with the OB cluster at the center. Total velocity integrated maps and channel maps give insight into the spatial distribution and the kinematic structure of the dense gas in the giant molecular cloud from which the starburst cluster originated. We identify 13 molecular clumps with radii less than 0.8 pc and derive upper limits for their virial masses as well as lower limits for their H_2 column densities: $\langle \mathcal{M}_{\rm vir} \rangle \lesssim (1.0 \pm 0.6) \cdot 10^3\,\mathcal{M}_\odot$ and $\langle \mathcal{N}(H_2) \rangle \gtrsim (0.4 \pm 0.2) \cdot 10^{23}\,{\rm cm}^{-2}$. One of the clumps, MM 11, clearly stands out with a mass and column density 4 times higher than average. The CS (3–2) / CS (2–1) map shows higher intensity ratios to the south of the OB cluster than to the north (0.80 ± 0.08 versus 0.32 ± 0.11), which indicates a substantial difference in the physical conditions (either opacities or excitation temperatures) of the molecular gas. From the average of the line peak velocities, $14.2 \pm 1.6\,{\rm km\,s}^{-1}$, we deduce a kinematic distance of 7.7 ± 0.2 kpc for NGC 3603 . We estimate the star formation efficiency ($\gtrsim 30\,\%$) of the central part of the NGC 3603 H II region. If we assume the age of the OB cluster to be less than 3 Myr and the star formation rate to be larger than $1.3 \cdot 10^{-3}\,\mathcal{M}_\odot\,{\rm yr}^{-1}$, the derived timescale for gas removal ($\tau \sim 6$ Myr) can explain why the starburst cluster itself is nearly void of interstellar material. The remnant clump MM 1 appears to constitute the head of a prominent pillar which still becomes dispersed by ionizing radiation and stellar winds originating from the massive stars of the cluster. Because some of the molecular clumps are associated with near and mid infrared sources as well as OH, H_2O and CH_3OH maser sources we conclude that star formation is still going on within NGC 3603 .

A&A, in press

A SEARCH FOR RADIO SUPERNOVAE AND SUPERNOVA REMNANTS IN THE REGION OF NGC 1569'S SUPER STAR CLUSTERS

A. Greve([1]), A. Tarchi([2,3]), S. Hüttemeister([4,5]), R. de Grijs([6]), J.M. van der Hulst([7]),S.T. Garrington([8]) and N. Neininger([2])
([1])Institut de Radio Astronomie Millimétrique, 300 rue de la Piscine, 38406 St. Martin d'Hères, France, ([2])Astronomisches Institut der Universität Bonn, Auf dem Hügel 71, D–53121 Bonn, Germany, ([3])Max-Planck Institut für Radioastronomie, Auf dem Hügel 69, D–53121 Bonn, Germany, ([4])Astronomisches Institut der Ruhr-Universität Bochum, Universitätsstr. 150, D–44780 Bochum, Germany, ([5])Onsala Space Observatory, S–43920 Onsala, Sweden, ([6])Institute of Astronomy, University of Cambridge, Madingley Road, Cambridge CB3 0HA, UK, ([7])Kapteyn Astronomical Instituut, Postbus 800, 9700 AV Groningen, The Netherlands, ([8])Nuffield Radio Astronomy Laboratories, Jodrell Bank, Macclesfield Cheshire SK11 9DL, UK

Abstract:
We have used MERLIN, at 1.4 and 5 GHz, to search for radio supernovae (RSNe) and supernova remnants (SNRs) in the unobscured irregular dwarf galaxy NGC 1569, and in particular in the region of its super star clusters (SSCs) A and B. Throughout NGC 1569 we find some 5 RSNe and SNRs but the SSCs and their immediate surroundings are largely devoid of non-thermal radio sources. Even though many massive stars in the SSCs are expected to have exploded already, when compared with M 82 and its many SSCs the absence of RSNe and SNRs in and near A and B may seem plausible on statistical arguments. The absence of RSNe and SNRs in and near A and B may, however, also be due to a violent and turbulent outflow of stellar winds and supernova ejected material, which does not provide a quiescent environment for the development of SNRs within and near the SSCs.

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New Preprints

568. MOLECULAR LINE STUDY OF THE VERY YOUNG PROTOSTAR IRAM 04191 IN TAURUS: INFALL, ROTATION, AND OUTFLOW
2002, *Astronomy and Astrophysics*

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	from abroad:	(33) 476 82 49 00	(33) 476 51 59 38
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Plateau de Bure	Institut de Radioastronomie Millimétrique, Observatoire du Plateau de Bure, 05250 St Etienne en Dévoluy, France		
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Granada	Instituto de Radioastronomía Milimétrica, Avenida Divina Pastora 7, Núcleo Central, 18012 Granada, España	(34) 958 80 54 54	(34) 958 22 23 63
Pico Veleta	Instituto de Radioastronomía Milimétrica, Estación Radioastronómica IRAM-IGN del Pico Veleta, Sierra Nevada, 18012 Granada, España	(34) 958 48 20 02	(34) 958 48 11 48

E-Mail Addresses:

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

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