IRAM Newsletter

Number 56 August 5th , 2003

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IRAM SUMMER SCHOOL 2003 – mm Observing Techniques and Applications

IRAM SUMMER SCHOOL 2003 – mm Observing Techniques and Applications

October 3-10, 2003
Pradollano (Sierra Nevada, Spain)

The purpose of the school is to attract new users to current and future mm-telescopes. This second school in IRAM Spain will concentrate on single dish mm-astronomy.

There will be a lecture course on mm-techniques and applications to different areas of research, scientific highlight talks, observations with the IRAM 30-m telescope and a lab course on "Data analysis and interpretation".

Topics:

– mm-astronomical observing techniques

– Inter- and circumstellar chemistry
– Physical conditions of the interstellar medium
– Extragalactic astronomy and cosmology
– Imaging

Lecturers: F. Bertoldi (MPIfR), J. Cernicharo (CSIC), F. Combes (Observatoire de Paris), P. Cox (Univ. Paris Sud), A. Greve (IRAM), S. Hüttemeister (Univ. Bochum) plus six teaching assistants

LOC: J. Lobato, R. Mauersberger ...

Applications will be accepted from young scientists with little previous experience in mm-astronomy. The course is limited to 40 students, who will be selected on the basis of their CV and references. We will apply for EU grants to cover participants' costs for travel and lodging.

Further information and inscription under http://www.iram.es/IRAMES/events/summerSchool2003

Rainer MAUERSBERGER

Personnel Changes

IRAM Granada

Since April 1st, Nuria MARCELINO is working as a predoctoral fellow at IRAM Granada.

Starting April 1st Jean-Francois DESMURS is working as an astronomer in Granada and at Pico Veleta Observatory.

Since May 1st, Enrique LOBATO is working as a telescope operator at Pico Veleta Observatory.

In June, Teresa GALLEGO will leave the 30m-operator group.

Rainer MAUERSBERGER

IRAM Grenoble

The SIS group welcomes Arno BARBIER, who has arrived on February 24th.

Since April 7th, Sebastien BLANCHET is working as software engineer with the Grenoble computer group.

After many years as station chef on the Plateau de Bure, Thierry CROUZET has left IRAM on March 3rd. The interferometer has more than doubled its capacities during his time, and has come back to full scientific operation after the accidents in 1999. We wish him all the best for his future career.

The receiver group welcomes two new members: Sebasien MOUGEL who has arrived on February 2nd (ALMA project) and Sylvain MAHIEU who started work on March 31st. Alessandro NAVARRINI has left IRAM after a completing his thesis successfully, and is working now in Berkley, California.

Nathalie FAVARIO has joined the administration group on May 12th as a legal adviser. Céline RAMBAUD has started work as a secretary on July 2nd (she is not related with our Plateau de Bure operator André RAMBAUD).

Arancha CASTRO-CARRIZO has joined the astronomer's group in July 2003. She is working on evolved stars.

Michael BREMER

IRAM Grenoble News

The present IRAM Newsletter is a combination of the May and August Version (by itself, the May edition would have been very small).

The proposal submission time limit is this time on September 11th, which was due to organisational reasons. We hope that this will cause no inconvenience for astronomers in the United States.

News from the IRAM web site: The old web server http://iram.fr has been removed, all web traffic passes now through the servers http://www.iram.fr and http://www.iram.es (IRAM Grenoble and Granada, respectively), which partially mirror each other. Please update your bookmarks and links, if you have not already done so. The final shutdown of the old server caused some surprises when the navigational icons in thousands of web pages (which had relied on the old web server as icon server) suddenly refused to work, but some automated scripts soon removed this dependency and improved the html syntax for better mirroring. Since then, the web site has grown further and is used by several IRAM groups for the daily exchange of information.

The IRAM Annual Report 2002 is now available. A scanned and OCR (optical character recognition) processed version is available under `http://www.iram.fr/-IRAMFR/ARN/AnnualReports/IRAM_2002.pdf`, with a size of 12.4 MBytes. Printed copies are available on request.

In the recent months, the IRAM Grenoble web server has been down occasionally due to hacker attacks. An upgrade of the system, together with the installation of a search engine and webmail (with strong contributions by Sebastien BLANCHET) should reduce these problems. The Grenoble offices have also been burglared one night and computer equipment stolen, some of which was recovered later by the police. Visiting astronomers are therefore accomodated preferentially in hotels, and an intrusion alert system has been installed. Considering the recent heat wave in Grenoble and the fact that the rooms were not climatized, visitors have mostly welcomed the change.

Michael BREMER

News from the 30m Telescope

Summer transport schedule to Pico Veleta

	Departure from Granada	Departure from the Telescope
Monday	08:15 h	10:30 h
Tuesday	08:15 h	10:30 h and 17:00 h
Wednesday	**** no transport organized ****	
Thursday	10:00 h	17:00 h
Friday	08:15 h	10:30 h and 17:00 h

Javier LOBATO

Radiolink between Granada and the 30m Telescope replaced

The radiolink between Granada and the 30m telescope has been replaced by a new unit. The old radiolink started to show intermittant failures in February 2003. Unfortunately, the supplier did not offer to repair the equipment. However, the Instituto de Astrofisica de Andalucia had used such a radiolink before and we received from them material to replace the failing units. Since May 7th, 2003 we are using the replacement.

We also modified the remote observing software such that remote observing via ISDN (possible from Grenoble and Bonn) is now done by dialing directly the telescope and not the Granada ISDN line. As there is no technical support we are nevertheless investigating alternatives, e.g., based on the "free" 2.4 GHz frequency.

Walter BRUNSWIG and Miguel MUNOZ

IRAM Program Committee Recommendations

The IRAM program committee convened in Grenoble on April 3 and 4 to discuss the proposals submitted for the summer 2003 scheduling period. The committee was chaired by Malcolm Walmsley (Oss. di Arcetri, Firenze).

Plateau de Bure Interferometer Proposals

A: Accepted, B: Backup, C: Rejected					
Project	Rate	Project	Rate	Project	Rate
N001	B	N002	C	N003	A
N004	A	N005	B	N006	A
N007	C	N008	B	N009	B[2]
N00A	B	N00B	A	N00C	A
N00D	B	N00E	C	N00F	C
N010	C	N011	A	N012	B
N013	B	N014	C	N015	A[2]
N016	B[1]	N017	A[1]	N018	B[1]
N019	B	N01A	B	N01B	B
N01C	A	N01D	C	N01E	A
N01F	B	N020	A[1]	N021	A[1]
N022	C	N023	B	N024	B
N025	C	N026	B[2]	N027	C
N028	A	N029	B[2]	N02A	B

[1] some parts of the program - others rated C

[2] Time Filler program

A total of 42 proposals were received for the interferometer. The principal investigators of each proposal will also be informed by letter which will include comments issued by the committee if there are any.

For the interferometer, the programs were classified A (accepted), B (backup) and C (rejected). Programs rated A will be scheduled in priority. Further time, if it becomes available, will go to the B programs, taking into account scientific merit, crowding in certain right ascension ranges and general aspects of balance.

For projects rated A and B and without IRAM internal collaborator, please consult the list of local contacts.

30m Proposals

111 proposals were received for the 30m telescope, requesting 4603,50 hours of telescope time. The highest rating "A" was given to 31 proposals; 53 proposals were rated "B", i.e. were given backup status. The remaining proposals, although scientifically valuable in most cases, were rated "C". The individual ratings are listed in the attached table. All A-rated proposals will be scheduled on the telescope, although some with less time than requested. We expect that about half of the B-rated programs will actually be scheduled. The selection will take into account scientific merit, crowding in certain right ascension ranges, and general aspects of balance. Proposals rated "C" will not get telescope time.

The principal investigators of each proposal will also be informed by letter which will include comments issued by the committee if there are any.

A		B		C	
006-03	063-03	001-03	060-03	002-03	066-03
008-03	065-03	003-03	061-03	007-03	067-03
009-03	068-03	004-03	062-03	011-03	080-03
014-03	069-03	005-03	064-03	012-03	085-03
018-03	075-03	010-03	070-03	016-03	095-03
021-03	077-03	013-03	071-03	017-03	098-03
022-03	082-03	015-03	072-03	019-03	100-03
024-03	083-03	020-03	073-03	028-03	104-03
030-03	087-03	023-03	074-03	031-03	107-03
034-03	090-03	025-03	076-03	039-03	110-03
035-03	091-03	026-03	078-03	047-03	111-03
043-03	093-03	027-03	079-03	049-03	
044-03	094-03	029-03	081-03	050-03	
052-03	097-03	032-03	084-03	051-03	
057-03	109-03	033-03	086-03	053-03	
059-03		036-03	088-03	058-03	
		037-03	089-03		
		038-03	092-03		
		040-03	096-03		
		041-03	099-03		
		042-03	101-03		
		045-03	102-03		
		046-03	103-03		
		048-03	105-03		
		054-03	106-03		
		055-03	108-03		
		056-03			

Roberto NERI and Clemens THUM

Proposals for IRAM Telescopes

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

September 11th, 2003, 17:00 MEST (UT + 2 hours)

The scheduling period extends from 15 November 2003 to 15 May 2004, covering roughly the winter period at our observatories.

Proposals are submitted through our web–based submission facility. Instructions are found on our web page at URL:

`http://www.iram.fr/GENERAL/submission/submission.html`

The submission facility will be opened about three weeks before the proposal deadline. Proposal form pages and the 30m time estimator are available now.

Please avoid last minute submissions when the network could temporarily be congested. As an insurance against network congestion or failure, we still accept, in well justified cases, proposals submitted by:

– fax to number: (33/0) 476 42 54 69 or by

– 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 for the same proposal, send in your proposal *only once*. Note that the web facility allows cancellation and modification of proposals before the deadline. The facility also allows to view the proposal in its final form as it appears after re–compilation at IRAM. We urge proposers to make use of this facility as we always receive a number of proposals with formal defects (figures missing, blank pages, etc.).

Valid proposals contain 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. Proposals should *not exceed these 5 pages* of scientific material. Excepting the technical pages for the interferometer, longer proposals will be cut.

Proposals should be self-explanatory, clearly state the aims, and explain the need of the requested IRAM telescope. The amount of time requested should be carefully justified (see below).

The cover page, in postscript or in LaTeX format, and the LaTeX style file `proposal.sty` may be obtained from the IRAM web pages[1] at URL `./GENERAL/submission/-proposal.html`. In case of problems, contact the secretary, Cathy Berjaud (e–mail: `berjaud@iram.fr`). Please, make sure that your proposals use the current form pages. This is particularly important at the current deadline, since the style file has been modified at a number of places for facilitating a detailed computerized handling of the proposals.

In all cases, indicate on the cover page whether your proposal is (or is not) a *resubmission* of a previously rejected proposal or a *continuation* of a previously accepted proposal. In both cases we request that the proposers 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).

[1] from here on we give only relative URL addresses. In the absolute address the leading dot (.) is to be replaced by the address of one of our mirror sites: `http://www.iram.fr` or `http://www.iram.es`.

Do not use characters smaller than 11pt. They could render your proposal illegible when copied or faxed. If we notice any formal problems sufficiently before the deadline, we will try to contact the principal investigator and solve the problem together.

VLBI observations are possible with both IRAM telescopes. All available dishes of the interferometer are then used as a fully phased array. The IRAM telescopes are expected to participate occasionally in global and regional 3mm VLBI sessions. Instructions for submission of global 3mm VLBI proposals are given in a separate section below.

VLBI experiments at shorter wavelengths are also envisaged with the IRAM telescopes, possibly in cooperation with other telescopes. The organizational context of these VLBI observations ($\lambda < 3$mm and regional 3mm) is presently being explored. Such observations are carried out on an experimental basis. Interested astronomers should contact M. Bremer.

Roberto NERI, 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 observatory's set of four dual polarization heterodyne receivers centered at wavelengths of 3, 2, 1.3, and 1.1 mm.
2. the 9 pixel heterodyne receiver array, HERA, operating at 1.3 mm wavelength
3. a 1.2 mm bolometer array, probably MAMBO–2 with 117 pixels

Emphasis will be put on observations at the shorter wavelengths. In total, about 3000 hours of observing time will be available, which should allow scheduling of a few longer programmes (up to $\sim$ 150 hours).

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

What is new ?

The **second polarization module** of HERA is approaching completion. The upgrade which will take HERA out of operation for about a month, is planned to start at the end of October. Given the risk involved in the upgrade and the fact that some observational parameters are not yet precisely know for the full array, we request HERA proposers to still use the parameters of the present single polarization array when estimating integration times. In case of a successful upgrade the time allocated to the accepted proposals will then be adjusted according to the technical evaluation of the full array.

The additional HERA polarization makes necessary an **expansion of the IF distribution** system. A whole new set of the 120m long IF cables is installed together with switching units which permit flexible connections to continuum detectors, attenuators, and the increasing complement of backends.

A new broadband autocorrelator, WILMA (Wideband Line Multiple Autocorrelator), will be shipped to Pico Veleta in autumn. Although interfacing hardware and acquisition software still have to be prepared, we aim to have WILMA available when the full HERA array becomes operational. This autocorrelator, designed for exclusive use with the dual polarization HERA frontend, consists of 18 units each of which handles the full 1 GHz IF band of one HERA detector. Each WILMA band has 512 spectral channels with a spacing of 2 MHz.

VESPA is now fully operational in its many modes and configurations, including its cross correlation mode. Cross correlation is used for polarimetry (see below).

Applications

On the official cover page, please fill in the line 'special requirements' if you request either polarimetric observations, service or remote observing. If the observations need or have to avoid specific dates, enter them here. 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 the source list in J2000 coordinates. 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 adhere to the format indicated on the proposal form (no hand writing, please). If your source list is longer (e.g. more than 15 sources) than what fits onto the cover page, please use the **newly provided LaTeX** macro `\extendedsourcelist`.

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.

Reminders

A handbook ("The 30m Manual") collects most of the information necessary to plan 30m telescope observations[6]. 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 from the URL `./IRAMES/otherDocuments/manuals/index.html`. A catalog of well calibrated spectra for a range of sources and transitions (Mauersberger et al. [9]) is very useful for monitoring spectral line calibration. A copy of the 30m file with the calibrated spectra can be downloaded from the spanish web site.

The astronomer on duty (whose schedule can be found at URL `./IRAMES/groups/astronomy/aodsched.html`) should be contacted well in advance of an observing run for any special questions concerning the preparation of an observing run (e.g. setup of on-the-fly maps etc).

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 essential, although the spectral baselines with HERA are among the best known in frequency switching. Certain limitations exist with respect to maximum frequency throw (≤ 45 km/s), backends, phase times etc.; for a detailed report see [4].

Observing time estimates

This matter needs special attention as a serious time underestimate may be considered as evidence for sloppy proposal preparation. We strongly recommend to use the web–based Time Estimator (URL: `./IRAMES/obstime/-time_estimator.html`), whenever applicable. A new version 2.5 handles heterodyne (single pixel and HERA) as well as bolometer observations with updated instrumental parameters. Suggestions and questions can be addressed to Axel Weiß (aweiss@iram.es).

If very special observing modes are proposed which are not covered by the Time Estimator, proposers must give sufficient technical details so that their time estimate can be *reproduced*. In particular, the proposal must give values for $T_{\rm sys}$, the spectral resolution, the expected antenna temperature of the signal, the signal/noise ratio which is aimed for, all overheads and dead times, and the resulting observing time. A technical report explaining how to estimate the telescope time needed to reach a given sensitivity level in various modes of observation was published in the January 1995 issue[2] of the IRAM Newsletter [5]. It has been included in the 30m telescope Manual [6].

Proposers should base their time request on normal winter conditions, corresponding to 4mm of precipitable water vapor. Conditions during afternoons can 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 best winter conditions, the proposers must clearly say so in their time estimate paragraph. Such proposals will however be particularly scrutinized.

Pooled observing

As in the previous semesters, we plan to reserve a large fraction of the winter semester to pooled observing. The proposals participating in the pool are observed by Granada staff and cooperating external astronomers, under the coordination by Axel Weiss. The participating proposals are grouped according to their demand on weather quality, and they get observed following the priorities assigned by the program committee.

[2] electronically available on the IRAM web pages at URL `http://www.iram.fr/IRAMFR/PV/ARN/newsletter.html`

The organization of the observing pool is described at `./IRAMES/observing/flexible/flexible.html`. Typically, the bolometer proposals are included in the pool, along with suitable heterodyne proposals. Participation in the pool is voluntary, and the respective box on the proposal form should be checked.

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 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 then decide which proposals can actually be accepted for this 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, from OAN in Madrid (near Parque de Retiro), and from IRAM in Grenoble. This observing mode is available to projects without 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 proposal, the P.I. is requested to give sufficient detail to the secretary, Cathy Berjaud (berjaud@iram.fr) on how the remote observer can be contacted. Please note that IRAM is not responsible for the remote stations in Paris, Madrid, or Bonn.

Remote observers affiliated with the MPIfR or other institutes near Bonn should contact F. Bertoldi (bertoldi@mpifr-bonn.mpg.de) or Dirk 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 M. Gerin (gerin@lra.ens.fr) for arrangements. Astronomers who want to use the Madrid station are requested to contact Javier Alcolea (j.alcolea@oan.es). Remote observers in or near Grenoble please contact (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. A concise summary of telescope characteristics is published on the IRAM web pages.

HERA

The **HE**terodyne **R**eceiver **A**rray is expected to be available for most of next winter. The 9 pixels are arranged in the form of a center–filled square and are separated by $24''$. Each beam is split into two linear polarizations (after the November upgrade) which couple to separate SIS mixers. The 18 mixers feed 18 independent IF chains. Each set of 9 mixers is pumped by a seperate local oscillator system. The same positions can thus be observed simultaneously at any two frequencies inside the HERA tuning range (210-276 GHz).

A derotator optical assembly can be set to keep the 9 pixel pattern stationary in the equatorial or horizontal system. Receiver characteristics (of the single polarization system) are listed in Tab. 1, and an updated user manual (version 1.7) 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 still known for only a few frequencies, (the 3 CO isotopes at 230.5, 220.4, and 219.6 GHz; CS at 244.9 GHz; HCN at 265.9 GHz; HCO^+ at 267.6 GHz; DCN and $HC^{15}N$ at 217.2 and 259 GHz; H_2CO at 225.7 GHz; H30α at 231.9 GHz), HERA proposals for any frequency within the nominal tuning range of 210 – 276 GHz are 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 currently be connected to three sets of backends: 20pt0pt

- ▷ VESPA with the following combinations of nominal resolution (KHz) and maximum bandwidth (MHz): 20/40, 40/80, 80/160, 320/320, 1250/640. The maximum bandwidth can actually be split into two individual bands for each of the 18 detectors at most resolutions. These individual bands can be shifted separately up to $\pm$200 MHz offsets from the sky frequency (see also the sections on backends below).
- ▷ a low spectral resolution (4 MHz channel spacing) filter spectrometer covering the full IF bandwidth of 1 GHz. Nine units (one per HERA pixel) are available. Note that only one polarization of the full array is thus connectable to these filter banks.
- ▷ WILMA with one 1 GHz wide band for each of the 18 detectors. The bands have 512 spectral channels spaced out by 2 MHz.

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 $2' - 10'$). Extragalactic proposals should take into account the current limitations of OTF line maps, as described in the User Manual, due to baseline instabilities induced by residual calibration errors. HERA proposers should use the web–based Time Estimator. For details about observing with HERA, consult the User manual. Karl Schuster (schuster@iram.fr), the HERA project scientist, or Albrecht Sievers, the astronomer in charge of HERA (sievers@iram.es), may also be contacted.

Given the risk involved in the upgrade and considering that some relevant observational parameters are not yet well known for the full array, we request HERA proposers to use the parameters of the present single polarization array when estimating integration times. As mentioned above, the times scheduled for the successful proposals may then be adjusted, once the parameters of the full array are known.

The single pixel 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 four of these eight receivers can be combined for simultaneous observations in the four ways depicted in Tab. 1. Note that they cannot be combined with HERA nor with the bolometers. Also listed are typical system temperatures which apply to normal winter weather (4mm) 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 not more than 15 min to tune four such receivers.

General point about receiver operations

Tuning of the single pixel/dual polarization receivers is now considerably faster and more reproducible than before. Particular frequencies, like those near a limit of the tuning range, may still be problematic, and we recommend in such cases 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 XPOL

An upgrade of the IF polarimeter is now available[16], where the cross correlation between the IF signals from a pair of orthogonally polarized receivers is made digitally in VESPA. The new observing procedure, designated XPOL, generates simultaneous spectra of all 4 Stokes parameters. The following combinations of spectral resolution (kHz) and bandwidth (MHz) are available: 40/120, 80/240, 320/480, and 1250/640. A few hardware and software complications still exist (involving manual wiring of LO cables and manual phase calibration) which are expected to be solved early in the next semester.

Although successful XPOL observations were made at several frequencies, experience is still limited, particularly with respect to long integrations and observations of extended sources. Data reduction software using CLASS enhanced with a graphical user interface is available (H. Wiesemeyer). A short guide (at `http://www.iram.fr/IRAMFR/PV/veleta.html`) describes XPOL observations. Polarimetry proposals are invited with the restriction that the target sources be not larger than the main beam, except in well justified cases.

MPIfR Bolometer arrays

The bolometer arrays, MAMBO–1 (37 pixels) and MAMBO–2 (117 pixels), consist of concentric hexagonal rings of horns centered on the central horn. Spacing between horns is $\simeq 20''$. Each pixel has a HPBW of $11''$. We expect that MAMBO–2 will be normally used, but MAMBO–1 is kept as a backup.

The effective sensitivity of MAMBO–1 for onoff and mapping observations is ~ 35 mJy $\mathrm{s}^{\frac{1}{2}}$. For MAMBO–2 effective sensitivities of ~ 40 mJy $\mathrm{s}^{\frac{1}{2}}$ (ON/OFF mode) and ~ 45 mJy $\mathrm{s}^{\frac{1}{2}}$ (mapping mode) were measured. Since in the mapping mode all beams cover the inner region of the map area, MAMBO–2 turns out to be more sensitive if areas of $2'$ and larger are to be mapped (see the Time Estimator). The sensitivities apply to bolometric winter conditions (τ(250GHz) ~ 0.25, elevation 45 deg, and application of skynoise reduction algorithms. In cases where skynoise reduction algorithms (simply the subtraction of correlated sky-noise) can not be applied (e.g. extended source structure), the effective sensitivity is typically about a factor of 2 worse. For those projects, only atmospheric conditions with low skynoise (i.e. stable atmosphere, no clouds, little turbulence) are recommened unless the expected signal is about 1 Jy/beam or stronger.

The bolometer arrays are mostly used in two basic observing modes, ON/OFF and mapping. Previous experience with MAMBO–2 shows that the ON/OFF reaches typically an rms noise of ~ 3 mJy in 10 min of total observing time (about 200 sec of ON source, or about 400 sec on sky integration time) under stable conditions. Up to 30 percent lower noise may be obtained in perfect weather. In this observing mode, the noise integrates down with time t as $\sqrt{t}$ to rms noise levels below 0.5 mJy.

In the mapping mode, the telescope is scanned in azimuth (also the direction of the wobbler throw) in such

Table 1: Heterodyne receivers available for the next winter 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 (4mm pwv) 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 AB	CD	AD	BC	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/V					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: tuning parameters are not yet complete

a way that all pixels see the source once. A typical single map[3] with MAMBO–2 covering a fully and homogeneously sampled area of 150″ × 150″ (scanning speed: 5″per sec, raster step: 8″) reaches an rms of 2.8 mJy/beam in 1.3 hours. The area actually scanned (7.3′ × 6.5′) is larger than this by the wobbler throw and the array size. 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 ambitious goal.

The bolometers are used with the wobbling (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 [7] and MOPSI[8]). Time estimators for planning ON/OFF or mapping observations are also available [7, 13].

Bolometer proposals will be pooled together like in previous semesters along with suitable heterodyne proposals. The web–based time estimator handles well the usual bolometer observing modes, and its use is again strongly recommended. The time estimator uses rather precise estimates of the various overheads which will be applied to all bolometer proposals. If exceptionally low noise levels are requested which may be reachable only in a perfectly stable (perfect winter) atmosphere, the proposers must clearly say so in their time estimate paragraph. Such proposals will however be particularly scrutinized. On the other extreme, if only strong sources are observed and moderate weather conditions are required, the proposal may be used as a backup in the observing pool. The proposal should point out this circumstance, as it affects positively the chance that the proposal is accepted and observed.

The Telescope

Beam and Efficiencies

Table 2 lists the size of the telescope beam for the range of frequencies of interest. Forward and main beam efficiencies are also shown (see also the note by U. Lisenfeld and A. Sievers, IRAM Newsletter No. 47, Feb. 2001). The variation of the coupling efficiency to sources of different sizes can be estimated from plots in Greve et al. [12].

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 ≃ 170″ and 800″ (see [12] for details). Astronomers should take into account this error beam when converting antenna temperatures into brightness temperatures. A variable and sometimes large contribution to the error beam was known to come from telescope astigmatism[3]. Extensive work during the last years had shown that the astigmatism resulted from temperature differences between the telescope backup structure and the yoke. The recent installation of heaters in the yoke by J. Peñalver has nearly completely removed the astigmatism[15].

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

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

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: $\eta_{\rm mb} = 1.2\epsilon\exp(-(4\pi R\sigma/\lambda)^2)$
with $\epsilon = 0.69$ and $R\sigma = 0.07$

Pointing and Focusing

Since the systematic use of inclinometers the telescope pointing became much more stable. Pointing sessions are now scheduled only once every 2 weeks. The fitted pointing parameters typically yield an absolute rms pointing accuracy of better than $3''$ [10]. Receivers are closely aligned (within $\leq 2''$). 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 can occasionally occur. 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.

Backends

The following four spectral line backends are available which can be individually connected to any single pixel receiver and, if indicated, also to 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.

VESPA, the versatile spectrometric and polarimetric array, 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 and user modes are summarized in a Newsletter contribution [14] and in a user guide, but are best visualised on a demonstration program which can be downloaded from our web page at URL `http://www.iram.fr/IRAMFR/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 consists of nine units. Each unit has 256 channels (spacing of 4 MHz, spectral resolution at 3 dB is 6.2 MHz) and thus covers a total bandwidth of 1 GHz. The 9 units are designed for connection to HERA, but a subset of 4 units can also be connected to the backend distribution box which feeds the single pixel spectral line receivers. All these receivers have a 1 GHz RF bandwidth except for A100 and B100 (500 MHz only). At the present time, a 4 MHz filterbank cannot be used simultaneously with the autocorrelator or the 100 KHz filterbank on the same receiver.

An 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. A logical link named “data.30m” pointing to this file of calibrated spectra is made available in all newly created project accounts.

The **new autocorrelator WILMA** consists of 18 units which connect to the 18 detectors of HERA. Each unit provides 512 spectral channels, spaced out by 2 MHz and thus covering a total bandwidth of 1 GHz. Each band is sliced into two 500 MHz subbands which are digitized with 2 bit/1GHz samplers. An informative technical overview of the architecture is available on the backend section of our web pages (URL: `./IRAMFR/-TA/backend/veleta/wilma/index.html`).

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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, Rainer MAUERSBERGER

News from the Plateau de Bure Bure Interferometer

WEATHER CONDITIONS AND OBSERVATIONS

Good news! The weather reports for Western Europe and the Plateau de Bure could not have been better for the last winter period. Due to excellent observing conditions from January to April, the observatory has brought to completion almost every A-rated project before the end of the winter period. We have also invested observing time on many B projects, and even on a few targets of opportunity. Since last December, a total of 59 different projects has successfully been scheduled for observations. Concerning projects that have been started shortly before the end of the winter period, we plan to bring these to completion in the next few months.

Not only that the observing efficiency of the interferometer has been higher than in previous years, the quality of the data has also been very high. The scheduling of the A configuration, which has been available again for the first time since the winter 1998/1999, and the extended bandwidth capabilities of the six antenna correlator have been beneficial for a good number of projects.

Finally, we would like to remind users of the Plateau de Bure Interferometer that B-rated proposals which were not started have to be resubmitted again. The daily status of all ongoing projects is accessible on the Internet (URL: `./IRAMFR/PDB/project.html`).

The northern track extension

According to current plans, construction work on the northern track extension should be resumed in August when the "blondin" will become available, and will hopefully be completed in time for the winter 2003/2004 scheduling period. Redesign work was started early this year to modify the current set of AB configurations in view of the extension of the northern track from station N29 to N46, and should achieve completion before the end of the summer. The new configurations should significantly improve the mapping of medium and low declination sources. Further details will be given in the next issue of the Newsletter.

Call for Observing Proposals for the Plateau de Bure Interferometer

Conditions for the next winter session

Based on our winter 2002/2003 experience in carrying out configuration changes with limited access to the Observatory, we plan again to schedule three configuration changes next winter. We therefore ask investigators to submit proposals for all four of the primary configurations of the six antenna array. 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 2003/2004
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: in a typical winter, 20-30% of the time is found to be poor at 1.3mm, but still excellent at 3mm. We therefore invite proposers to submit a significant number of proposals also for observations at 3mm.

Call for Proposals

Under normal operating conditions, IRAM schedules and completes between 40 to 60 projects during the winter period, with on average an elapsed time of at least two months between start and end of a project. Selection is based on scientific merit, technical feasibility, and suitability for 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 `./IRAMFR/PDB/docu.html`). Proposers should read this document carefully before submitting any proposal.

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.

Configurations of the six antennas array

The six antennas can be arranged in four primary configurations. The current configurations for the winter period are:

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

Note that the stations of the current AB configuration set will change, should station N46 on the northern track extension become available in time for the winter 2003/2004 scheduling period.

- `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 it 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 and higher frequencies. Higher frequencies are not feasible on all antennas because of limitations in the triplers, however. For details about observing at frequencies adjacent to the guaranteed tuning range of the 3mm and 1.3mm receivers, please consult with R.Neri.

Signal to Noise

The rms noise can be computed from

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

where

- $T_{\rm SYS}$ is the system temperature (150 K below 110 GHz, 200 K at 115 GHz, 400 K at 230 GHz for sources at $\geq 20°$)
- $J_{\rm pK}$ 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)
- $T_{\rm on}$ is the on-source integration time per configuration in seconds (2 to 8 hours, depending on source declination). Because of calibrations and antenna slew time, the effective on-source time is about 70% of the total observing time.
- B is the spectral bandwidth in Hz (580 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 particularly for projects aiming at deep integrations.

Coordinates and Velocities

The interferometer operates in the J2000.0 system. For best position 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 which can independently be placed anywhere in the 110–680 MHz band. Seven modes of configuration are available, 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 if the continuum is strong. 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 SSB modes (160MHz/128, 80MHz/256, 40MHz/512, 20MHz/512) the two central channels are not affected by the Gibbs phenomenon and, therefore, these modes are preferable 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 downward compatible with the previous releases, but the reverse is not true. Observers who wish 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 dedicated computers at IRAM. Remote data reduction is possible, and especially for experienced user of the Plateau de Bure Interferometer. Please contact R.Neri if you are interested in reducing the data from your home institute.

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 includes documents of general interest to potential users, and more specialized documents intended for observers on the site (IRAM on-duty astronomers, operators, or observers with non-standard programs). All documents can be retrieved on our Web page at `./IRAMFR/PDB/docu.html`

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 at `.-IRAMFR/PDB/docu.html`. The IRAM staff is prepared to provide help if contacted well before the deadline. Note that the proposal should not only justify the scientific interest, but also the need for the Plateau de Bure Interferometer.

Roberto NERI

VLBI Observations and Call

Introduction

In October 2002 and April 2003, two global VLBI experiments at 3mm wavelength have taken place involving both IRAM instruments, with the 6-antenna Plateau de Bure in phased-array mode for the first time. The IRAM 30-m telescope has already prooved its value in global VLBI observations for many years, but these two experiments now have shown that also the Plateau de Bure can work reliably as a phased array VLBI station. Both IRAM instruments are now ready to offer observing time in VLBI mode to the scientific community.

Call for Global VLBI Proposals at 3mm wavelength

We announce the opportunity for coordinated, high angular resolution and high sensitivity GLOBAL VLBI observations in the 3mm band (85 - 95 GHz), complementing existing stand-alone VLBA observations at this frequency. The Global 3mm VLBI Array consists of 8 VLBA antennas equipped with 3mm receivers, plus the IRAM 30-m telescope on Pico Veleta (Spain), the IRAM phased 6-element interferometer on Plateau de Bure (France), and the MPIfR 100-m radio telescope in Effelsberg (Germany). Other telescopes may join later.

The Global 3mm VLBI Array is the successor to the former Coordinated Millimeter VLBI Array (CMVA) and offers 3 to 4 times more sensitivity than the stand-alone VLBA. Observations with the Global 3mm VLBI array will be scheduled in time blocks in special observing sessions, performed twice per year. The next two sessions are tentatively planned for April 16-21, 2004 and October 8-13, 2004. The actual duration of each session will depend on proposal pressure.

The Global 3mm VLBI Array basically supports the same observing modes as the VLBA. For standard continuum observations the VLBI recording will be done at 256 Mbit/s (corresponding to a bandwith of 128 MHz). Correlation will be performed in absentia at the MPIfR MK4 correlator in Bonn unless some technical reason for using another correlator is given in the proposal. The P.I. will receive the correlated data in uv-fits format.

Proposals for the April 2004 session should be prepared in a similar fashion as "normal cm-VLBI proposals", using the standard VLBI cover sheet and instructions available on the web under URL http://www.nrao.edu/administration/directors_office/vlba-gvlbi.shtml and should be submitted electronically **as e-mail** before

October 1st 2003, the normal VLBI deadline

to the following two addresses (in copy):

propsoc@nrao.edu
and propvlbi@mpifr-bonn.mpg.de

Proposals will be reviewed by NRAO and the participating European Observatories.

The European Schedule Coordinator, Dr. R. Porcas (MPIfR), will forward proposal copies to the participating European Institutes and ensure the scientific evaluation of the proposals by the respective local committees. Finally, the referee ratings of these observatories and the NRAO will be combined.

Global VLBI observations at 3mm are subject to some technical restrictions, which are summarized on the following web-page (http://www.mpifr-bonn.mpg.de/div/vlbi/-globalmm/index.html). The following persons are ready to provide help: at IRAM: Dr. Michael BREMER (bremer@iram.fr) and at MPIfR: Dr. Thomas Krichbaum (tkrichbaum@mpifr-bonn.mpg.de).

The IRAM and MPIfR VLBI teams

VLBI: what changes compared to a local interferometer?

Many IRAM users are familiar how the Plateau de Bure Interferometer works. There are some important differences in VLBI mode, which concerns some technical aspects but also the science which can be done. Please see the web page by T. Krichbaum (first reference of the next section "some useful web pages") for detailed technical information. The following points are a small introduction for observers which are not familiar with VLBI.

When operating in VLBI mode, the Plateau de Bure correlator operates in "phased array mode": it adds up the local baseline amplitude and phases, so that the VLBI terminal can register the signal as if it came from a single dish antenna (of an equivalent surface close to the whole interferometer).

The observations themselves are made synchronously on all participating observatories. At each telescope the so called VLBI field system, which is a VLBI control computer, runs the mutual VLBI schedule, which ensures that all telescopes observe the same source at the same time. Together with time stamps from the local H-maser clock, the complex data (amplitude and phase) are formatted, digitized and then written on magnetic tape. For each experiment only a limited amount of recording tapes are available. After the experiment, the recorded data are shipped to one of the VLBI correlator centers in the world, correlated, and made available to the P.I. of the proposal. The post-correlation analysis (calibration and fringe fitting) is done using AIPS at the P.I.'s institute.

The main advantage of VLBI is that it gives a tremendously high **angular resolution** (current world record: $\approx 20-30\mu$ arcsec at 1.3 mm) using the method of Earth-rotation aperture synthesis. However, only a tiny fraction of the surface of the synthesized antenna is actually filled by the contributing antennas. Therefore it is only possible to observe sources with relatively high surface brightness; brightness temperatures T_B ($\propto 10^{12} S_{\rm Jy} \nu_{\rm GHz}^{-2} \theta_{\rm mas}^{-2}$ [K]) must be at least $10^8 - 10^9$ Kelvin or 0.1-0.4 Jansky on spatial scales close to the synthesized beam size of typically 0.05 - 0.1 mas at 3 mm wavelengths (extended emission is suppressed as in a local interferometer).

Typical targets for mm VLBI are therefore quasars and masers and other compact, mainly non-thermally radiating radio sources. In the course of months the spatial resolution allows to study the evolution of maser spots around stars and details of quasar jet evolution.

Observing Frequencies: The available frequency range is (84 - 95 GHz). In standard mode, observations are done close to 86 GHz, including the SiO ($2 \rightarrow 1$) line at 86.243 GHz in the recording bandpass. Since not all stations can tune easily to all frequencies in the aforementioned 3mm band, the proposers are ask to contact the technical VLBI advisors (see below), if they wish to observe at non-standard frequencies. In any case the frequency flexibility and the number of possible retunings per observing session is limited (Doppler-tracking of course is no problem).

Observing bandwidths are currently limited by the rate with which the data can be written on tape. The MK4 system offers recording rates of up to 256 Mbits/sec, corresponding to a bandwidth of up to 128 MHz. The new MK5 system offers recording with a recording rate of up to 1Gbit/s (in Europe) and up to 512 Mbit/s at the VLBA. These new recording modes are still under development.

The field of view of VLBI observations is limited by the time averaging which has to be applied, and is considerably smaller than the primary beam size of the participating antennas. In VLBI only a small field of view of some tens of synthesized beams is possible. At 3mm wavelengths this corresponds typically to a few milli-arcseconds. See the CMVA web links below for more details on the theory.

Proposal Preparation: VLBI demands observing time from many contributing institutes, which makes it more "expensive" than institute-specific time. Please prepare your proposals carefully with a good scientific justification and avoid last-minute submissions (The VLBA account may bounce large e-mail proposals and give FTP submission details).

Reduction Software: VLBI data is typically reduced in AIPS (Astronomical Image Processing System, http://www.aoc.nrao.edu/aips/).

Some useful web pages

Web pages with more details on VLBI are currently under construction. The list below gives a first overview but is not exhaustive.

- Technical details on VLBI observations: http://www.mpifr-bonn.mpg.de/div/vlbi/-globalmm/index.html
- Technical details on PdBI correlator in VLBI mode by Marc Torres: http://www.iram.fr/IRAMFR/TA/backend/-vlbi/index.html
- Very long baseline array observational status summary (J.M. Wrobel, April 5, 2002) http://www.aoc.nrao.edu/vlba/obstatus/obssum/-obssum.html
- CMVA Technical Information:
  Array sensitivity: http://web.haystack.mit.edu/-cmva/tech_1.html
  Field of view vs. Time averaging:
  http://web.haystack.mit.edu/cmva/tech_2.html
- Picture gallery of our cm-wavelength colleagues: http://www.evlbi.org/gallery/images.html

Michael BREMER

Scientific Results in Press

DENSE GAS IN NEARBY GALAXIES - XV. HOT AMMONIA IN NGC 253, MAFFEI 2 AND IC 342

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Abstract:
The detection of NH_3 inversion lines up to the $(J, K) = (6, 6)$ level is reported toward the central regions of the nearby galaxies NGC 253, Maffei 2, and IC 342. The observed lines are up to 406 K (for $(J, K) = (6, 6)$) and 848 K (for the (9, 9) transition) above the ground state and reveal a warm ($T_{\rm kin} = 100 \ldots 140$ K) molecular component toward all galaxies studied. The tentatively detected $(J, K) = (9, 9)$ line is evidence for an even warmer (> 400 K) component toward IC 342. Toward NGC 253, IC 342 and Maffei 2 the global beam averaged NH_3 abundances are $1 - 2\,10^{-8}$, while the abundance relative to *warm* H_2 is around 10^{-7}. The temperatures and NH_3 abundances are similar to values found for the Galactic central region. C-shocks produced in cloud-cloud collisions can explain kinetic temperatures and chemical abundances. In the central region of M 82, however, the NH_3 emitting gas component is comparatively cool (~ 30 K). It must be dense (to provide sufficient NH_3 excitation) and well shielded from dissociating photons and comprises only a small fraction of the molecular gas mass in M 82. An important molecular component, which is warm and tenuous and characterized by a low ammonia abundance, can be seen mainly in CO. Photon dominated regions (PDRs) can explain both the high fraction of warm H_2 in M 82 and the observed chemical abundances.

Astronomy and Astrophysics, in Press

DESIGN OF 129-174 GHZ SSB SIS MIXER FOR BAND 2 OF NEW GENERATION RECEIVER OF IRAM PDB INTERFEROMETER

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Abstract:
We present the design of a backshort tuned Single Side Band (SSB) SIS mixer covering the frequency range 129-174 GHz, for Band 2 of New Generation Receiver of IRAM's Plateau de Bure Interferometer. A stability criterion for an SSB SIS mixer has been derived using the standard quantum theory of mixing and applied to the design. The mixer is based on a wideband single ended probe transition from WR6 full-height waveguide to microstrip line. The RF signal is coupled in a series array of two Nb/Al-AlOx/Nb junctions, each having an area of 1.6 x 1.6 μm^2, and a critical current density of $j_c = 4$ kA/cm^2. A parallel inductor tunes out the reactive part of the series combination of the SIS array with a capacitive stub that provides a ground for the RF and a path for the IF output. The intrinsic capacitance and inductance of the chip have been kept to a minimum value to achieve 4 GHz IF band. A receiver noise below 15 K (quasi-SSB, image gain less than -14 dB) is estimated over the 129-174 GHz band. The mixer can be operated in DSB mode with low noise and stable operation.

Accepted for Publication in: Proceedings of the 14th International Symposium on Space Terahertz Technology, 22-24 April 2003, Tucson, AZ, USA

DESIGN OF A DUAL POLARIZATION SIS SIDEBAND SEPARATING RECEIVER BASED ON WAVEGUIDE OMT FOR THE 275-370 GHZ FREQUENCY BAND

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Abstract:
We report on the design of a wideband Orthomode Transducer (OMT) integrated with two 90° waveguide hybrid couplers and four 16 dB branch-guide LO directional couplers for the 275-370 GHz frequency band. The device allows the sideband separation for each of two mutually orthogonal polarizations to be achieved by employing four fixed-tuned SIS DSB mixer-units. The central part of the system is based on a Boifot type junction OMT as realized by Wollack, and is similar to the design discussed by Narayanan. The proposed device takes advantage of the -3 dB splitting operated over one polarization of the RF input power that is delivered in the two side arms of the Boifot orthomode junction by a thick septum parallel to the E-field of the considered polarization; the RF signals of the split polarization are added through two 16 dB branch-guide couplers to the signals of a Local Oscillator (LO) that enter the Boifot orthomode junction side arms with phase difference of 90°. The RF and LO are applied in two fixed-tuned DSB SIS mixers whose IF outputs are recombined in a 4-8 GHz IF 90° quadrature hybrid, so that the resulting downconverted upper (USB) and lower

(LSB) sideband of the considered polarization are separated. The LO quadrature hybrid, the 16 dB waveguide couplers, and the idea of assembling these elements to get a single polarization sideband separating receiver (2SB) are adopted from the work of Claude. The RF signal of the orthogonal polarization passing the septum is divided using an in-phase power divider and delivered through side arms perpendicular to the previous. The sideband separation for this second polarization is realized using the same scheme as for the first polarization. The advantage of the device is to exploit the -3 dB splitting operated over each of two mutually orthogonal polarizations by the waveguide OMT junction and power divider, as required for sideband separation, and to avoid the problem of signals recombination of classical waveguide OMTs. The proposed dual polarization sideband separating receiver design results directly from the intrinsic properties of a classical Boifot orthomode junction. Both the OMT junction and the in-phase power splitter have been optimised using a 3D electromagnetic simulator. Return loss better than 16 dB, and trasmitted power to the four side arms within 0.1 dB of the reference value at -3 dB of the single polarization input excitation are expected over the RF band of design. Because of symmetry properties, the structure has not cross-polarization. Although the 3D structure looks complex, the proposed device can easily be constructed using conventional split-block techniques with reliability and cost-effectiveness.

Accepted for Publication in: Proceedings of the 14th. International Symposium on Space Terahertz Technology, 22-24 April 2003, Tucson, AZ, USA.

210-320 GHz MULTI-HOLE DIRECTIONAL COUPLER DESIGN AND MEASUREMENT

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Abstract:
The design of a 210-320 GHz multi-hole directional coupler is described. The coupler performance is measured with a millimeter vector network analyser across the band 205-350 GHz and compared with simulations. The coupler consists of two waveguides whose broad walls are separated by a thin metal sheet with an array of circular holes according to a Chebyshev distribution of couplings. The coupling is 11 dB with a typical variation of ±2 dB across the WR3 band and the isolation is more than 25 dB.

International Journal of Infrared and Millimeter Waves, Vol. 24, Number 7, July 2003

The young cluster in the CB34 globule – II. The clumps and the outflows

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Abstract:
The molecular environment of the young cluster of Class 0 YSOs located in the globule CB34 has been investigated through a multiline millimetre survey. The CO, ^{13}CO, C^{18}O, and CS emissions show that the present star forming process is concentrated into three molecular clumps with size of ~ 0.25 pc which are embedded in a cool more extended gas. The spatial distribution of the high-velocity emission reveals the occurrence of multiple outflows which are associated with the brightest YSOs.

The interaction of the outflows with the molecular clumps has been studied by using the abundances of products of shocked chemistry such as SiO and SO. The abundances of these molecules at the high velocities of the outflows can be used to further specify, with respect to the continuum results, the characteristics of the Class 0 YSOs. In particular, one of the YSOs which does not show the presence of SiO and SO at high velocities is thought to be in a more evolved phase where most of the molecules produced at high velocities in the shocked regions have been already destroyed.

MNRAS, in press

Mass-loss from dusty, low outflow-velocity AGB stars
I. Wind structure and mass-loss rates

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Abstract:
We present the first results of a CO(2-1), (1-0), and 86 GHz SiO maser survey of AGB stars, selected by their weak near-infrared excess. Among the 65 sources of the present sample we find 10 objects with low CO outflow velocities, $v_{\rm exp} \leq 5\,{\rm km\,s^{-1}}$. Typically, these sources show (much) wider SiO maser features. Additionally, we get 5 sources with composite CO line profiles, i.e. a narrow feature is superimposed on a broader one, where both components are centered at the same stellar velocity. The gas mass-loss rates, outflow velocities and velocity structures suggested by these line profiles are compared with

the results of hydrodynamical model calculations for dust forming molecular winds of pulsating AGB stars. The observations presented here give support to our recent low outflow-velocity models, in which only small amounts of dust are formed. Therefore, the wind generation in these models is dominated by stellar pulsation. We interpret the composite line profiles in terms of successive winds with different characteristics. Our hydrodynamical models, which show that the wind properties may be extremely sensitive to the stellar parameters, support such a scenario.

accepted by Astronomy & Astrophysics

SELF-CONSISTENT MODELING OF THE OUTFLOW FROM THE O-RICH MIRA IRC −20197

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Abstract:
We present a self–consistent time–dependent model for the oxygen–rich Mira variable IRC −20197. This model includes a consistent treatment of the interactions among hydrodynamics, thermodynamics, radiative transfer, equilibrium chemistry, and heterogeneous dust formation with TiO_2 nuclei. The model is determined by the stellar parameters, stellar mass $M_* = 1.3\,M_\odot$, stellar luminosity $L_* = 1.4\,10^4\,L_\odot$, stellar temperature $T_* = 2400\,K$, and solar abundances of the elements. The pulsation of the star is simulated by a piston at the inner boundary where the velocity varies sinusoidally with a period of $P = 636\,d$ and an amplitude of $\Delta v_p = 8\,km\,s^{-1}$. Based on the atmospheric structure resulting from this hydrodynamic calculation at different phases, we have performed angle– and frequency–dependent continuum radiation transfer calculations, which result in the spectral energy distributions at different phases of the pulsation cycle and in synthetic light curves at different wavelengths. These are in good agreement with the infrared observations of IRC −20197. The model yields a time averaged outflow velocity of $11.9\,km\,s^{-1}$ and an average mass loss rate of $7.3\,10^{-6}\,M_\odot yr^{-1}$ which are in good agreement with the values derived from radio observations. Furthermore, the chemical composition of the resulting grains is discussed.

Appeared in: A&A **407**, *191-206 (2003)*

New Preprints

570. PROPOSAL FOR VERY-WIDE IF-BAND MIXERS DEVELOPMENT AT IRAM WITHIN THE FP6 PROGRAM
C. Muthu, R. Bachiller
2003, *Recent Research Development in Astronomy and Astrophysics*

571. DENSE GAS IN NEARBY GALAXIES XI. HOT AMMONIA IN NGC 253, MAFFEI 2 AND IC 342
R. Mauersberger, C. Henkel, A. Weiss, A.B. Peck, Y. Hagiwara
2003, *Astronomy and Astrophysics*

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	from France:	0 492 52 53 60	0 492 52 53 61
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