IRAM
Institut de Radioastronomie Millimétrique
Institut für Radioastronomie im Millimeterbereich
Instituto de Radioastronomía Milimétrica

Newsletter

Number 68 February 23rd, 2007

Contents

Calendar

March 15th, 2007 17:00h CET (UT+1 hour):
Deadline for the submission of IRAM observing proposals for the period from May 15, 2007 to November 15, 2007.

April 16/17 2007:
Program committee meeting

June 25 2007:
IRAM Executive Council meeting

25 years IRAM Granada

In 1982 IRAM started its activities with a small group in Granada to plan and construct Pico Veleta observatory. From the personnel hired at that time, Gloria España, Gregorio Galvez, José García and Francisco Urbano are still working at our institute. From the international staff at IRAM Spain, Walter Brunswig and Miguel Muñoz have been working at IRAM for 25 years or longer. We appreciate their effort for the successful operation of IRAM Granada and the Pico Veleta Observatory.

Rainer MAUERSBERGER

Pre-Announcement: 3rd Millimeter Observing School in Pradollano

IRAM is planning the 4rth Millimeter Observing School which will take place in autumn 2007 (September or October) in Pradollano (Sierra Nevada, Spain).

The purpose of this school is to introduce young astronomers into the field of radio astronomy at mm-wavelengths with special emphasis on single dish observations. The school will comprise a series of lectures, work in groups and observations with the IRAM 30-m telescope.

Details will be announced as soon as possible on our web pages http://www.iram.es/IRAMES and in future issues of the IRAM Newsletter.

Rainer MAUERSBERGER

Staff Changes

IRAM GRANADA

In September 2006, Mr. Víctor ESPIGARES from the operators group has left IRAM. He is now working as a software engineer at the Instituto de Astrofísica de Andalucía (IAA).

Since October 2006, Mr. Santiago NAVARRO MORAL is working as a telescope operator at Pico Veleta Observatory.

Since Feb. 1st 2007, Ignacio RUIZ PERALTA is working in the antenna group and telescope operation.

Rainer MAUERSBERGER

IRAM GRENOBLE

The receiver group welcomes two new members: Youness BOUTGLAY has stared work as a technician on August 1st. On September 1st, Samuel LECLERCQ has joined the receiver group as a physicist.

The scientific software group has also two new members: On November 1st, Emmanuel REYNIER started work, and Jean-Christophe ROCHE has arrived on November 22nd.

A long-time member of the backend group has gone into retirement at the end of December. Being a kind and competent colleague, Christian CASTEELS has been with the institute since June 1980, and has participated in the development of many high-precision components of the Bure LO and correlator system. We wish him all the best, and a pleasent active retirement.

On January 31st, Matthias SCHICKE has left IRAM to work for a renowned international company. Matthias joined the IRAM SIS group for his physics thesis in September 1998, worked successfully on numerous projects, and became SIS group leader in June 2006. Besides his qualities as a scientist, he has been a good colleague. We wish him all the best for his future career.

Michael BREMER

Open Positions

IRAM POSTDOCTORAL ASTRONOMY POSITION - SCIENCE OPERATIONS GROUP

Institut de Radio Astronomie Millimétrique
300 rue de la Piscine
F - 38406 St-Martin-d'Hères
Email submission: indigo@iram.fr
- Mrs. Brigitte Indigo, Personnel Department
Email inquires: neri@iram.fr
- Dr. Roberto Neri, PdBI Project Scientist

Posting date: February, 13, 2007
Closing date: April 02, 2007

Applications are invited for an astronomer position in the Science Operations Group (SOG) of the Plateau de Bure Interferometer (PdBI) at the IRAM Headquarters in Grenoble (France).

IRAM is an international research organisation for millimeter/submillimeter astronomy supported by the CNRS (France), the Max-Planck Gesellschaft (Germany) and the IGN (Spain). IRAM operates two of the largest and most technologically advanced instruments in the world, a 30-meter single-dish telescope located in the Sierra Nevada, Spain, and an interferometer of six 15-meter antennas located at Plateau de Bure at an altitude of 2550 m in the French Alps. The Plateau de Bure antennas are equipped with dual polarization receivers that operate in the 80 to 115 GHz and 200 to 260 GHz bands (end of 2006), 120 to 180 GHz band (end of 2007) and 250 to 350 GHz band (end of 2008).

We are seeking for candidates with a PhD in astronomy and preferably with demonstrated observational experience with millimeter/submillimeter astronomical facilities. The successful candidate is expected to participate in the astronomical operations of the PdBI and to conduct his own research objectives with the PdBI. Priority will be given to candidates whose research interests cover current areas of research at IRAM.

The successful candidate will be expected to contribute 50% of the time to

– serve as astronomer-on-duty. SOG staff astronomers travel to the Plateau de Bure observatory on a regular basis to develop and maintain a good understanding of PdBI operations.

- provide technical support and expertise in the analysis and interpretation of PdBI data to investigators and visiting astronomers.
- interact with the scientific software development group to work in improving the data reduction and quality assurance pipeline of the PdBI.

The appointment is initially for two years with the possibility of extension, and could start as early as June 01, 2007. To apply, please send curriculum vitae, bibliography and statement of research interests, and arrange for three letters of reference. Applications should be submitted no later than April 02, 2007 for full consideration.

Roberto NERI

PhD stipend at IRAM Granada

A PhD stipend is available at Pico Veleta Observatory to do thesis work under the guidance of Dr. Rainer Mauersberger. Start: as soon as possible. The stipend is initially for one year and is renewable. A letter of intent and a CV should be sent by email to the station manager of Pico Veleta Observatory Dr. Rainer Mauersberger (mauers@iram.es). The evaluation will start on March 5th, 2007.

Rainer MAUERSBERGER

Junior Postdoc Position at IRAM Granada

IRAM will apply for a Juan de la Cierva postdoc position of the Spanish Ministry of Education and Science at IRAM Spain in the fields of astronomy or informatics. This position is limited to three years, and is open to candidates who have completed their PhD in recent years or will complete it this spring. The yearly stipend will be approximately 24.000 Euros. IRAM may contribute to the relocation of the successful candidate. Further information in Spanish and English is avalable on the website of the MEC (http://www.mec.es/ciencia/jsp/-plantilla.jsp?area=delacierva&id=11) Since the deadline, which is still unknown, might be defined on short notice, any interested candidates are encouraged to send a letter of intent with their CV as soon as possible to the station manager of Pico Veleta observatory, Rainer Mauersberger (mauers@iram.es).

Rainer MAUERSBERGER

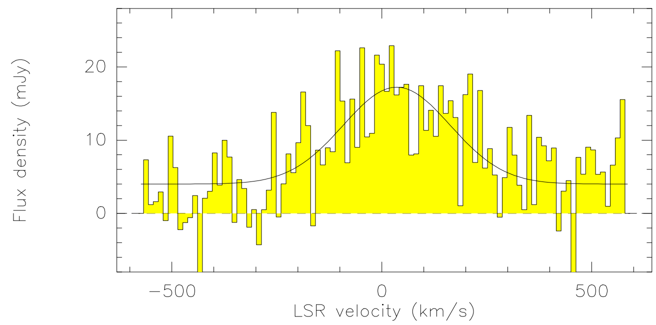

Figure 1: Spectrum of the [CII] 157.74 microns emission line in the quasar J1148+5251 observed at a redshift of 6.42. The data are shown with a spectral resolution of 10 km/s and were obtained in only 3.5 hours with the New Generation Receivers on the Plateau de Bure interferometer in the D configuration. The observed frequency (256.17 GHz) is the highest frequency ever observed at the PdBI. The solid line shows the Gaussian fit to both the underlying continuum and the line profile.

A Winter Night's Dream: First Light at 256 GHz with the Plateau de Bure Interferometer.

The New Generation Receivers (NGRx) project is one of the most challenging and ambitious projects IRAM has been developing in the last years. As the result of a combined and concerted team effort, the installation of the NGRx was done on schedule and was followed by a successful test and science commissioning phase. The delivery of the first two receiver bands (86 - 116 GHz and 202 - 257 GHz) to the astronomical community was effective as of January 18th, 2007.

A highlight of the NGRx is the first-light at 256 GHz, which was obtained during the night of January 28th, 2007. This is the highest frequency ever observed with the Plateau de Bure Interferometer. At 22:45 UT Andre Rambaud and Patrick Chaudet, operators at the Plateau de Bure observatory, tuned the 1mm bands of the NGRx to observe the fine structure line of [CII] in the host galaxy of the highest redshift QSO J1148+5251 (z=6.42). After only 3.5 hours on-source, a clear detection of the [CII] emission line was achieved together with the underlying continuum (Fig. 1). The PdBI result is in perfect agreement with the spectrum of the 30-meter telescope which was obtained after 12.4 hours on-source integration time (Maiolino et al. 2005).

This exciting result illustrates the excellent performance and sensitivity of the NGRx which we are pleased to share with you. Today the NGRx band at 3mm and 1mm are running without any problem to perform regular astronomical observations, weather permitting. The next plans are to install the 2mm band which will become available for the winter period of 2007/2008 and to deliver the 0.8mm band for the winter 2008/2009 scheduling period. This will conclude the NGRx project and provide the PdBI with a unique suite of receivers operating from 3 to 0.8 mm with high sensitivities.

Pierre COX

Proposals for IRAM Telescopes

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

March 15th, 2007 17:00h CET (UT+1 hour)

The scheduling period extends now from May 15, 2007 to November 15, 2007. Proposals should be 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 be congested. As an insurance against network congestion or failure, we still accept, in well justified cases, proposals submitted by:

– fax to number: (+33) 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. Color plots will be printed/copied in grey scale. If color is considered essential for the understanding of a specific figure, a respective remark should be added in the figure caption. The color version may then be consulted in the electronic proposal by the referees.

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 possibility as we always receive a number of corrupted proposals (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. Except for the technical pages for the interferometer, longer proposals will be cut.

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.

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 interferometer or 30m proposal. 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 suffered from bad weather).

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

Applications for **zero spacing observations** have been simplified. If the need for complementary 30m observations is evident already at the time when the PdB interferometer proposal is prepared, just note this need on the interferometer proposal. A separate proposal for the 30m telescope is not required. The blank form for interferometer proposals contains a bullet, labelled "zero spacing" which should then be checked. The interferometer style file will prompt for an additional paragraph in which the scientific need for the zero spacings should be described. It is essential to give here all observational details, including size of map, sampling density and rms noise, spectral resolution, receiver configuration and time requested.

A mailing list has been set up for astronomers interested in being notified about the availability of a new Call for Proposals. A link to this mailing list is on the IRAM web page (http://www.iram.fr. The list presently contains all users of IRAM telescopes during the last two years. Please check that your email address in this list is correct, and point out the existence of this list to interested colleagues.

Jan Martin WINTERS & Clemens THUM

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

Travel funds for European astronomers

IRAM is one of the organizations participating in the RadioNet project, an initiative funded by the European Commission within the FP6 Programme to improve and encourage communication among astronomers of the European Community and associated countries. Transnational access (TNA) is the largest RadioNet programme and provides funding for travel expenses incurred by eligible users for carrying out their observations or reducing their data. As a partner of RadioNet, IRAM has now some limited TNA funds to pay travel expenses for eligible users. Detailed information about user eligibility, TNA contacts, policies and travel claims for the IRAM 30m telescope and Plateau de Bure Interferometer can be found on the RadioNet home page at `http://www.radionet-eu.org`.

Observers requesting TNA support will be asked to provide the necessary personal and professional information to IRAM. Funding through RadioNet should be acknowledged in publications resulting from TNA supported observations.

Roberto NERI & Clemens THUM

Note concerning publications based on results obtained with IRAM instruments

The use of data obtained with IRAM instruments should be acknowledged in the following way:

The following footnote should appear on the first page of papers based on observations made with the 30-meter telescope and the interferometer:

"Based on observations carried out with the IRAM 30-meter telescope. IRAM is supported by INSU/CNRS (France), MPG (Germany) and IGN (Spain)."

"Based on observations carried out with the IRAM Plateau de Bure Interferometer. IRAM is supported by INSU/CNRS (France), MPG (Germany) and IGN (Spain)."

In addition, publications that arise from work supported by the European Community funded RadioNet project should include the following acknowledgement:

"This work has benefited from research funding from the European Community's Sixth Framework Programme."

Pierre COX

Call for Observing Proposals on the 30m Telescope

Summary

Proposals for three types of receivers will be considered for the coming summer 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 dual–polarization heterodyne receiver array, HERA, operating at 1.3 mm wavelength
3. a 1.2 mm bolometer array with 37 or 117 pixels

In total, about 2800 hours of observing time will be available, which should allow scheduling of a few longer programmes (up to ~ 150 hours).

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

What is new?

Since November 2005, the telescope runs under a VME and Linux based new control system (NCS). While some optimization, mainly related to telescope tracking and timing, is still going on, virtually all functionality of the old control system has been recovered. Notable exceptions are the coordinate system (only J2000 is currently supported) and the `RASTER` command. OTF, ONOFF or TRACKING (with frequency switching) commands together with SIC loops should be used instead. Observations with the rotated wobbler (non–azimuth wobbling directions) which are of interest mainly for bolometer mapping, are possible again.

Remote observing will be available from our Granada office, and later during the summer semester also from Grenoble and, possibly, Bonn.

The NCS team maintains a detailed web page (../IRAMES/ncs30m) where the current status is in depth.

The **dual polarization HERA** is operational together with its backends for high (VESPA) and low spectral resolution (WILMA, 4 MHz filters). Although tuning parameters are now available for a large range of frequencies, it is still recommended to send us HERA frequencies in advance.

Like last semester, a **bolometer array**, preferentially the 117–channel MAMBO II, which should be used for observing time estimates, will be available. HERA and bolometer observations will be organized in observing pools.

Applications

On the official cover page, please fill in the line 'special requirements' **if you request either polarimetric observations or service 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 (thum@iram.fr). 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 equatorial 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 LaTeXmacro `\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 of observing time.

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

For any questions regarding the telescope and the control programs, we recommend to consult the NCS web pages (../IRAMES/ncs30m) and our page with the summary of telescope parameters.

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/mainWiki/-AstronomerOnDutySchedule) should be contacted well in advance for any special questions concerning the preparation of an observing run.

Frequency switching is available for both HERA and the single pixel 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 ($\leq$ 45 km/s), backends, phase times etc.; for a detailed report see [4]. This report also explains how to identify mesospheric lines which may easily be confused in some cases with genuine astronomical lines from cold clouds.

Observing time estimates

This matter needs special attention as a serious time underestimate may be considered as a sure sign of sloppy proposal preparation. We strongly recommend to use the web–based Time Estimator at URL ../IRAMES/-obstime/time_estimator.html , whenever applicable. Versions 2.6 and higher handle heterodyne (single pixel and HERA) as well as bolometer observations with updated instrumental parameters.

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. The details of the procedures on which our time estimator is based are explained in a technical report published in the January 1995 issue[2] of the IRAM Newsletter [5].

Proposers should base their time request on normal summer conditions, corresponding to 7mm of precipitable water vapor. Conditions during afternoons can be degraded due to anomalous refraction. The observing efficiency is then reduced and the flux/temperature calibration is more uncertain than the typical 10 percent (possibly slightly more for bolometer observations). If exceptionally good transmission or stability of the atmosphere is requested which may be reachable only in winter conditions, the proposers must clearly say so in their time estimate paragraph. Such proposals will however be particularly scrutinized.

[2] electronically available at URL `../IRAMFR/ARN/-newsletter.html`

Pooled observing

As in previous semesters, we plan to pool the bolometer with other suitable proposals into a bolometer pool. HERA projects will be pooled with other less demanding project into a HERA pool. Both pools will be organized in several sessions, occupying a significant fraction of the totally available observing time. The proposals participating in the pools will be observed by IRAM staff, the PIs and Co-PIs of participating projects and other cooperating external astronomers. The pool observations will be organized by the pool coordinators, Stéphane Léon (bolometers) and Helmut Wiesemeyer (HERA). The participating proposals are grouped according to their demand on weather quality, and they get observed following the priorities assigned by the program committee. The organization of the bolometer and the HERA observing pools are described at ../IRAMES/mainWiki/PoolObserving.

Bolometer and heterodyne proposals which are particularly weather tolerant qualify as backup for the pools. Participation in the pools is voluntary, and the respective box on the proposal form should be checked.

Questions concerning the pool organization can be directed to the scheduler (thum@iram.fr) or the Pool Coordinators, Stéphane Léon (leon@iram.es) and Helmut Wiesemeyer (wiesemeyer@iram.es).

Service observing

To facilitate the execution of short (≤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 in 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, will be available from the downtown Granada office, and later during the summer also from Grenoble and possibly Bonn. The remote stations in Paris and Madrid will be available later.

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 summer. Whenever possible, HERA observations will be pooled. The 9 dual–polarization 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 a successful upgrade in March 2005) which couple to separate SIS mixers. The 18 mixers feed 18 independent IF chains. Each set of 9 mixers is pumped by a separate local oscillator system. The same positions can thus be observed simultaneously at any two frequencies inside the HERA tuning range (210-276 GHz for the first polarization, and 210-242 for the second polarization).

A derotator optical assembly can be set to keep the 9 pixel pattern stationary in the equatorial or horizontal coordinates. Receiver characteristics are listed in Tab. 1, and an updated user manual (version 2.0) 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. HERA observers are therefore advised to send a list of their frequencies to Granada at least 2 weeks ahead of their run.

Recent observations have shown that the noise temperature of the pixels of the second polarization array may vary across the 1 GHz IF band. The highest noise occurs towards the band edges which are, unfortunately, picked up when HERA is connected with VESPA whose narrow observing band is located close to the lower edge of the 1 GHz band. Therefore, while not as important for wide band observations with centered IF band, the system noise in narrow mode is higher (factor 1.5 – 2) as compared to the first polarization array. We do not recommend to use the second polarization for frequencies > 241 GHz.

HERA can be connected to three sets of backends:

▷ 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 ±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 connectible to these filter banks.

▷ WILMA with a 1 GHz wide band for each of the 18 detectors. The bands have 512 spectral channels spaced out by 2 MHz.

HERA will be operational in two basic spectroscopic observing modes: *(i)* raster maps[3] 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 HERA 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. The HERA project scientist, Karl Schuster (schuster@iram.fr), or Albrecht Sievers (sievers@iram.es), the astronomer in charge of HERA, may also be contacted.

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 average summer weather (7mm 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 not more than 15 min to tune four such receivers.

Extended tuning range: 72 – 80 GHz.

Several molecules of high astrophysical importance have transitions in the frequency band 66 – 80 GHz, i.e. between the atmospheric O_2 absorption band and the low frequency edge of the nominal 3mm tuning range (see Tab.1). Tests have shown that both 3mm receivers, A 100 and B 100 have good performance (good upper sideband rejection and system temperature) in the range 80 – 77 GHz. The receivers become increasingly double sideband below 77 GHz, until their behavior becomes erratic around 72 GHz. Due to the rapid variation of the image gain, special care must be exercised with calibration. A new image gain calibration tool is provided and described in the test report available on the IRAM web site (at ../IRAMFR/PV/veleta.htm). The report includes a set of reference spectra.

Observations in the 72 – 80 GHz range do not require any special arrangements. But note that the A 230 (B 230) receiver is not available when the A 100 (B 100) receiver is used below 80 GHz.

[3] As long as the NCS raster command is not operational, the raster pattern has to be traced out with the help of a SIC loop.

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 in the range 72 – 80 GHz or those near a limit of the tuning range, may still be problematic. In these cases, we 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 XPOL.

An upgrade of the IF polarimeter [16] is now available, 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, and 320/480.

Although successful XPOL observations were made at many frequencies, experience is still limited, particularly at 1.3mm wavelength and with respect to observations of extended sources. Considerable progress was made in reducing polarization sidelobes, notably for Stokes V. Interested users should contact C. Thum for details. Data reduction software using CLASS enhanced with a graphical user interface is available (H. Wiesemeyer, wiesemey@iram.es). A short guide (at /IRAMFR/PV/veleta.htm) describes XPOL observations. Polarimetry proposals for observation of extended sources should demonstrate that their observations are feasible in the presence of the known sidelobes (see [16]).

MPIfR Bolometer arrays

The bolometer arrays, MAMBO–1 (37 pixels) and MAMBO–2 (117 pixels), are provided by the Max–Planck–Institut für Radioastronomie. They 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 both bolometers for onoff observations is ~ 40 mJy s$^{\frac{1}{2}}$ and ~ 45 mJy s$^{\frac{1}{2}}$ for mapping. The *rms*, in mJy, of a MAMBO–2 map is typically

$$rms = 0.4 f \sqrt{v_{scan} \Delta s}$$

where v_{scan}, in arc sec/sec, is the velocity in the scanning direction and Δs, in arc sec, is the step size in the orthogonal direction. The factor f is 1 (2) for sources of size $< 30''$ ($> 60''$). It is assumed that the map is made large

Table 1: Heterodyne receivers available for the next summer observing semester. 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 summer conditions (pwv = 7mm) 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.

receiver	polari– zation	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	60 - 80	> 20	1.5	0.5	120	
B 100	H	1			4	81 - 115.5	60 - 80	> 20	1.5	0.5	120	1
C 150	V		2		4	129 - 183	70 - 125	15 - 25	4.0	1.0	200	
D 150	H		2	3		129 - 183	80 - 125	8 - 17	4.0	1.0	200	
A 230	V	1		3		197 - 266	85 - 150	12 - 17	4.0	1.0	450	2
B 230	H	1			4	197 - 266	95 - 160	12 - 17	4.0	1.0	450	2
C 270	V		2		4	241 - 281	125 - 250	10 - 20	4.0	1.0	1000	3
D 270	H		2	3		241 - 281	150 - 250	9 - 13	4.0	1.0	1000	3
HERA	H/V					210 - 276	110 - 380	∼ 10	4.0	1.0	400	2, 4

1: tuning range extended to ≥ 72 GHz under special conditions (see text)
2: noise increasing with frequency
3: performance at ν < 275 GHz; noisier above 275 GHz.
4: the V–array (2nd polarization) of HERA has slightly higher noise which may vary across the IF band; it should not be used for frequencies higher than 241 GHz.

enough that all beams cover the source. The sensitivities apply to bolometric conditions (stable atmosphere), (τ(250GHz) ∼ 0.3, elevation 45 deg, and application of skynoise filtering algorithms). In cases where skynoise filtering algorithms are not or not fully effective (e.g. extended source structure, atmosphere not sufficiently stable), 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 recommended 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 ∼ 2.3 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 0.4 mJy.

In the mapping mode, the telescope is scanning in the direction of the wobbler throw (default: azimuth) in such a way that all pixels see the source once. A typical single map[4] 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 1.9 hours if skynoise filtering is effective. Much more time is needed (see Time Estimator) if sky noise filtering cannot be used. The area actually scanned (8.0′ × 6.5′) must be larger than the map size (add the wobbler throw and the array size (4′), the source extent, and some allowance for baseline determination) if the EHK–algorithm is used to restore properly extended emission. Shorter scans may lead to problems in restoring extended structure. Mosaicing is also possible to map larger areas. Under many circumstances, maps may be co–added to reach lower noise levels. If maps with an rms $\lesssim$ 1 mJy are proposed, the proposers should contact R. Zylka (zylka@iram.fr).

The bolometers are used with the wobbling secondary mirror (wobbling at a rate of 2 Hz). The orientation of the beams on the sky changes with hour angle due to parallactic and Nasmyth rotations, as the array is fixed in Nasmyth coordinates and the wobbler direction is fixed with respect to azimuth during a scan. Bolometer proposals participating in the pool have their observations (maps and ONOFFs) pre-reduced by a data quality monitor which runs scripts in MOPSIC. This package, complete with all necessary scripts, is also installed for off-line data analysis in Granada and Grenoble. It is also available for distribution from the IRAM Data Base for Pooled Observations or directly from R. Zylka (zylka@iram.fr). The older software packages (NIC [7] and MOPSI [8]) are still available, but cannot process data obtained with the NCS.

Bolometer proposals will be pooled together like in previous semesters along with suitable heterodyne proposals as long as the respective PIs agree. The web–based time estimator handles well the usual bolometer observing modes, and its use is again strongly recommended.

4 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).

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 (quasi 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 sufficient, 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 $\simeq 170''$ 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].

Pointing and Focusing

With the systematic use of inclinometers the telescope pointing became much more stable. Pointing sessions are now scheduled at larger intervals. The fitted pointing parameters typically yield an absolute rms pointing accuracy of better than $3''$ [10]. An effort is made that receivers are closely aligned. 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.

Table 2: Main observational parameters of 30m telescope.

frequency [GHz]	θ_b ["] (1)	η_F (2)	η_{mb} (3)	S_ν/T_A^* [Jy/K]
86	29	0.95	0.78	6.0
110	22	0.95	0.75	6.3
145	17	0.93	0.69	6.7
170	14.5	0.93	0.65	7.1
210	12	0.91	0.57	7.9
235	10.5	0.91	0.51	8.7
260	9.5	0.88	0.46	9.5
279	9	0.88	0.42	10.4

(1) beam width (FWHP). A fit to all data gives:
θ_b ["] = 2460 / frequency [GHz]
(2) forward efficiency (coupling efficiency to sky)
(3) main beam efficiency. Based on a fit of measured data to the Ruze formula:
$\eta_{\rm mb} = 1.2\epsilon \exp(-(4\pi R\sigma/\lambda)^2)$
with $\epsilon = 0.69$ and $R\sigma = 0.07$

Unnecessarily large wobbler throws should be avoided, since they introduce a loss of gain, particularly at the higher frequencies, and imply a loss of observing efficiency (more dead time).

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 the 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 single pixel receivers (must be set up in narrow band mode).

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 /IRAMFR/PV/veleta.htm. 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.

The **wideband autocorrelator WILMA** consists of 18 units. They can be connected 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/1 GHz samplers. An informative technical overview of the architecture is available at URL ../IRAMFR/TA/backend/veleta/-wilma/index.htm. Note that WILMA cannot presently be connected to any of the single pixel receivers.

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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 Interferometer

Following the successful installation and commissioning of the Next Generation Receivers (NGRs) for the 3 mm and 1.3 mm atmospheric windows last fall, regular observing was resumed on January 18th, 2007 when the array was in its 6D configuration. We switched to the A configuration (that provides baselines up to 760m) on January 28 and the baselines were determined with high precision (better than 14 deg phase rms at 86 GHz on the longest baselines). It is planned to move to the B configuration around end of February and to the C configuration by end of March. The switch back to the most compact configuration D is foreseen before end of April. According to these plans, it will not be possible to complete projects requesting deep integrations using the compact configurations before the end of the current observing period.

The observing conditions in January were quite mediocre due to the unusually warm winter in Europe, but they improved considerably by the end of the month. Only commissioning projects were observed with the NGR system in D configuration but as of February 13 already 17 tracks have been scheduled in A configuration for regular user projects.

As far as A-rated projects are concerned, we look forward to bring many of these to completion before the end of the current winter semester. B-rated projects are likely to be observed only if they fall in a favorable LST range. We remind users of the Plateau de Bure interferometer that B-rated proposals which are not started before the end of the winter period have to be resubmitted.

Global VLBI observations, which include the array in the 3mm phased-array mode, are planned from May 10 to 15, 2007.

Investigators, who wish to check the status of their project, may consult the interferometer schedule on the Web at ../PDBI/ongoing.html. The page is updated daily.

Jan Martin WINTERS

Call for Observing Proposals on the Plateau de Bure Interferometer

Conditions for the next summer period

As every year, we plan to carry out extensive technical work during the summer semester, including the regular maintenance of the antennas. During this period, regular scientific observations will therefore mostly be carried out with the five element array. In addition to the antenna maintenance, an upgrade of the computer system on Bure will be carried out. All HPUX and OS9 systems will be replaced by LINUX PCs along with major modifications of the corresponding antenna control and data acquisition software in the real-time system. Further work will be done on the reduction of the sun avoidance circle. Finally, new receivers operating in the 2 mm band will be installed on all six antennas. This new set of receivers, which will open a new frequency band at the Plateau de Bure interferometer, will be become available for the community at the end of the summer semester, after thorough testing and commissioning.

We plan to start the maintenance at the latest by the end of May and to schedule the 5D configuration between June and September. Scheduling of the 6D and 6C configurations will be tailored to progress being made in the commissioning of the 2 mm NGR system.

We strongly encourage observers to submit proposals that can be executed during summer operating conditions. To keep the procedure as simple as possible, we ask to focus on:

- observations requesting the use of the 3mm receivers
- circumpolar sources or sources transiting at night between June and September,
- observations that qualify for the 5D, 6D, and 6C configurations

Proposal category

Proposals should be submitted for one of the four categories:

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

3MM: Proposals that ask for 3mm data.

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 even periods when only a subset of the standard 5-antenna 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, non-standard configurations 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

Configurations planned for the summer period are:

Name	Stations
5Dq	W08 E03 N07 N11 W05
6Dq	W08 E03 N07 N11 N02 W05
6Cq	W12 E10 N17 N11 E04 W09

Part of the projects will be scheduled at the end of the summer period when the six-element array is expected to be back to operation. Projects that should be observed with a subset of the five-element array, will be adjusted in uv-coverage and observing time.

The following configuration sets are available:

Set	Main purpose
D	Detection + “low” resolution mapping at 1.3mm
CD	3.5″ resolution mapping at 3mm

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

Receivers

Since December 2006 all antennas are equipped with a new generation of dual polarization receivers for the 3 mm and 1.3 mm atmospheric windows. The frequency range is 81 GHz to 116 GHz for the 3 mm band, and 201 to 256 GHz for the 1.3 mm band.

Each band of the new receivers is dual-polarization (two RF and IF channels) with the two RF channels of one band observing at the same frequency (common LO). The different bands are not co-aligned in the focal plane (and therefore on the sky). The mixers are single-sideband, backshort-tuned; they can be tuned USB or LSB, both choices being available in the central part of the RF band. The typical image rejection is 10 dB. Each IF channel is 4 GHz wide (4-8 GHz). Only one frequency band can be connected to the IF transmission lines at any time. Because of this reason and due to the pointing offsets between different frequency bands, only one band can be observed at any time. The other band is in stand-by (power on and local oscillator phase-locked) and is available, e.g., for pointing. Time-shared observations between two frequency bands can not be offered for the summer (this mode is currently being tested).

The two IF-channels (one per polarization), each 4 GHz wide (total 8 GHz) are transmitted by optical fibers to the central building. At present, the 4 GHz bandwidth can be processed only partially by the existing correlator, through a dedicated IF processor that converts selected 1 GHz wide slices of the 4-8 GHz first IFs down to 0.1-1.1 GHz, the input range of the existing correlator. Further details are given in the section describing the correlator setup and the IF processor.

PdBI Receiver Specifications

	Band 1	Band 3
RF coverage	81–116	201–256
T_{rec}	40–55	40–60 (LSB)
T_{rec}		50–70 (USB)
G_{im}	−10 dB	−12 − 8 dB
RF range in LSB	81–104	201–244
RF range in USB	104–116	244–256

Signal to Noise

The rms noise can be computed from

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

where

- $J_{\rm pK}$ is the conversion factor from Kelvin to Jansky (22 Jy/K at 3 mm, 35 Jy/K at 1.3 mm)
- $T_{\rm sys}$ is the system temperature ($T_{\rm sys}$ = 100 K below 110 GHz, 180 K at 115 GHz, 250 K at 230 GHz for sources at $\delta \geq 20°$ and for typical summer conditions.)
- 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 (5), and $N_{\rm c}$ is the number of configurations: 1 for D, 2 for CD, 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 various calibration observations the total observing time is typically 1.4 $T_{\rm ON}$.
- B is the spectral bandwidth in Hz (up to 2 GHz for continuum, 40 kHz to 2.5 MHz for spectral line, according to the spectral correlator setup)
- $N_{\rm pol}$ is the number of polarizations: 1 for single polarization and 2 for dual polarization (see section *Correlator* for details).

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 offsets 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

IF processor

At any given time, only one frequency band is used, but with the two polarizations available. Each polarization delivers a 4 GHz bandwidth (from IF=4 to 8 GHz). The two 4-GHz bandwidths coincide in the sky frequency scale. The current correlator accepts as input two signals of 1 GHz bandwidth, that must be selected within the 4 GHz delivered by the receiver. In practice, the new IF processor splits the two input 4–8 GHz bands in four 1 GHz "quarters", labeled *Q1...Q4*. Two of these quarters must be selected as correlator inputs. The system allows the following choices:

- first correlator entry can only be Q1 HOR, or Q2 HOR, or Q3 VER, or Q4 VER
- second correlator entry can only be Q1 VER, or Q2 VER, or Q3 HOR, or Q4 HOR

where HOR and VER refers to the two polarizations:

Quarter IF1 [GHz]	Q1 4.2 – 5.2	Q2 5 – 6	Q3 6 – 7	Q4 6.8 – 7.8
input 1	H	H	V	V
input 2	V	V	H	H

How to observe two polarizations? To observe simultaneously two polarizations at the same sky frequency, one must select the same quarter (Q1 or Q2 or Q3 or Q4) for the two correlator entries. This will necessarily result in each entry seeing a different polarization. The system thus give access to 1 GHz $\times$ 2 polarizations.

How to use the full 2 GHz bandwidth? If two different quarters are selected (any combination is possible), a bandwidth of 2 GHz can be analyzed by the correlator. But only one polarization per quarter is available in that case; this may or may not be the same polarization for the two chunks of 1 GHz.

Is there any overlap between the four quarters? In fact, the four available quarters are 1 GHz wide each, but with a small overlap between some of them: Q1 is 4.2 to 5.2 GHz, Q2 is 5 to 6 GHz, Q3 is 6 to 7 GHz, and Q4 is 6.8 to 7.8 GHz. This results from the combination of filters and LOs used in the IF processor.

Is the 2 GHz bandwidth necessarily continuous? No: any combination of two quarters can be selected. Adjacent quarters will result in a continuous 2 GHz band. Non-adjacent quarters will result in two independent 1 GHz bands. Note that in any case, the two correlator inputs are analyzed independently.

Where is the selected sky frequency in the IF band? It would be natural to tune the receivers so that the selected sky frequency corresponds to the middle of the IF bandwidth, i.e. 6.0 GHz. However, this corresponds to the limit between Q2 and Q3. It is therefore highly recommended to center a line at the center of a quarter (see Section "ASTRO" below). At 3 mm, the receivers offer best performance in terms of receiver noise and sideband rejection in Q2 (i.e. the line should be centered at an IF1 frequency of 5500 MHz) whereas at 1 mm best performance is obtained in Q3 (i.e. the line should be centered at 6500 MHz).

Spectral units of the correlator

The correlator has 8 independent units, which can be placed anywhere in the 100–1100 MHz band (1 GHz bandwidth). 7 different 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 observed source has a strong continuum. 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 may be preferable for some 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 is lost at the end of each subband. The 8 units can be independently connected to the first or the second correlator entry, as selected by the IF processor (see above). Please note that the center frequency is expressed – as in the old system – in the frequency range seen by the correlator, i.e. 100 to 1100 MHz. The correspondence to the sky frequency depends on the parts of the 4 GHz bandwidth which have been selected as correlator inputs.

ASTRO

The software `ASTRO` has been updated to reflect these new receiver/correlator setup possibilities. Astronomers are urged to download the most recent version (**February 2007 or later**) of GILDAS at `../IRAMFR/GILDAS/` to prepare their proposals.

The old `LINE` command has been replaced by several new commands (see internal help):

- `NGR_LINE`: receiver tuning
- `NARROW`: selection of the narrow-band correlator inputs
- `SPECTRAL`: spectral correlator unit tuning
- `PLOT`: control of the plot parameters.

A typical session would be:

```
! choice of receiver tuning
ngr_line xyz 230 lsb

! choice of the correlator windows
narrow Q1 Q3

! correlator unit #1, on entry 1
spectral 1  20 520 /narrow 1

! correlator unit #2, on entry 1
spectral 2 320 260 /narrow 1

! correlator unit #3, on entry 2
spectral 3  40 666 /narrow 2
...
```

Sun Avoidance

For safety reasons, the sun avoidance circle has been extended to 45 degrees. Please take this into account for your target sources AND for the calibrators.

Mosaics

The PdBI has mosaicing capabilities, but the pointing accuracy may be a limiting factor at the highest frequencies. Please contact the Science Operations Group (sog@iram.fr) in case of doubts.

Data reduction

Proposers should be aware of constraints for data reduction:

- In view of the new receiver system, **data have to be reduced in Grenoble**. Proposers will not come for the observations, but will have to come for the reduction. For the time being, remote data reduction will not be offered for projects observed with the NGR system.
- 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. Data reduction will be carried out on dedicated computers at IRAM. 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 your local contact or the Science Operations Group (sog@iram.fr) if you are interested in this.
- CLIC evolves to cope with upgrades of the PdBI array. The newer versions are downward compatible with the previous releases. Observers who wish to finish NGR 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 advise observers having a copy of CLIC to take special care in maintaining it up-to-date. The upgrade of CLIC to handle the NGR data implied many modifications for which backward compatibility with old PdBI receiver data has not yet been fully checked. To calibrate data obtained with the "old" receiver system, we thus urge you to use the January 2007 version of CLIC.

Local Contact

A local contact will be assigned to every A or B rated proposal which does not involve an in-house collaborator. He/she 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 program complexity, IRAM may require an in-house collaborator instead of the normal local contact.

Technical pre-screening

All proposals will be reviewed for technical feasibility in parallel to being sent to the members of the program committee. Please help in this task by submitting technically precise proposals. 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 the Interferometer Science Operations Group (sog@iram.fr) 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 the Internet at ../IRAMFR/PDB/docu.html
Note however, that the documentation on the web has not yet been updated with respect to the new generation receivers. All information currently available on the new generation receiver system is given in this call for proposals.

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 this call and at ../IRAMFR/PDB/docu.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 the need for the Plateau de Bure Interferometer.

Jan Martin WINTERS

New Hydrogen maser for the PdBI

ARRIVAL OF EFOS-38

In summer 2006, Plateau de Bure received its new hydrogen maser for very long baseline interferometry (VLBI). The EFOS-38 maser was constructed over a 15 month period in Neuchâtel, Switzerland.

In March 2006, a major change occurred in the Neuchatel maser production: all maser activities (including service for existing EFOS masers, staff, production and R&D) were transferred from the Observatoire de Neuchâtel to the newly founded T4Science corporation. EFOS-38 was completed at T4Science and underwent a rigorous testing program.

The specifications were quite demanding because this maser shall allow Plateau de Bure to do VLBI up to its highest foreseen frequency band at 350 GHz, which requires not only an excellent long-term stability but also a very clean signal on timescales shorter than one second. EFOS-38 met and surpassed the specifications.

On acceptance by IRAM, the maser was transported to the Plateau de Bure on August 23rd (Fig. 2) and connected to the LO system. Since then, the 5 MHz signal generated by the maser has been monitored against a GPS reference, and has proven to be linear within the precision of the fit over a period of about three months. This corresponds to a deviation of about one second in six million years.

In recent years, Plateau de Bure could not participate in two Global VLBI sessions due to maser failures. With the new EFOS-38, we are confident that the reliability and quality of VLBI campaigns at Bure will be much improved.

MASER BACKGROUND INFORMATION

Active hydrogen masers are one of the most precise frequency references in operation today. Their basic reference is the hyperfine transition of atomic hydrogen (i.e. the famous 21 cm line), but the precision is further improved by the mechanical precision of the resonating cavity of the active maser. The decreasing signal-to-noise ratio of the maser signal on small time scales requires the presence of a high quality quartz resonator, which dominates the phase stability below timescales of 1-2 seconds. EFOS-38 is equipped with a BVA 8607 from Oscilloquartz, with an extra low phase noise.

The new Bure maser is a model of the EFOS-C series, which is a combination of a Russian physics package (by the VREMIA-CH J.S. company based in Nihzny Novgorod) and the electronics and monitoring package developed in Neuchâtel. On top of the standard no-break power supply of the Bure correlator room, the maser has a dedicated UPS which provides an additional 15 hours autonomy in case of power failure. It is installed in a temperature controlled, vibration-dampened rack to provide an optimum input signal to the Interferometer.

Local high-quality frequency standards are essential at observatories participating in Global millimeter VLBI. A common frequency reference cannot be shared world-wide with the required precision in real time, therefore each observatory has to provide individual frequency standards with an exactness and stability that will allow to detect the same photons across the world.

Michael BREMER

VLBI News

Plateau de Bure obtained its new EFOS-38 maser in time for the Global VLBI session in October 2006. Unfortunately a revision in the time schedule of the new generation receiver installation put the interferometer out of operation for a time window including the VLBI session.

Due to the simultaneous installation of a new subreflector on the Effelsberg 100-m telescope, the European and

Figure 2: Arrival of EFOS-38 on the Plateau de Bure. After a transport by road, the maser was lifted by cablecar to the Plateau de Bure and then carefully moved to the correlator room where it was fully activated. The last photo shows the thermally regulated rack into which the maser was integrated in February 2007 (last photo by A. Grosz, others by M. Bremer).

transatlantic baselines of the experiment lost a lot of sensitivity and also essential redundancy, should weather conditions result in the dropout of other stations. The VLBI schedulers therefore decided to plan a reduced Global session with projects which did not critically depend on an optimum UV coverage or high sensitivity.

During this reduced October session, the IRAM 30-m telescope on Pico Veleta participated to nearly 100% of the time.

Michael BREMER

Fifth IRAM millimeter interferometry school - a review

The fifth IRAM millimeter interferometry school took place in Grenoble, October 2–6 2006. This event was supported by RadioNet. Seventy participants attended the lectures which presented the millimeter interferometry techniques and data reduction, the Plateau de Bure interferometer, and the ALMA project. Calibration and imaging tutorials were also organized to allow participants to reduce real Plateau de Bure data, and to take a guided tour of the IRAM Grenoble laboratories. Many participants presented recent work in posters (Fig. 3).

The lectures given during the week are now available on-line at: http://www.iram.fr/IRAMFR/IS/school.htm.

The next IRAM millimeter interferometry school will be organized in 2008.

Frédéric GUETH and Michael BREMER

Monitoring the 3mm polarization of Active Galactic Nuclei

Since a few years, the IRAM 30m telescope has polarimetric capabilities which are based on cross–correlations between the Observatory's single pixel heterodyne receivers. In a procedure designated XPOL, the IF signals of a pair of orthogonally polarized receivers tuned to the same frequency are cross correlated in the digital backend VESPA. Since the receivers are linearly polarized, the complex cross correlation gives Stokes U and V. Sum and difference of the IF powers gives the other Stokes parameters, I and Q. Continuum observations use VESPA configured

Figure 3: Some impressions from the fifth IRAM interferometry school in Grenoble (October 2006): Group photo, tutorials, lectures and poster session.

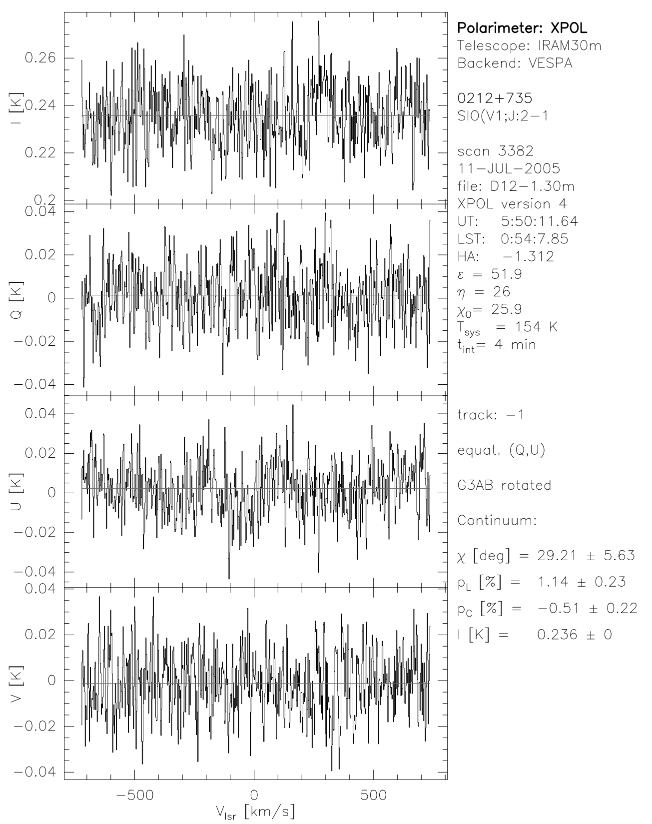

Figure 4: XPOL observation of B0212+735 at 86 GHz with the IRAM 30m telescope. Source flux density is 1.2 Jy. Integration time is 4 min.

for a bandwidth of 480 MHz, using nearly all of the instantaneous bandwidth of the 3mm receivers.

Figure 4 shows a typical 3mm continuum observation of a medium strong ($S_\nu \sim 2$ Jy) AGN. The four Stokes parameter are all observed simultaneously. The fractional linear and circular polarization, p_L and p_C, and the polarization angle χ are then derived in the usual way after averaging of the spectral channels. In a 4 minute observation of a 1 Jy source at 90 GHz, like the one shown here, the polarization degrees and χ have statistical errors of the order $\lesssim 1\%$ and $\lesssim 5°$, respectively, at which level systematic errors start to dominate.

XPOL observations are now routine, and several scientific projects have been successfully completed (see, e.g. Wiesemeyer, Thum & Walmsley 2004, A&A **391**, 479), and a large AGN survey was made at 90 GHz (Thum et al., in preparation). While this survey serves as a useful snapshot of the polarization properties of the AGN population as a whole, it became quite clear even during the short duration of this survey that many of the sources vary not only in their 3mm power, but also in their polarization properties. Such variations are well known at longer wavelengths where some semi–regular programs exist for monitoring their properties. No such effort is currently made at short millimeter wavelengths.

In order to contribute to a more complete characterization of these variations and help to investigate their causes, IRAM now plans to start a polarization monitoring program on the 30m telescope. Given the ease of use of XPOL and its reliability, such a program now becomes feasible. This complements the *Total Power* monitoring which is conducted by the Observatory since 1986 (Ungerechts et al. 1998, ASP Conf.Ser. **144**, p.140 (IAU colloq. **164**), and references therein). As certainly not more telescope time can be devoted to monitoring of polarization than to that of Total Power (ca. 4 hours/week), the program sources must be carefully selected.

The program is open to any interested astronomer. In fact, participation by non–IRAM astronomers working in AGN research is very welcome. Participation is conceivable at various levels, including the definition of the source sample, support of the observations, data reduction, preparation of a data base, and scientific data analysis. The acquired data are proprietary to the group of participating astronomers for a duration of 12 months and then become public.

Astronomers interested in the proposed polarization monitoring are invited to contact us.

Clemens THUM & Helmut WIESEMEYER

IRAM Archive of published 30-m data: almacén

IRAM Spain is making an effort to make data sets which were observed at the 30-m telescope available to the general public. However, IRAM takes no responsibility for the correct calibration of the data. Anybody wishing to use it should consult the respective publications or contact the original owners. Of course appropriate credit should be made to the original publication(s). The website of almacén is http://www.iram.es/IRAMES/dataarchive/init.html

Inclusion of the data sets *is on a voluntary basis* by the owners of the data (unless a special agreement has been made with the IRAM direction at the time when the observing time was granted). In order to make an interpretation as easy as possible, the data sets should be calibrated, quality controlled and well described by the authors, and made available in a format that is easy to read (e.g. FITS, CLASS). They may be accompanied by related publications, pictures, press releases etc. Anybody who wants to make their data available should contact the station manager of Pico Veleta Observatory Rainer Mauersberger (mauers@iram.es).

Rainer MAUERSBERGER

Program Committee Recommendations - Winter 06/07

The IRAM program committee convened in Grenoble on October 16 and 17 to discuss the proposals submitted for the winter 06/07 scheduling period . The committee was chaired by Mario Tafalla (Observatorio de Madrid). The principal investigators of each proposal have been informed by letter which included comments issued by the committee if there were any. As usual, the proposals were classified A (accepted), B (backup), and C (rejected).

IRAM Plateau de Bure Interferometer

A total of 113 proposals were received for the interferometer. Proposals 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. The ratings for each project are listed in Tab. 3.

For proposals rated A or B which do not have an IRAM internal collaborator, please consult the list of local contacts.

30m Proposals

136 proposals were received for the 30m telescope, requesting 5490 hours of telescope time. This includes 5 interferometer proposals which requested an estimated 85 hours for zero spacing observations. The highest rating "A" was given to 32 proposals; 51 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 Tab. 4. 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.

Please note: The zero spacing proposals are not listed here. They will be scheduled on the 30m if they get observed at Bure.

Jan Martin WINTERS and Clemens THUM

Scientific Results in Press

Coupling the dynamics and the molecular chemistry in the Galactic center

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Abstract:
Most of the Galactic center (GC) gas moves in nearly circular orbits in a nuclear ring (hereafter the Galactic center ring, GCR). This is the case of cloud complexes such as Sgr A or Sgr B, where the gas is dense, warm and exhibits a rich molecular chemistry. The origin of these properties is thought to be shocks, in particular due to the large scale dynamics of the Galaxy. In addition, there are gas clouds moving in highly non-circular orbits known from observations of low density tracers such as CO(1-0). The physical conditions of the clouds moving with non-circular velocities are not well known.

We have studied the physical conditions of the gas in non-circular orbits to better understand the origin of the

Table 3: IRAM PdBI proposal ratings for winter 2006/2007. A: Accepted, B: Backup, C: Rejected

Project	Rate	Project	Rate	Project	Rate	Project	Rate	Project	Rate	Project	Rate
Q031	B	Q032	B	Q033	C	Q034	C	Q035	C	Q036	C
Q037	C	Q038	C	Q039	C	Q03A	C	Q03B	C	Q03C	C
Q03D	C	Q03E	C	Q03F	B	Q040	C	Q041	C	Q042	B
Q043	C	Q044	B	Q045	C	Q046	A	Q047	B	Q048	A‡
Q049	C	Q04A	C	Q04B	C	Q04C	B†	Q04D	C	Q04E	C
Q04F	B†	Q050	C	Q051	A	Q052	B	Q053	C	Q054	B
Q055	B	Q056	C	Q057	C	Q058	C	Q059	B†	Q05A	B†
Q05B	C	Q05C	C	Q05D	B	Q05E	B†	Q05F	C	Q060	C
Q061	B	Q062	B	Q063	B†	Q064	A†	Q065	C	Q066	B
Q067	C	Q068	C	Q069	B	Q06A	C	Q06B	C	Q06C	A‡
Q06D	C	Q06E	C	Q06F	B	Q070	B	Q071	C	Q072	B
Q073	A	Q074	B	Q075	B	Q076	A†	Q077	A	Q078	A†
Q079	A‡	Q07A	B†	Q07B	C	Q07C	C	Q07D	C	Q07E	C
Q07F	C	Q080	C	Q081	C	Q082	A[II]	Q083	C	Q084	C
Q085	B†	Q086	A	Q087	B	Q088	C	Q089	B‡	Q08A	B
Q08B	B	Q08C	C	Q08D	C	Q08E	C	Q08F	B	Q090	A
Q091	C	Q092	A	Q093	C	Q094	A	Q095	C	Q096	B
Q097	C	Q098	B†	Q099	C	Q09A	B	Q09B	B	Q09C	A
Q09D	A[II]	Q09E	B	Q09F	C	Q0A0	-	Q0A1	A		

† some parts of the program – others rated B or C
‡ with time restrictions
[II] join with other project

Table 4: IRAM 30m telescope proposal ratings for winter 2006/2007

A		B			C		
126-06	129-06	121-06[1]	124-06	125-06[1]	122-06	123-06	127-06
133-06	134-06[2]	131-06	132-06[1]	135-06	128-06	130-06	138-06
137-06	142-06[1]	136-06[1]	139-06	141-06	140-06	143-06	152-06
144-06	149-06	145-06	146-06	147-06	153-06	155-06	156-06
150-06[1]	157-06	148-06	151-06	159-06[1]	160-06	161-06	166-06
158-06	165-06	162-06[1]	163-06	164-06	170-06	173-06	174-06
169-06[2]	172-06[2]	167-06	168-06	171-06	176-06	177-06	184-06
179-06[1]	180-06[2]	175-06[1]	178-06	182-06	185-06	186-06	189-06
181-06	183-06[1]	187-06[1]	191-06[1]	193-06[1]	192-06	194-06	195-06
188-06	190-06[1]	196-06[1]	200-06	202-06	197-06	199-06	201-06
198-06	207-06[1]	203-06	204-06	205-06[1]	206-06	211-06	214-06
212-06[1]	213-06[2]	208-06	209-06[1]	210-06[1]	215-06	216-06	217-06
220-06[1]	221-06	218-06	219-06	226-06	223-06	224-06	225-06
222-06	228-06[2]	229-06[1]	232-06	234-06	227-06	230-06	233-06
231-06	237-06[1]	235-06[1]	236-06	238-06	243-06	244-06	248-06
242-06	245-06	239-06[1]	240-06[1]	241-06	249-06	250-06	
		246-06	247-06[1]	251-06			

[1]) time reduced [2]) part of time rated B

unusual physical conditions of the GC molecular gas and the possible effect of the large scale dynamics on these physical conditions.

Using published CO(1-0) data, we have selected a set of clouds belonging to all the kinematical components seen in the longitude-velocity diagram of the GC. We have carried out a survey of dense gas in all the components using the $J = 2-1$ lines of CS and SiO as tracers of high density gas and shock chemistry.

We have detected CS and SiO emission in all the kinematical components. The gas density and the SiO abundance of the clouds in non-circular orbits are similar to those in the GCR. Therefore, in all the kinematical components there are dense clouds that can withstand the tidal shear. However, there is no evidence of star formation outside the GCR. The high relative velocity and shear expected in the dust lanes along the bar major axis could inhibit the star formation process, as observed in other galaxies. The high SiO abundances derived in the non-circular velocity clouds are likely due to the large-scale shocks that created the dust lanes.

Appeared in: A&A 455, 963-969

Adapting and expanding the Plateau de Bure interferometer

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Abstract:
We were recently faced with the following problem: The T-shaped Plateau de Bure Interferometer is expanding its tracks to achieve higher spatial resolution in astronomical images at mm wavelengths. Two more stations for positioning the antennas during observations are being built at the ends of the extended tracks. Which of the given stations should the remaining four antennas occupy to accommodate the new stations? What is the optimal set of antenna configurations, given the new extended one, to achieve necessary coverage of the uv-plane at a variety of spatial resolutions? We present in this paper the solutions to the above questions, resulting from a novel method we have recently developed. The method is based on identifying which placement of elements provides the most appropriate uv-plane sampling.

Appeared in: AIPC 848, 857

NGC 2146's starburst region and extended structure

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Abstract:
We present mm-wavelength and optical observations of the starburst region in NGC 2146. This region of ~ 4 kpc diameter contains a well-ordered distribution of stars, gas, and dust, and a well-ordered rotation. The possible anomalies found in our observations are a warped CO distribution and an increase in the CO line width at the NW edge of the starburst region. The investigation of a possible encounter or merger origin of the starburst may therefore have to concentrate on the distorted outer structure of the galaxy.

There are three large-scale features of ~ 20 kpc extent, two of which give the impression of being stellar sub-systems. The third feature is an imcomplete and expanding ring of H II regions and stars, apparently indicating an event that occurred some 300 Myrs ago.

Appeared in: A&A 459, 441

A Keplerian Gaseous Disk around the B0 Star R Monocerotis

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Abstract:
We present high angular resolution observations of the circumstellar disk around the massive Herbig Be star R Mon ($M_* \sim 8M_\odot$) in the continuum at 2.7 and 1.3 mm and the ^{12}CO 1-0 and 2-1 rotational lines. On the basis of the new 1.3 mm continuum image, we estimate a disk mass (gas+dust) of $0.007M_\odot$ and an outer radius of < 150 AU. Our CO images are consistent with the existence of a Keplerian rotating gaseous disk around this star. Up to our knowledge, this is the most clear evidence for the existence of Keplerian disks around massive stars reported thus far. The mass and physical characteristics of this disk are similar to those of the more evolved T Tauri stars and indicate a shorter timescale for the evolution and dispersal of circumstellar disks around massive stars which lose most of their mass before the star becomes visible.

Appeared in: ApJ 649, L119

ATOMIC CARBON IN APM 08279+5255 AT Z = 3.91

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Abstract:
We present a detection of [C I] $^3P_1 -^3 P_0$ emission in the lensed quasar APM 08279+5255 at z=3.91 using the IRAM Plateau de Bure interferometer. The [C I] line velocity and width are similar to the values of previously detected high-J CO and HCN lines in this source, suggesting that the emission from all of these species arises from the same region. The apparent luminosity of the [C I] line is $L'_{C\,I} = (3.1 \pm 0.4) \times 10^{10}$ K km s^{-1} pc^2, which implies a neutral carbon mass $M_{C\,I} = (4.4 \pm 0.6)m^{-1} \times 10^7 M_\odot$, where m is the lensing magnification factor. The [C I] line luminosity is consistent with the large molecular gas mass inferred from the nuclear CO line luminosity ($\sim 10^{11} m^{-1} M_\odot$). We also present an upper limit on the H_2O $1_{10} - 1_{01}$ line luminosity in APM 08279+5255 of $L'_{H_2O} < 1.8 \times 10^{10}$ K km s^{-1} pc^2 (3σ).

Based on observations carried out with the IRAM Plateau de Bure Interferometer. IRAM is supported by INSU/CNRS (France), MPG (Germany), and IGN (Spain).

Appeared in: ApJ 651, 46

INTERFEROMETRIC CO J = 2-1 EMISSION MAPPING OF THE PROTOPLANETARY NEBULA IRAS 19475+3119

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Abstract:
We present $\sim 2''$ resolution interferometric maps of the ^{12}CO J=2-1 emission in the PPN IRAS 19475+3119 obtained with OVRO. These data probe two distinct molecular components, namely, a slowly expanding shell and a fast bipolar outflow.We have used a spatiokinematic model of the 12CO J=2-1 emission to constrain the properties of these two components. The shell has inner and outer radii of $R_{in} \sim 6.5 \times 10^{16}$ cm and $R_{out} \sim 2 \times 10^{17}$ cm and expands at $V_{exp} \sim 11$ km s^{-1}. The ^{12}CO $J = 2-1$ line wing emission arises in a bipolar structure that emerges from two diametrically opposite holes in the slow shell. The bipolar outflow is aligned with one of the two lobe pairs of the quadrupolar optical nebula (at P.A.$\sim 80°$). Both the holes and the bipolar outflow are most likely the result of the interaction of fast, collimated post-AGB winds with the shell. The quadrupolar morphology of the optical nebula indicates two distinct bipolar post-AGB winds ejected in two different directions. The elongation of the optical counterpart of the shell (at P.A.$\sim -45°$) and two similarly aligned CO clumps suggest that the slow shell has also been affected by the wind interaction. The expansion velocity in the bipolar outflow increases linearly with the distance from the nebula center and reaches $V_{exp} = 30$ km s^{-1} (projected) at the tips of the lobes. This velocity gradient yields a relatively long kinematical age of $\sim$ 1900 yr, assuming an outflow inclination of $i = 30°$ with respect to the plane of the sky; this age is comparable with the post-AGB lifetime estimated from the shell expansion velocity and inner radius. We derive a mean kinetic temperature of $\sim$ 14 K and a total mass of $\sim 0.4 M_\odot$. The collimation and linear momentum ($P \sim 4 \times 10^{38}$ g cm s^{-1}) of the outflow are unlikely to result from radiation pressure on dust grains.

Appeared in: ApJ 643, 945

SPECTRAL LINE CONFUSION AT z = 3.9: DETECTION OF HNC AND TENTATIVE DETECTION OF CN IN APM 08279+5255

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Abstract:
The presence of large reservoirs of molecular gas in the early Universe has been demonstrated through the detection of rotational transitions of CO in high redshift ultraluminous galaxies and quasars. The derived masses are in excess of 10^{10} $M_\odot$ and the gas is found to be warm and dense. Obviously, a prodigious star formation activity is taking place in some of those objects, as attested

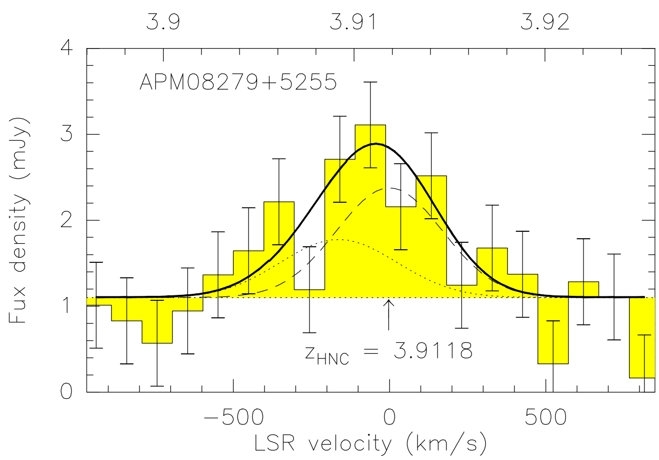

Figure 5: Spectrum of the HNC(5–4) and CN (4–3) emissions from APM 08279+5255, The velocity scale is relative to the HNC frequency redshifted by $z = 3.9118$. The velocity resolution is 97 km s^{-1}, the r.m.s. noise 0.5 mJy. The thick line represents the best fit synthetic spectrum and the dotted and dashed lines the contributions from CN and HNC to this spectrum. The CN contribution is the blend of 2 fine-structure components.

by the huge far-infrared luminosities. These considerations have triggered searches for molecular species having higher dipole moments than CO and that are better probes of the very dense gas associated with star formation. Two such molecules were detected so far in high-z sources: HCN and HCO^+.

We report in this Letter the detection with the Plateau de Bure interferometer of a broad spectral line with a center frequency of 92294 MHz (relative to the LSR) in the quasar APM 08279+5255 ($z = 3.91$) . We identify this line as a blend of the J = 5–4 transition of HNC and of the N= 4–3 transition of CN. Although the two transitions are well separated in frequency (336 MHz between HNC and the upper fine-structure component of CN), the large redshift of the quasar reduces the splitting to 68 MHz, so that the broad (FWHP 400 kms^{-1}) HNC and CN lines arising in the nuclear region of the quasar are blended.

HNC and CN are the $4^{\rm th}$ and $5^{\rm th}$ molecular species detected at redshift $z > 1$. The derived HNC and CN line intensities are 0.6 and 0.4 times that of HCN J= 5–4. If HNC and HCN are co-spatial and if their J= 5–4 lines are collisionally excited, the [HNC]/[HCN] abundance ratio must be equal to 0.6 within a factor of 2, similar to its value in the cold Galactic clouds and much larger than in the hot molecular gas associated with Galactic HII regions. It is possible, however, that fluorescent infrared radiation plays an important role in the excitation of HNC and HCN.

Dissipative structures of diffuse molecular gas: II - The translucent environment of a dense core

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Abstract:
Aims. This paper belongs to a series of four, dedicated to the analysis of the dynamical, thermal and chemical properties of translucent molecular gas, with the perspective of characterizing the processes driving the dissipation of supersonic turbulence, an anticipated prerequisite of dense core formation.

Methods. We analyze the small scale morphology and velocity structure of the parsec-scale environment of a low mass dense core ($1\,M_\odot$). Our work is based on large maps made with the IRAM-30m telescope in the two lowest rotational transitions of ^{12}CO and ^{13}CO with high angular ($20''$ or 0.015 pc at 115 GHz) and spectral ($0.055\,{\rm km\,s^{-1}}$) resolutions. The field is translucent, hence providing strong constraints on the column density and physical conditions in the gas.

*Results.*More than one third of the field mass (6.5 $M_\odot$) lies in an elongated tail of dense and cold gas, possibly extending beyond the edge of the map and connected to the core in space and velocity. This core tail is highly turbulent and sub-structured into narrow filaments of aspect ratio up to 20. These are pure velocity structures with velocity shears in the range $2 - 10$ km s^{-1}pc^{-1}. Another third of the mass, according to the weak extinction of the field, lies in more dilute molecular and atomic gas. Its molecular fraction, largely traced by optically thick ^{12}CO lines, is even more turbulent than the dense core tail. The gas emitting in the broad wings of the ^{12}CO lines is organized into a conspicuous network of narrow criss-crossed filaments, whose pattern at the parsec scale is seen for the first time. The gas there is optically thin in the ^{12}CO $(1-0)$ line ($\tau_{12} < 0.2$), warmer than 25 K and more dilute than $1000\,{\rm cm}^{-3}$. These optically thin ^{12}CO-filaments, though contributing to about 10% of the mass of the environment, have a CO cooling rate a few times larger than that of the whole field on average. Whether dense or dilute, all the filamentary structures in the field (with transverse sizes $0.015 - 0.03$ pc), are preferentially oriented along the direction of the magnetic fields, as measured a few parsecs away. Using the Chandrasekhar-Fermi method, we estimate the intensity of the magnetic fields intensity in the dilute molecular gas to be $B_{pos} = 15\ \mu$G. We infer that the turbulent motions in the dilute gas are in the trans-Alfvénic range.

Conclusions. The 1 $M_\odot$dense core is surrounded by a translucent and highly turbulent environment whose gas dynamics are not super-Alfvénic. The low mass dense core is not isolated but still connected to a massive reservoir

of dense gas. Filaments of optically thin ^{12}CO are found to radiate more efficiently in the CO lines than the whole field on average. These are the structures that we tentatively identify with the locus of intermittent dissipation of turbulence, and for which there is no observational evidence that they are shocks.

Accepted for publication in A&A

Resolving the inner dust disks surrounding LkCa 15 and MWC 480 at mm wavelengths

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Abstract:
We performed sub-arcsecond high-sensitivity interferometric observations of the thermal dust emission at 1.4 mm and 2.8 mm in the disks surrounding LkCa 15 and MWC 480, with the new 750 m baselines of the IRAM PdBI array. This provides a linear resolution of about 60 AU at the Taurus distance.

We report the existence of a cavity of about 50 AU radius in the inner disk of LkCa 15. Whereas LkCa 15 emission is optically thin, the optically thick core of MWC 480 is resolved at 1.4 mm with a radius of about 35 AU, constraining the dust temperature. In MWC 480, the dust emission is coming from a colder layer than the CO emission, most likely the disk mid-plane.

These observations provide direct evidence of an inner cavity around LkCa 15. Such a cavity most probably results from the tidal disturbance created by a low mass companion or large planet at about 30 AU from the star. These results suggest that planetary system formation is already at work in LkCa 15. They also indicate that the classical steady-state viscous disk model is a too simplistic description of the inner 50 AU of "proto-planetary" disks, and that the disk evolution is coupled to the planet formation process. The MWC 480 results indicate that a proper estimate of the dust temperature and size of the optically thick core are essential to determine the dust emissivity index.

Appeared in: A&A 2006, 460, L43-L47

A complete 12CO 2-1 map of M 51 with HERA. I. Radial averages of CO, HI, and radio continuum

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Abstract:
The mechanisms governing the star formation rate in spiral galaxies are not yet clear. The nearby, almost face-on, and interacting galaxy M 51 offers an excellent opportunity to study at high spatial resolutions the local star formation laws.

In this first paper, we investigate the correlation of H_2, H I, and total gas surface densities with the star forming activity, derived from the radio continuum (RC), along radial averages out to radii of 12 kpc.

We have created a complete map of M 51 in ^{12}CO 2-1 at a resolution of 450 pc using HERA at the IRAM-30 m telescope. These data are combined with maps of H I and the radio-continuum at 20 cm wavelength. The latter is used to estimate the star formation rate (SFR), thus allowing to study the star formation efficiency and the local Schmidt law $\Sigma_{SFR} \propto \Sigma^n_{gas}$. The velocity dispersion from CO is used to study the critical surface density and the gravitational stability of the disk. Results: . The total mass of molecular material derived from the integrated ^{12}CO 2-1 intensities is $2 \times 10^9 M_\odot$. The 3σ detection limit corresponds to a mass of $1.7 \times 10^5 M_\odot$. The global star formation rate is $2.56 M_\odot$ yr^{-1} and the global gas depletion time is 0.8 Gyr. H I and RC emission are found to peak on the concave, downstream side of the outer south-western CO arm, outside the corotation radius. The total gas surface density Σ_{gas} drops by a factor of ~ 20 from $70 M_\odot$ pc^{-2} at the center to $3 M_\odot$ pc^{-2} in the outskirts at radii of 12 kpc. The fraction of atomic gas gradually increases with radius. The ratio of H I over H_2 surface densities, Σ_{HI}/Σ_{H2}, increases from ~ 0.1 near the center to ~ 20 in the outskirts without following a simple power-law. Σ_{HI} starts to exceed Σ_{H2} at a radius of ~ 4 kpc. The star formation rate per unit area drops from $\sim 400 M_\odot pc^{-2} Gyr^{-1}$ in the starburst center to $\sim 2 M_\odot pc^{-2} Gyr^{-1}$ in the outskirts. The gas depletion time varies between 0.1 Gyr in the center and 1 Gyr in the outskirts, and is shorter than in other non-interacting normal galaxies. Neither the H I surface densities nor the H_2 surface densities show a simple power-law dependence on the star formation rate per unit area. In contrast, Σ_{gas} and Σ_{SFR} are well characterized by a local Schmidt law with a power-law index of $n = 1.4 \pm 0.6$. The index equals the global Schmidt law derived from disk-averaged values of Σ_{gas} and Σ_{SFR} of large samples of normal and starburst galaxies. The critical gas velocity dispersions needed to stabilize the gas against gravitational collapse in the differentially rotating disk of M 51 using the Toomre criterion, vary with radius between 1.7 and 6.8 km s^{-1}. Observed radially averaged dispersions derived from the CO data vary between 28 km s^{-1} in the center and ~ 8 km s^{-1} at radii of 7 to 9 kpc. They exceed the critical dispersions by factors Q_{gas} of 1 to 5. We speculate that the gravitational potential of stars leads to a critically stable disk.

Appeared in: A&A 461, 143

The interstellar medium of the Antennae Galaxies

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Abstract:
To study the properties of the interstellar medium in the prototypical merging system of the Antennae galaxies (NGC 4038 and NGC 4039), we have obtained ^{12}CO (1-0), (2-1) and (3-2) line maps, as well as a map of the 870μm continuum emission. Our results are analysed in conjunction with data from X-ray to radio wavelengths. In order to distinguish between exact coincidence and merely close correspondence of emission features, we compare the morphological structure of the different emission components at the highest available angular resolution. To constrain the physical state of the molecular gas, we apply models of photon dominated regions (PDRs) that allow us to fit CO and [CII] data, as well as other indicators of widespread PDRs in the Antennae system, particularly within the super giant molecular cloud (SGMC) complexes of the interaction region (IAR) between the two galaxies. The modeled clouds have cores with moderately high gas densities up to 4×10^4 cm^{-3} and rather low kinetic temperatures $\leq$ 25K). At present, all these clouds, including those near the galactic nuclei, show no signs of intense starburst activity. Thermal radio or mid-infrared emission are all observed to peak slightly offset from the molecular peaks. The total molecular gas mass of the Antennae system adds up to $\sim 10^{10}$M$_\odot$. In the vicinity of each galactic nucleus, the moleculargas mass, $1 - 2 \times 10^9$M$_\odot$, exceeds that of the Galactic centre region by a factor of almost 100. Furthermore, the gas does not seem to deviate much from the N_{H_2}/I_{CO} ratio typical of the disk of our Galaxy rather than our Galactic centre.

Accepted for publication in A&A

A global 86 GHz VLBI survey of compact radio sources

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Abstract:
We present results from a large global VLBI(Very Long Baseline Interferometry) survey of compact radio sources at 86 GHz which started in October 2001. The main goal of the survey is to increase the total number of objects accessible for future 3mm-VLBI imaging by factors of 3-5. The survey data reach the baseline sensitivity of 0.1 Jy, and image sensitivity of better than 10 mJy/beam. To date, a total of 127 compact radio sources have been observed. The observations have yielded images for 109 sources, and only 6 sources have not been detected. Flux densities and sizes of core and jet components of all detected sources have been measured using Gaussian model fitting. From these measurements, brightness temperatures have been estimated, taking into account resolution limits of the data. Here, we compare the brightness temperatures of the cores and secondary jet components with similar estimates obtained from surveys at longer wavelengths (e.g. 15 GHz). This approach can be used to study questions related to mechanisms of initial jet acceleration (accelerating or decelerating sub-pc jets?) and jet composition (electron-positron or electron-proton plasma?).

To appear in: Proc. of the 8th EVN Symposium held in Torun Poland, Sep. 26-29 2006

Characteristics and Performance of the North American ALMA Prototype Antenna

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Abstract:
The submillimeter antennas of the Atacama Large Millimeter Array (ALMA) have specifications that are beyond the current state of the art in accurate reflector antenna technology. Considering that as many as 64 of these antennas will eventually be needed, the ALMA partners AUI/NRAO and ESO each agreed to acquire a prototype antenna, and subject these to an extensive evaluation program. In this paper we summarize the performance of the ALMA North American prototype antenna.

Appeared in: Revealing the Molecular Universe: One Antenna is Never Enough, ASP Conf. Series 2006, 356, 253. Eds. D.C. Backer, J.W. Moran, and J.L. Turner

Multi-wavelength afterglow observations of the high redshift GRB 050730

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Abstract:
Context: GRB 050730 is a long duration high-redshift burst ($z = 3.967$) that was discovered by Swift. The afterglow shows variability and was well monitored over a wide wavelength range. We present comprehensive temporal

and spectral analysis of the afterglow of GRB 050730 including observations covering the wavelength range from the millimeter to X-rays.

Aims: We use multi-wavelength afterglow data to understand the complex temporal and spectral decay properties of this high redshift burst.

Methods: Five telescopes were used to study the decaying afterglow of GRB 050730 in the B, V, r', R, i', I, J and K photometric pass bands. A spectral energy distribution was constructed at 2.9 h post-burst in the B, V, R, I, J and K bands. X-ray data from the satellites Swift and XMM-Newton were used to study the afterglow evolution at higher energies.

Results: The early afterglow shows variability at early times and the slope steepens at 0.1 days (8.6 ks) in the B, V, r', R, i', I, J and K passbands. The early afterglow light curve decayed with a powerlaw slope index $\alpha_1 = -0.60 \pm 0.07$ and subsequently steepened to $\alpha_2 = -1.71 \pm 0.06$ based on the R and I band data. A millimeter detection of the afterglow around 3 days after the burst shows an excess in comparison to theoretical predictions. The early X-ray light curve observed by Swift is complex and contains flares. At late times the X-ray light curve can be fit by a powerlaw decay with $\alpha_x = -2.5 \pm 0.15$ which is steeper than the optical light curve. A spectral energy distribution (SED) was constructed at ~ 2.9 h after the burst. An electron energy index, p, of ~ 2.3 was calculated using the SED and the photon index from the X-ray afterglow spectra and implies that the synchrotron cooling frequency ν_c is above the X-ray band.

Appeared in: A&A 460, 415

Extensive multiband study of the X-ray rich GRB 050408. A likely off-axis event with an intense energy injection

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Abstract:
Aims: Understand the shape and implications of the multiband light curve of GRB 050408, an X-ray rich (XRR) burst.

Methods: We present a multiband optical light curve, covering the time from the onset of the γ-ray event to several months after, when we only detect the host galaxy. Together with X-ray, millimetre and radio observations we compile what, to our knowledge, is the most complete multiband coverage of an XRR burst afterglow to date.

Results: The optical and X-ray light curve is characterised by an early flattening and an intense bump peaking around 6 days after the burst onset. We explain the former by an off-axis viewed jet, in agreement with the predictions made for XRR by some models, and the latter with an energy injection equivalent in intensity to the initial shock. The analysis of the spectral flux distribution reveals an extinction compatible with a low chemical enrichment surrounding the burst. Together with the detection of an underlying starburst host galaxy we can strengthen the link between XRR and classical long-duration bursts.

Based on observations collected at SAO, La Silla, Roque de los Muchachos, Haleakala, Kitt Peak, Cerro Tololo, TÜBITAK, Kiso, Observatorio de Sierra Nevada, Plateau du Bure, GMRT and RATAN-600. Appendices A and B are only available in electronic form at http://www.aanda.org

Appeared in: A&A 462, 57

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