IRAM
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Institut für Radioastronomie im Millimeterbereich
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Newsletter

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Calendar

September 1, 2006: Inscription deadline for the interferometry school.

September 11, 2006 17:00 CEST (UT+2h): Deadline for the submission of IRAM observing proposals for the period from November 15, 2006 to May 15, 2007.

October 1, 2006 Deadline for the submission of global VLBI proposals for the spring 2007 session.

October 2-6, 2006: Fifth IRAM Millimeter interferometry school.

Fifth IRAM Interferometry School

IRAM prepares its 5th Interferometry School, which will be held from October 2-6, 2006 in the IRAM Grenoble Headquarters. The school website can be visited under the URL http://www.iram.fr/IRAMFR/IS/school.htm.

The regular inscription has been closed because the maximum number of participants has been reached, but a waiting list is open. Please contact Cathy Berjaud (berjaud@iram.fr) for details.

Frédéric GUETH and Michael BREMER

Staff Changes

IRAM Grenoble

In the administration group, Claude VIANEY-LIAUD has returned from her one-year sabbatical leave on August 1st.

Several personnel changes have taken place in the receiver group: Yoann SALOMEZ and Baptiste JAMMET have left on June 30th, and Youness BOUTGLAY has started work on August 1st.

Michael BREMER

IRAM GRANADA

In May 2006, Sergio Martin finished his PhD Thesis on "Chemistry and physics of the interstellar medium in central regions of galaxies". He has been working on this thesis during the last four years at IRAM Granada. In Fall 2006, he will start as a postdoc at the Harvard CfA. We wish him all the best for his career.

Starting August 21th 2006, Helmut Wiesemeyer, now working at IRAM Grenoble, will be working in IRAM Granada in the astronomy group. Among his duties will be the organisation of the HERA pool, development of data reduction software and other support for the observatory.

Rainer MAUERSBERGER

Travel funds for European astronomers

IRAM is one of the organizations partipating 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

Proposals for IRAM Telescopes

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

September 11, 2006 17:00 CEST (UT+2h)

The scheduling period extends from November 15, 2006 to May 15, 2007, covering roughly the winter period at our observatories. 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 cancelation 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 decribed. 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 new 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. The list presently contains all users of IRAM telescopes during the last 2 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

Call for Observing Proposals on the 30m Telescope

Summary

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

[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.

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 $\sim$ 150 hours).

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

What is new?

The telecope is now being operated under a new control system (NCS). Although allmost all features available under the old control system are already operational in the NCS, a small number of restrictions still hold. Most visibly, the only coordinate system fully supported by the NCS now is equatorial J2000.0, and we request observers to use this system for their source coordinates and offsets. Source offsets can be in the Equatorial J2000.0 system, projection "radio"; in the "true angle" horizontal system; and in the Nasmyth system (receiver offsets). SET ANGLE UNIT other than [arcsec] is no yet supported. The "Raster" command is still not available. OTF, ONOFF or TRACKING (with frequency switching) commands together with SIC loops should be used instead. Observations with the rotated wobbler which are of interest for bolometer mapping, are in preparation.

Remote observing is not yet implemented, so astronomers are asked to travel to the observatory, or in case of short and straightforward observations, consider service observing.

The NCS team makes a strong effort to maintain a web page (../IRAMES/ncs30m) where the current status is described.

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. HERA observations will be organized as an observing pool similar to the bolometer observations.

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

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.

If time has already been given to a project but turned out to be insufficient, explain the reasons, e.g. indicate the amount of time lost due to bad weather or equipment failure; if the fraction of time lost is close to 100%, don't rewrite the proposal, except for an introductory paragraph. For continuation of proposals having led to publications, please give references to the latter.

Reminders

A handbook ("The 30m Manual") collects much of the information necessary to plan 30m telescope observations[6]. It is however outdated in many sections, and we recommend also to consult the NCS web pages (../IRAMES/ncs30m)

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 (e.g. setup of on-the-fly maps etc).

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 (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 winter conditions, corresponding to 4mm of precipitable water vapor. Conditions during afternoons can be degraded due to anomalous refraction. The observing efficiency is then reduced and the 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 best winter conditions, the proposers must clearly say so in their time estimate paragraph. Such proposals will however be particularly scrutinized.

Pooled observing

As in 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

[2]electronically available via the WWW starting at URL on our web pages `../IRAMFR/PV/ARN/newsletter.html`

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 observing pool is described at ../IRAMES/observing/flexible/flexible.html. A description of the HERA pool will follow soon.

Bolometer and heterodyne proposals which are particularly weather tolerant qualify as backup for the pool. Participation in the pool 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, used to be available from the downtown Granada office, from the MPIfR in Bonn, from the ENS in Paris, from the OAN in Madrid (near Parque de Retiro), and from IRAM in Grenoble. However, due to the transition to the telescope's new control system, remote observing will not be operational during several months. Observers are strongly encouraged either to consider service observing for short (≤ 8 h) and simple proposals, to participate in a pool, or to come to the telescope.

Technical Information about the 30m Telescope

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

HERA

The **HE**terodyne **R**eceiver **A**rray is expected to be available for most of next winter. 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).

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 1.9) 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 connectable 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

[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.

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 normal winter weather (4mm of water) at the center of the tuning range and at 45° elevation. All receivers are tuned by the operators from the control room. Experience shows that it normally takes 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.

Following the considerable demand for this frequency range in the last 2 semesters, the LO hardware has been simplified. As a result, 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.

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.fr). 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 ≃ 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 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

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

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

1: tuning range extended to $\geq$ 72 GHz under special conditions (see text)
2: noise increasing with frequency
3: performance at $\nu <$ 275 GHz; noisier above 275 GHz.
4: the V–array of HERA has slighly higher noise which may vary across the IF band.

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 recommened unless the expected signal is about 1 Jy/beam or stronger.

The bolometer arrays are mostly used in two basic observing modes, ON/OFF and mapping. Previous experience with MAMBO–2 shows that the ON/OFF reaches typically an rms noise of $\sim$ 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 $150'' \times 150''$ (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 ($8.0' \times 6.5'$) 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. The time estimator uses rather precise estimates of the various overheads which will be applied to all bolometer

[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).

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]. Receivers are closely aligned (within $\leq 2''$). Checking the pointing, focus, and receiver alignment is the responsibility of the observers (use a planet for alignment checks). Systematic (up to 0.4 mm) differences between the foci of various receivers can occasionally occur. In such a case the foci should be carefully monitored and a compromise value be chosen. Not doing so may result in broadened and distorted beams ([1]).

Wobbling Secondary

- Beam–throw is $\leq 240''$ depending on wobbling frequency. At 2 Hz, the maximum throw is $90''$
- Standard phase duration: 2 sec for spectral line observations, 0.25 sec for continuum observations.

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: $\theta_b[''] = 2460$ / 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

After the extension of the baselines last year, the Plateau de Bure Interferometer will see yet another major upgrade with the planned installation of the new generation of SIS receivers. These receivers, the result of a 6-year development effort at IRAM, are designed to operate in single-side band mode in one of any of the four band frequencies covering the 3 mm (Band 1), 2 mm, 1.3 mm (Band 3) and 0.8 mm atmospheric windows. They will offer dual polarization capabilities (horizontal/vertical, each) with an IF bandwidth of 4 GHz.

In view of the progresses made recently in the lab, the current plan is to install two channels (Band 1 and Band 3) for the upcoming winter scheduling period (2006/2007), and to have the full set of bands operational at the Plateau de Bure at the end of 2007. With the present correlator, it will only be possible to correlate two 1 GHz wide sections (one per polarization) within the 4 GHz bandwidth. Correlation of the full 4 GHz band on both polarizations will have to await the completion of a new correlator, presently under development. Finally, an important difference to the current receivers is that simultaneous dual-frequency observing will not be possible with the new generation receivers of the Plateau de Bure Interferometer.

The installation of the new generation receivers (NGRx) on the Plateau de Bure corresponds to a large system change, including transmission lines, software, and backends, which will result in unprecedented gains in sensitivity and bandwidth. To provide the new receivers for the coming winter period, IRAM is working on a very tight and intense schedule and calculated risks have to be taken in this transitional period. In view of recent work and tests done in the receiver laboratory, we are confident that the change to the new generation receivers will occur as planned. We have therefore decided to reissue a new call for proposals for the Plateau de Bure Interferometer which takes into account these recent developments and will supersede the call which was distributed in July. The new deadline for submission has been extended to September 11th, 2006 at 17:00 CEST (UT + 2 hours).

In order to incorporate the potential risks associated with this significant and difficult change, the new call for proposals will include 1) **science demonstration** proposals (∼ 30% of the total time) which will need the improved sensitivities of the new generation receivers and 2) **regular proposals** which will be based on the current receiver noise figures. For both types of proposals the advantage of the extended baselines and of the increased useful bandwidth should be taken into account. In the case the expected sensitivity will not be reached at the beginning of the observing session, the science demonstration proposals will **not** be observed.

Pierre COX

The new generation receivers

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 band can be connected to the IF transmission at any time. Because of this reason and the pointing offsets, 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 for phase calibration and/or time-shared alternate frequency observations.

The two IF-channels (one per polarization), each 4 GHz wide (total 8 GHz) are transmitted by optical fiber to the central building. At present, that 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 IF 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.

New PdBI Receiver Specifications

	Band 1	Band 3
RF coverage[1]	83–116	201–256
T_{rec}[2]	40–55	40–60 (LSB)
T_{rec}[2]		50–70 (USB)
G_{im}[3]	−10 dB	−12 – 8 dB
RF range in LSB	83–104[4]	201–244
RF range in USB	104–116	244–256

[1] Based on nominal RF frequency being converted to the center of the IF at 6 GHz. The total coverage extends 2 GHz more either side. The upper edge for Band 3 currently is limited by the triplers and should be raised to 267 GHz in 2007.

[2] Typical laboratory values.

[3] Estimated values based on measured junctions at the image frequency. Better values are expected at the band center.

[4] Transition between LSB and USB for Band 1 is flexible. The value will be fixed when all mixers are installed.

The receiver specifications will ultimately increase the sensitivity of the PdBI for spectral (single line) observations by factors 2 and 3 at 100 GHz and 230 GHz, respectively. Never such a gain has been planned in a single step at the Plateau de Bure since the opening of the interferometer. The expected factors in sensitivity result from gains in the receiver noise, from a better rejection of the image sideband at 230 GHz and from the possibility to observe with two orthogonal polarizations simultaneously. They assume that the performances obtained from the first front-end units in the laboratory will apply to all the units and will not degrade on the Plateau de Bure, due to unexpected phase instabilities or to data transmission problems. This, of course, cannot be guaranteed, especially during the first months of operation.

In order to operate this major change at the Plateau de Bure, regular observing will be suspended during the receiver installation and testing period from October to November.

Weather conditions and observations

All in all, the weather conditions have been very good at the Plateau de Bure last winter with long periods of excellent phase stability and low atmospheric opacity. The interferometer recorded a 50-60% observing efficiency in January and February but only a very low efficiency of 30% in March. To optimize the observing efficiency with respect to the sun avoidance constraints of A-rated projects and due to some delays with the installation of the prototype-type NGRx at the beginning of the last winter semester, the configuration schedule of the interferometer was slightly adjusted.

The array was moved to the most extended new configuration A (including stations E68 and N46) in mid January, moved to the new B configuration in mid February and to the C configuration in the second half of March. Because of the weather conditions, the array was rearranged to the most compact configuration (D) at the end of April. The Global VLBI observations from May 4 to 8, 2006 could not be joined by the Plateau de Bure array because of the irreparable breakdown of the CNRS maser 5 days before the start of the VLBI session.

Most of the A-rated projects could be completed before the end of the winter period, although a few projects requesting the D configuration had to be moved into the current summer period. We have also invested observing time on a number of B projects, and even on a few targets of opportunity. Since last December, a total of 57 different projects has successfully been scheduled for observations. Concerning projects that have been started shortly before the end of the winter period, we plan to bring these to completion in the next few months. A few deep integration and low-resolution observations of sources in the Orion-Taurus region had to be suspended because of sun avoidance constraints and are now deferred to the end of the summer semester.

Finally, we would like to remind users of the Plateau de Bure Interferometer that B-rated summer proposals which were not started by the proposal deadline, should be resubmitted. Investigators, who would like to check the status of their project, may consult the interferometer schedule on the Web at `../IRAMFR/PDB/ongoing.html`.

Call for Observing Proposals for the Plateau de Bure Interferometer

Conditions for the next winter session

Based on our experience in carrying out configuration changes with limited access to the observatory, we plan to schedule four configuration changes next winter. We therefore ask investigators to submit proposals for any of the 4 of the primary configurations of the six antenna array.

A preliminary configuration schedule for the winter period is outlined below. Adjustments to the provisional configuration planning will be made according to proposal pressure, weather conditions, the installation of the NGRx and other contingencies. E.g., depending on proposal pressure, the time in the A configuration may be extended. Due to the installation of the new receivers, the foreseen December session in the C configuration may be postponed and merged with the March-April session. We therefore may have less time available in C configuration this winter than in previous years. The configuration schedule should be taken as a guideline, in particular when the requested astronomical targets cannot be observed during the entire winter period (45° sun avoidance circle).

Conf	Scheduling Priority Winter 2006/2007
C	December
A	January – February
B	February – March
C	March – April
D	April – May

We strongly encourage observers to submit proposals for the new set of AB configurations that include 730 and 760 meter baselines. For these proposals we ask to focus on bright compact sources, possibly at high declination.

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

All applications under this call for proposals will have to take into account that the NGRx cannot be operated simultaneously at more than one frequency. Investigators will therefore have to make it clear whether a request is made for one (e.g., 3 mm) or two (i.e. 3 mm and 1 mm) frequency bands. Proposals that need observations in the two bands will have to be duly justified.

Call for Proposals

Proposal category

Proposals should be submitted for one of the six following categories:

`3mm:` Proposals that ask for 3 mm data only.

`1.3mm:` Proposals that ask for 1.3 mm data only.

`dual freq.:` Proposals may ask for observations at 3 mm and 1.3 mm. Note, that these will NOT be simultaneous since the new generation receivers cannot be operated simultaneously in the two frequency bands. Proposals should justify the need of both bands and make it clear which band is priority.

`time filler:` Proposals that have to be considered as backup projects to fill in periods where the atmospheric conditions do not allow mapping, or potentially, to fill in gaps in the scheduling, or periods when only a subset of the standard configurations will be available.

`special:` Exploratory proposals: proposals whose scientific interest justifies the attempt to use the PdB array beyond its guaranteed capabilities. This category includes, for example, non-standard frequencies for which the tuning cannot be guaranteed and more generally all non-standard observations. These proposals will be carried out on a "best effort" basis only.

`SD:` Science demonstration proposals that use the improved figures of the new receivers. Up to 30% of the available observing time might be given to this category. Please note that the science demonstration proposals will **not** be observed should the expected sensitivity not be reached at the beginning of the observing session.

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

Configurations of the six-antenna array

The six-element array can be arranged in the following configurations:

Conf	Stations					
A	W27	E68	N46	E24	E04	N29
B	W12	W27	N46	E23	E12	N20
C	W12	E10	N17	N11	E04	W09
D	W08	E03	N07	N11	N02	W05

The general properties of these configurations are:

- `A` alone is well suited for mapping or size measurements of very compact objects. It provides a resolution of 0.8″ at 100 GHz, ∼0.35″ at 230 GHz.
- `B` alone yields ∼1.2″ at 100 GHz and, in combination with A provides an angular resolution of ∼1.0″ at 100 GHz. In addition, because it contains long, intermediate and some short baselines, it could still be used in a tapered mode when a project is observed in marginal weather conditions despite some loss of sensitivity (for backup projects). It is mainly used for relatively strong sources.
- `C` provides a fairly complete coverage of the uv-plane (low sidelobe level) and is well adapted to combine with D for low angular resolution studies (∼3.5″ at 100 GHz, ∼1.5″ at 230 GHz) and with B for higher resolution (∼1.7″ at 100 GHz, ∼0.7″ at 230 GHz). C alone is also well suited for snapshot and size measurement experiments.
- `D` alone is best suited for deep integration and coarse mapping experiments. This configuration provides both the highest sensitivity and the lowest atmospheric phase noise.

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

Please consult the documentation on the Plateau de Bure configurations and the IRAM Newsletter No. 63 (August 4th., 2005: `../IRAMFR/ARN/aug05/aug05.html`) for further details.

Signal to Noise

The installation of the new generation receivers on the Plateau de Bure corresponds to a significant change of the receivers, transmission lines and backend. Although the new receivers will ultimately provide large gains in sensitivities and bandwidths as compared to the present receivers, they have not yet been tested under real observing conditions. IRAM will do its utmost so that the performances of the interferometer equipped with the new generation receivers will be as close as possible to those which are expected. However, it cannot guarantee these performances for the coming observing session. We consider therefore two categories of proposals that will be rated separately:

1) **science demonstration** proposals ($\sim$ 30% of the total time) that can be observed only with the improved noise temperatures that the new receivers should normally provide. Please check the `SD` bullet if you apply for this category.

2) **regular** proposals that can be done with the current receiver noise temperatures (i.e. the same as last year).

Both types of proposals may take advantage of the extended baselines and of the increased useful bandwidth. Conservatively, we plan to limit the science demonstration proposals to about 1/3 of the available time. In the case the expected sensitivity will not be reached at the beginning of the observing session, the science demonstration proposals will **not** be observed.

The sensitivity calculations can be made by using equation (1) below.

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

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.
  You may use for **regular** proposals $T_{\rm sys}$ = 150 K below 110 GHz, 200 K at 115 GHz, 400 K at 230 GHz for sources at $\geq 20°$
  and for **science demonstration** proposals $T_{\rm sys}$ = 100 K below 110 GHz, 170 K at 115 GHz, 190 K at 230 GHz for sources at $\geq 20°$)
- η is an efficiency factor due to atmospheric phase noise (0.9 at 3 mm, 0.8 at 1.3 mm).
- $N_{\rm a}$ is the number of antennas (6), and $N_{\rm c}$ is the number of configurations: 1 for D, 2 for CD, 2 for BC, and so on.
- $T_{\rm ON}$ is the on-source integration time per configuration in seconds (2 to 8 hours, depending on source declination). Because of 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 1σ noise level which is necessary to achieve each individual goal of a proposal, particularly for projects aiming at deep integrations.

Coordinates and Velocities

The interferometer operates in the J2000.0 coordinate system. For best positioning accuracy, source coordinates must be in the J2000.0 system; position errors up to 0.3″ may occur otherwise.

Please do not forget to specify `LSR` velocities for the sources. For pure continuum projects, the "special" velocity `NULL` (no Doppler tracking) can be used.

Coordinates and velocities in the proposal `MUST BE CORRECT`. A coordinate error is a potential cause for proposal rejection.

Correlator

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 IF=8 GHz. The two 4-GHz bandwidths coincide in the sky frequency scale. The current (narrow-band) 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.

How to observe two polarizations? To observe simultaneously two polarizations, 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 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 short 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.

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 is depending 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 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_INPUT`: selection of the narrow-band correlator inputs
- `SPECTRAL`: spectral unit tuning
- `PLOT`: control of the plot parameters.

A typical session would be:

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

! choice of the correlator windows
narrow_input 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, a sun avoidance circle is enforced at 45 degrees. Please take this into account for your sources and calibrators.

Mosaics

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

Data reduction

Proposers should be aware of constraints for data reduction:

- In general, data should be reduced in Grenoble. Proposers will not come for the observations, but may have to come for the data reduction.
- We keep the data reduction schedule very flexible, but wish to avoid the presence of more than 2 groups at the same time in Grenoble. Please contact us in advance.

- In certain cases, proposers may have a look at the uv-tables as the observations progress. If necessary, and upon request, more information can be provided. Please contact us if you are interested in this possibility.
- 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 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.

Data reduction will be carried out on dedicated computers at IRAM. Remote data reduction is possible, and especially for experienced users of the Plateau de Bure Interferometer. Please contact the Interferometer Science Operations Group (sog@iram.fr) if you are interested in this possibility.

Local contact

A local contact will be assigned to every A or B rated proposal that 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 addition to the scientific review by 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 the documentation 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 Radio Link between the 30-M Telescope and Granada Office

As of Tuesday, July 11th 2006, a new radio link between Pico Veleta and Granada Office has become fully operational.

This new radio link is by a factor of 5 faster than the old one, i.e. the new transfer rate is 36 Mbps, which corresponds in Ethernet terms to a bandwidth of 11.3 Mbps in full duplex (Fig. 1).

Tests have been carried out during which we have obtained an effective Ethernet throughput of 12.5 Mbps, which allows to transfer files of 750 MB between Granada and the 30-M (and vice versa) in only 10 minutes.

In the near future, it is planned to install similar systems between the telescope and the UGR (University of Granada, our gateway to the Internet) and Granada Office and UGR. This will provide redundancy paths to minimize the disconnection of the 30-M and the Granada Office from our own network and the Internet.

Miguel A. MUNÕZ

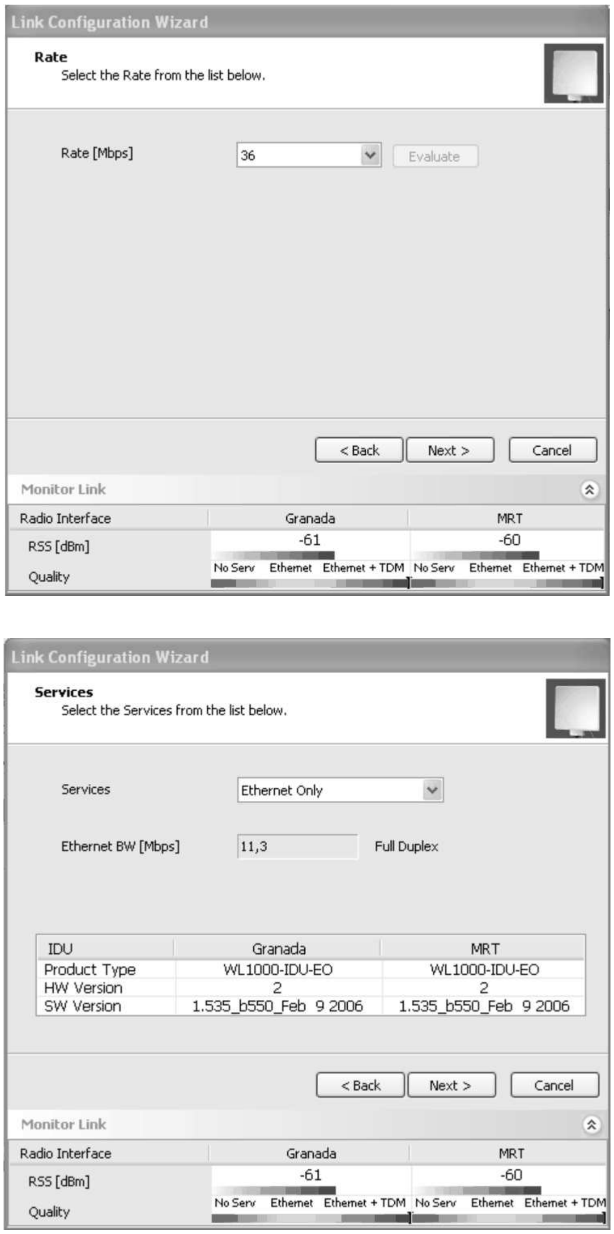

Figure 1: Configuration and monitoring of the radio link connection.

A new CLASS directed toward large data sets

CLASS is a GILDAS (`http://www.iram.fr/GILDAS`) software that has been used for years at the 30m-telescope to reduce and analyse the spectroscopic data. CLASS is also used in many other facilities (e.g. APEX, CSO, HHT, Effelsberg) and it is considered for use by Herschel/HIFI.

The development of CLASS started in the 1980s, and it was therefore written in FORTRAN77 and tailored to reduce pointed observations. On-The-Fly (OTF) support was added in the 90s but it showed limitations as the quantity of OTF data increased quickly over the years. Indeed, the advent of multibeam spectral-line receivers (e.g. HERA at the 30m) has increased the number of spectra by several orders of magnitude thus demanding enhanced software capabilities for the treatment of large datasets. For instance, a fully sampled ($4''$ sampling) map of $1\,\mathrm{deg} \times 1\,\mathrm{deg}$ is done with the HERA receiver in only 30 hours ($4''$/s scanning velocity) resulting in 8×10^5 reduced spectra. This represents 1.6 GB (assuming 500 spectral channels per spectrum). It was thus decided to develop a new version of CLASS, written in FORTRAN90, that would enable an easy reduction of large OTF data sets without loosing, of course, all existing tools that work satisfactorily. Most of the rewriting happened in 2005 and 30m users started to use it successfully during the winter 2005–2006.

The new developments were directed toward a better handling of large data sets. The underlying idea is to enable complex operations on a large quantity of spectra while keeping an easy access to every single spectrum. Both kind of operations are optimized to require the minimum number of typed commands to obtain an efficient user interface. To do this, the same command names may be used on a single spectrum or on a collection of spectra grouped in a given index list. No assumption is made a priori on the relationship between spectra that are selected in the index: e.g. the spectra may belong to many different scans. As some operations require consistent data sets, a new command was introduced to optionally check this consistency.

Among the operations already optimized toward large data sets are listing, visualization and baseline subtraction. Listing capabilities were expanded to quickly display in a compact form the whole file content in a way similar to a table of content. Two-dimensional displays (intensities of all the spectra in the index list as a function of the spectra number and of the velocity/frequency, see Fig. 2) enable the quick inspection of the data (e.g. platforming, ripples, line strength, kinematics). This feature is further improved by the possibility to sort the spectra in different orders (by time, by coordinates, by backend name, etc...). Using those basic capabilities, more sophisticated interactive utilities as the one shown in Fig. 3 have been developed to ease the exploration of the large data sets.

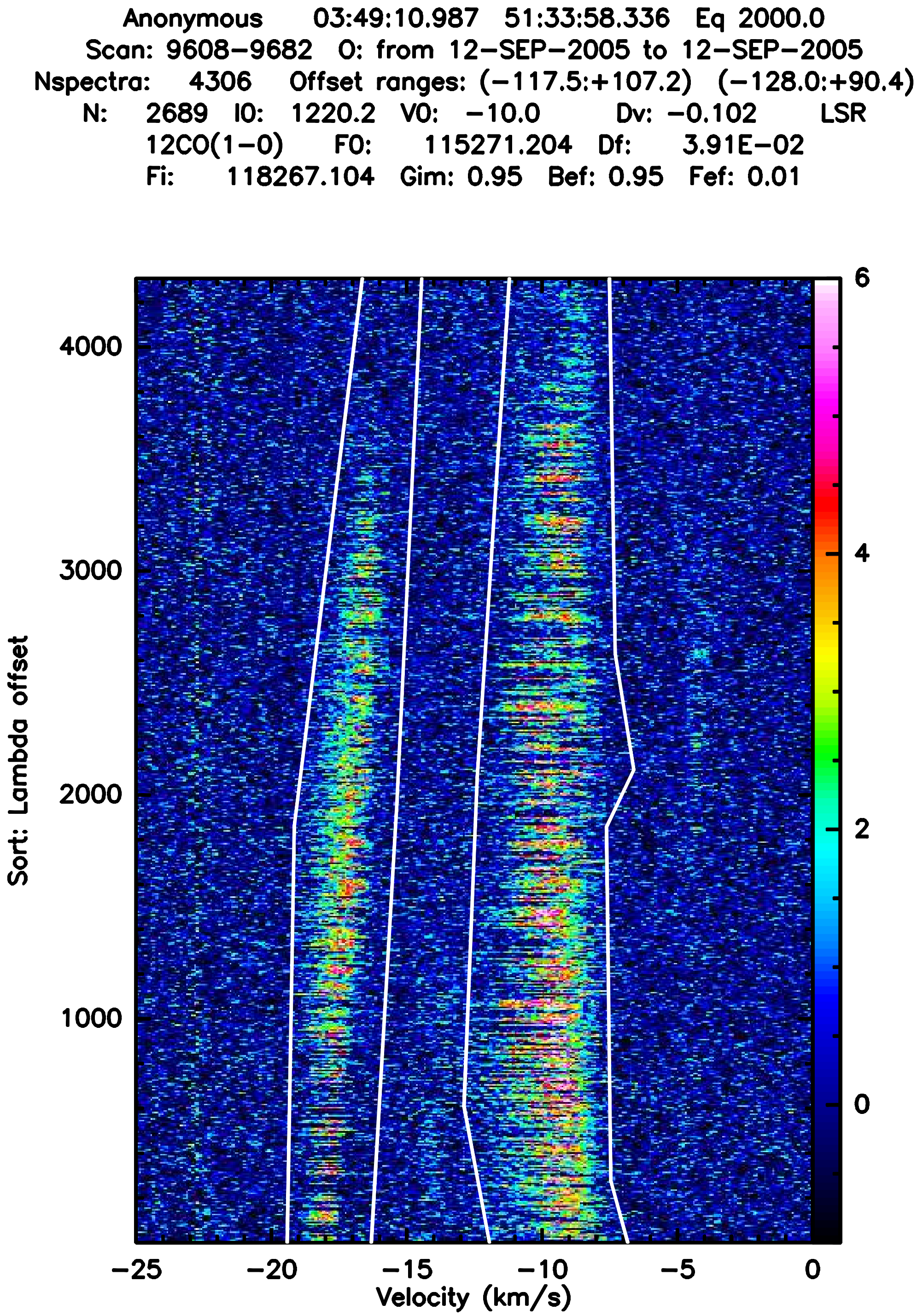

Figure 2: 2D visualization of about 4300 spectra sorted by increasing lambda offset. The 2 polygons displayed in white enable to define the area that contains the signal and should therefore not be used for baseline fitting.

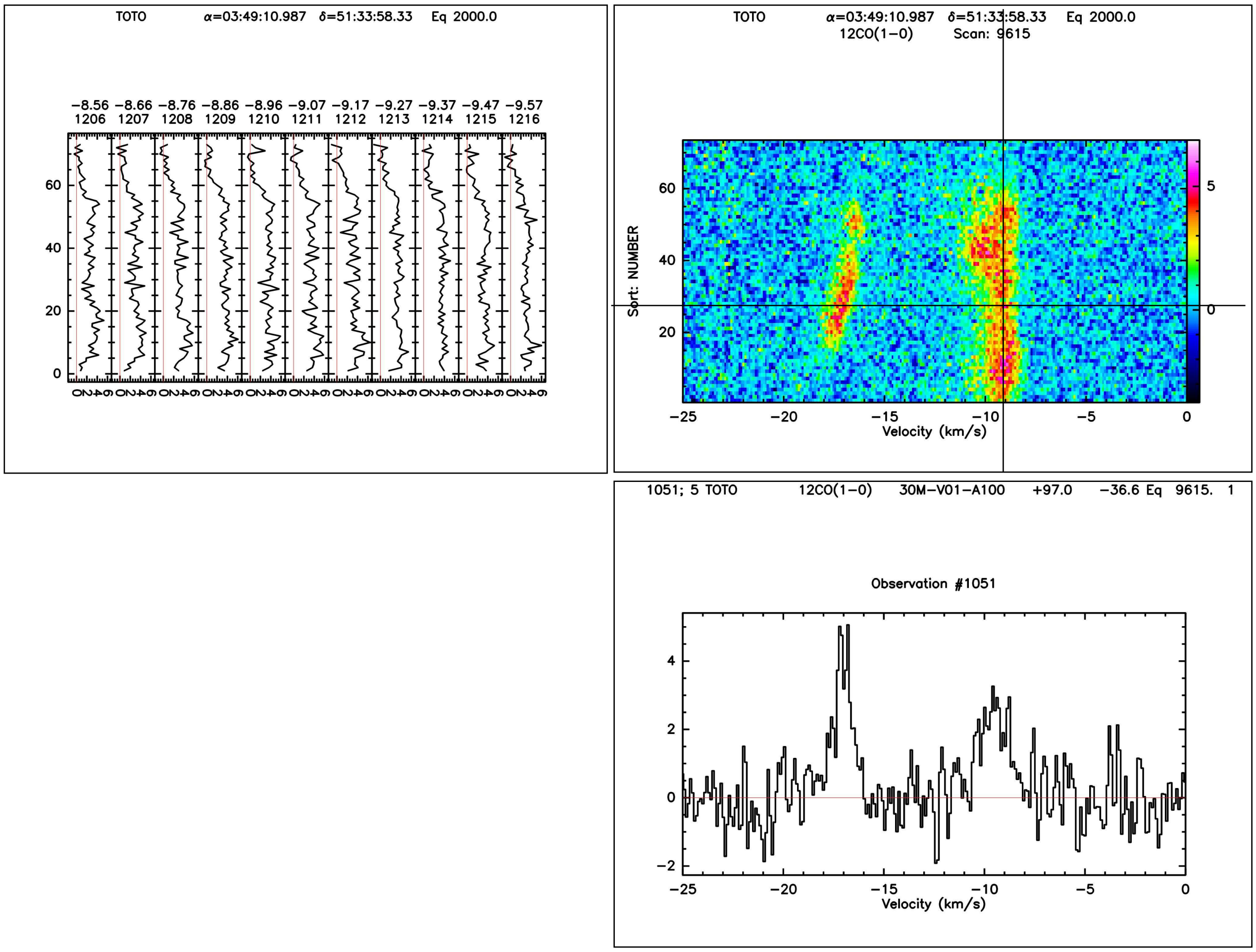

Figure 3: Data exploration utility using position/velocity plots with interactive cuts at constant position or velocity.

Baseline subtraction being a crucial operation in spectral line data reduction, we have extended the former capabilities of CLASS to enable the definition of baseline windows on an arbitrary number of spectra through the drawing of an arbitrary number of polygons on the two-dimensional displays (see Fig. 2).

Others improvements were also implemented. For instance, the building of images from non-gridded spectra was fully rewritten to enable a better control of the parameters (resolution, grid definition, etc...) by the users. Among the various analysis tools of CLASS, the fitting ones have been grouped in a new FIT language for clarity. All GREG utilities, including the facilities to visualize gridded spectra cubes (e.g. displaying channel maps or position-velocity diagrams, with interactive possibilities), are now available from CLASS. Finally, the documentation has been updated, taking into account previous lacks and new features. For the coming years, it is planned to anticipate the increase in the bandwidths of the instruments by removing CLASS limitations in the definition of the frequency/velocity axis of the spectra (i.e. definition of non-linear axis) while continuing to enlarge the capabilities of CLASS for reduction and analysis of large datasets from either single or multibeam receivers.

A technical memo ("CLASS Evolution: I. Improved OTF support") describing in details all the new features is available at

http://www.iram.fr/GENERAL/reports/class-evol1.pdf

Starting with the mar06 release of GILDAS, both flavors of CLASS (old and new) are compiled by default. They are thus directly available, after GILDAS installation, by typing `class` or `class90` at the shell prompt.

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Scientific Results in Press

DUST FORMATION AND MASS-LOSS IN LONG-PERIOD VARIABLE STARS

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Abstract:
An approach to describe dust forming circumstellar shells around pulsating Asymptotic Giant Branch stars is presented with the aim of understanding the mass-loss mechanism of these objects. The resulting model structures are discussed and the model predictions are compared with suitable observations. Finally, some implications of the mass-loss process on the evolution of the mass-losing star are discussed.

Appeared in: EAS Publications Series, Vol. 19, 167

ADAPTING AND EXPANDING INTERFEROMETRIC ARRAYS

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Abstract:
We outline here a simple yet efficient method for finding optimized configurations of the elements of radioastronomical interferometers with fixed pad locations. The method can be successfully applied, as we demonstrate, to define new configurations when changes to the array take place. This may include the addition of new pads or new antennas, or the loss of pads or antennas. Our method is based on identifying which placement of elements provides the most appropriate u-v plane sampling for astronomical imaging.

Appeared in: ApJS 164, 552

FIRST DETECTION OF HCO+ EMISSION AT HIGH REDSHIFT

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Abstract:
We report the detection of $HCO^+(J = 1 \leftarrow 0)$ emission toward the Cloverleaf quasar ($z = 2.56$) through observations with the Very Large Array. This is the first detection of ionized molecular gas emission at high redshift ($z > 2$). HCO^+ emission is a star formation indicator similar to HCN, tracing dense molecular hydrogen gas [$n(H2) \simeq 10^5$ cm^{-3}] within star-forming molecular clouds. We derive a lensing-corrected HCO^+ line luminosity of $L'_{HCO^+} = 3.5 \times 10^9$ K km s^{-1} pc^2. Combining our new results with CO and HCN measurements from the literature, we find an HCO^+/CO luminosity ratio of 0.08 and an HCO^+/HCN luminosity ratio of 0.8. These ratios fall within the scatter of the same relationships found for low-z star-forming galaxies. However, an HCO^+/HCN luminosity ratio close to unity would not be expected for the Cloverleaf if the recently suggested relation between this ratio and the far-infrared luminosity were to hold. We conclude that a ratio between HCO^+ and HCN luminosity close to 1 is likely due to the fact that the emission

from both lines is optically thick and thermalized and emerges from dense regions of similar volume. The CO, HCN, and HCO^+ luminosities suggest that the Cloverleaf is a composite active galactic nucleus-starburst system, in agreement with the previous finding that about 20% of the total infrared luminosity in this system results from dust heated by star formation rather than heating by the active nucleus. We conclude that HCO^+ is potentially a good tracer for dense molecular gas at high redshift.

Appeared in: ApJ 645, L13

Molecular gas in the Andromeda galaxy

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Abstract:

Aims. We study the distribution of the molecular gas in the Andromeda galaxy (M 31) and compare this with the distributions of the atomic gas and the emission from cold dust at $\lambda = 175\mu$m.

Methods. We obtained a new $^{12}CO(J = 1-0)$-line survey of the Andromeda galaxy with the highest resolution to date (23″, or 85 pc along the major axis), observed On-the-Fly with the IRAM 30-m telescope. We fully sampled an area of $2° \times 0\overset{\circ}{.}5$ with a velocity resolution of 2.6 km s^{-1}. In several selected regions we also observed the ^{12}CO(2-1)-line. Results.Emission from the ^{12}CO(1-0) line was detected from galactocentric radius $R = 3$ kpc to $R = 16$ kpc with a maximum in intensity at $R \sim 10$ kpc. The molecular gas traced by the (velocity-integrated) (1-0)-line intensity is concentrated in narrow arm-like filaments, which often coincide with the dark dust lanes visible at optical wavelengths. Between R=4 kpc and R=12 kpc the brightest CO filaments define a two-armed spiral pattern that is described well by two logarithmic spirals with a pitch angle of 7° −8° . The arm-interarm brightness ratio averaged over a length of 15 kpc along the western arms reaches about 20 compared to 4 for H I at an angular resolution of 45″. For a constant conversion factor X_{CO}, the molecular fraction of the neutral gas is enhanced in the spiral arms and decreases radially from 0.6 on the inner arms to 0.3 on the arms at $R \simeq 10$ kpc. The apparent gas-to-dust ratios $N(HI)/I_{175}$ and $(N(HI) + 2N(H_2))/I_{175}$ increase by a factor of 20 between the centre and $R \simeq 14$ kpc, whereas the ratio $2N(H_2)/I_{175}$ only increases by a factor of 4.

Conclusions. Either the atomic and total gas-to-dust ratios increase by a factor of 20 or the dust becomes colder towards larger radii. A strong variation of X_{CO} with radius seems unlikely. The observed gradients affect the cross-correlations between gas and dust. In the radial range $R = 8 - 14$ kpc total gas and cold dust are well correlated; molecular gas correlates better with cold dust than atomic gas. The mass of the molecular gas in M 31 within a radius of 18 kpc is $M(H_2) = 3.6 \times 10^8 M_\odot$ at the adopted distance of 780 kpc. This is 7% of the total neutral gas mass in M 31.

Appeared in: A&A 453, 459

Dissipative structures of diffuse molecular gas. I. Broad HCO+ (J=1-0) emission

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Abstract:

Aims: Specific chemical signatures of the intermittent dissipation of turbulence were sought in diffuse molecular clouds.

Methods: We observed HCO^+(1-0) lines and the two lowest rotational transitions of ^{12}CO and ^{13}CO with an exceptional signal-to-noise ratio in the translucent environment of low-mass dense cores, where turbulence dissipation is expected to take place. Some of the observed positions belong to a new kind of small-scale structure identified in CO(1-0) maps of these environments as the locus of non-Gaussian velocity shears in the statistics of their turbulent velocity field, i.e. singular regions generated by the intermittent dissipation of turbulence.

Results: We report the detection of broad HCO^+(1-0) lines (10 mK$< T_{A^*} < 0.5$ K). We achieve the interpretation of ten HCO^+ velocity components by conducting it in conjunction with that of the associated optically thin ^{13}CO emission. The derived HCO^+ column densities span a broad range, $10^{11} < N(HCO^+)/\Delta v < 4 \times 10^{12}$ cm^{-2}/km s^{-1}, and the inferred HCO^+ abundances, $2 \times 10^{-10} < X(HCO^+) < 10^{-8}$, are more than one order of magnitude above those produced by steady-state chemistry in gas that is weakly shielded from UV photons, even at large densities. We compare our results with predictions of non-equilibrium chemistry, swiftly triggered in bursts of turbulence dissipation and followed by a slow thermal and chemical relaxation phase, assumed to be isobaric. The set of values derived from observations, i.e. large HCO^+ abundances, temperatures in the range of 100-200 K, and

densities in the range $100 - 10^3$ cm^{-3}, unambiguously belongs to the relaxation phase. In contrast, the kinematic properties of the gas suggest that the observed HCO^+ line emission results from a space-time average in the beam of the whole cycle followed by the gas and that the chemical enrichment is made at the expense of the non-thermal energy. Last, we show that the "warm chemistry" signature (i.e. large abundances of HCO^+, CH^+, H_2O, and OH) acquired by the gas within a few hundred years, which is the duration of the impulsive chemical enrichment, is kept over more than a thousand years. During the relaxation phase, the H_2O/OH abundance ratio stays close to the value measured in diffuse gas by the SWAS satellite, while the OH/HCO^+ ratio increases by more than one order of magnitude.

Appeared in: A&A 452, 511

Probing isotopic ratios at z = 0.89: molecular line absorption in front of the quasar PKS 1830-211

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Abstract:
With the Plateau de Bure interferometer, we have measured the C, N, O and S isotopic abundance ratios in the arm of a spiral galaxy with a redshift of 0.89. The galaxy is seen face-on according to HST images. Its bulge intercepts the line of sight to the radio-loud quasar PKS 1830-211, giving rise at mm wavelengths to two Einstein images located each behind a spiral arm. The arms appear in absorption in the lines of several molecules, giving the opportunity to study the chemical composition of a galaxy only a few Gyr old. The isotopic ratios in this spiral galaxy differ markedly from those observed in the Milky Way. The $^{17}O/^{18}O$ and $^{14}N/^{15}N$ ratios are low, as one would expect from an object too young to let low mass stars play a major role in the regeneration of the gas.

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The IRAM Newsletter is edited by Michael Bremer at IRAM-Grenoble (e-mail address: `bremer@iram.fr`).

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