IRAM Newsletter

Contents

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IRAM Summer School 2001 – First Announcement

— Observing Techniques and Applications —

September 14-21, 2001

Pradollano (Sierra Nevada, Spain)

The purpose of the school is to attract new users to current and future mm-telescopes. This first school organized by IRAM in Spain will concentrate on single dish mm-astronomy.
There will be lectures on mm-techniques and their application to different areas of research, scientific highlight talks, observations with the IRAM 30-m telescope and a lab course on "Data analysis and interpretation".

Topics:
1. mm-astronomical observing techniques
2. Inter- and circumstellar chemistry
3. Physical conditions of the interstellar medium
4. Extragalactic astronomy and cosmology
5. Imaging

Lecturers: F. Bertoldi (MPIfR), J. Cernicharo (CSIC), R. Mauersberger (IRAM), K. Menten (MPIfR) and others, plus five teaching assistants.
LOC: F. Damour, A. Duflos, T. Gallego, U. Lisenfeld, J. Lobato, R. Mauersberger

Applications will be accepted from young scientists with little previous experience in mm-astronomy. The course is limited to 30 students, who will be selected on the basis of their CV and references. Financial support for travel and lodging for young researchers might become available.

Further information can be found on http://www.iram.es/summerschool
Letters of intent to participate can already be sent to: summerschool@iram.es

The 2002 IRAM Summer School will be devoted to Interferometry as in 1998 and 2000.

Rainer MAUERSBERGER

Calendar

March 1st, 2001 18:00h (MET):
Deadline for the submission of observing proposals for the period May 15, 2001 to Nov 15, 2001

April 2/3, 2001:
IRAM Program Committee meeting in Granada

April 2001: Scientific Advisory Committee

June 28/29 2001: IRAM Council

Future Means of Access to the Plateau de Bure

Following the study of ten different options which were characterized in terms of a large number of criteria, amongst which the safety and reliability (= 24 hour availability during 365 days per year) played key roles, which had been completed in a preliminary form in October 2000, discussions took place with the Conseil General at Gap, and with the Conseil Regional in Marseille.

As aleady reported in the previous Newsletter issue, there is a local interest to develop further the already well developed skiing (and summer vacation) area at Superdevoluy, and – on a longer timescale – a scientific outreach project in connection with the observatory installations.

It appears as if the interests of CNRS/INSU and IRAM on one side, and the interests of the local authorities could best be served by a combination of a telecabin and a 'funiculaire' solution. The telecabin would have the capacity to bring a larger number of people up to about 2000m, where skipistes are maintained, and the 'funiculaire' would go from there to the observatory at 2550m, and would at least initially only be used for IRAM purposes.

Consequently, a $2^{\rm nd}$ study contract has been signed between INSU and SCETAUROUTE aiming at a more detailed technical study of such a solution but also to look at the operational and maintenance aspects. In parallel the economic aspects will be analyzed. The results should be available by the end of February at latest.

If the results from these studies confirm the feasibility of this solution, the Technical Department attached to the Conseil General in Gap would take over the project leadership, provided that a partnership agreement can be signed between all parties involved, i.e. the CNRS/INSU, the Conseil Regional, and the Conseil General.

Michael GREWING

Changed Responsibilities – New Task Assignments

Following the return of Anne Dutrey to the Observatoire de Grenoble, Roberto NERI has taken over the responsibility of coordinating the activities related to the reduction and archiving of PdBI data, including the assignment of local contact astronomers.

At the same time, Helmut WIESEMEYER took over the role of the IRAM Project Scientist for the NIC bolometer software, a task that had previously been assigned to Roberto Neri.

Raphael MORENO is now responsible for the Plateau de Bure calibration task.

Michael GREWING

Personnel Changes

IRAM Grenoble

Frédéric GUETH has returned to the astronomer's group in Grenoble last October, and Nathalie FAVARIO has joined the IRAM administration. In 2001, Philippe NOUVEL will be working with the receiver group, and Yvan MOURIER is starting as an operator at the Plateau de Bure Interferometer.

At the end of 2000, Emmanuel DARTOIS has left for the University of Paris.

Michael BREMER

News from the 30m Telescope

Fluxes of pointing sources

We monitor the fluxes of quasars used as pointing sources at the IRAM 30m telescope. The most recent results can be found on our WWW pages at:

http://www.iram.es/Telescope/latest_fluxes.txt

This list is intended to help with the selection of pointing sources. A publication of the collected flux monitoring data is in preparation. Most results are available on request; please contact UL and HU.

Ute LISENFELD and Hans UNGERECHTS

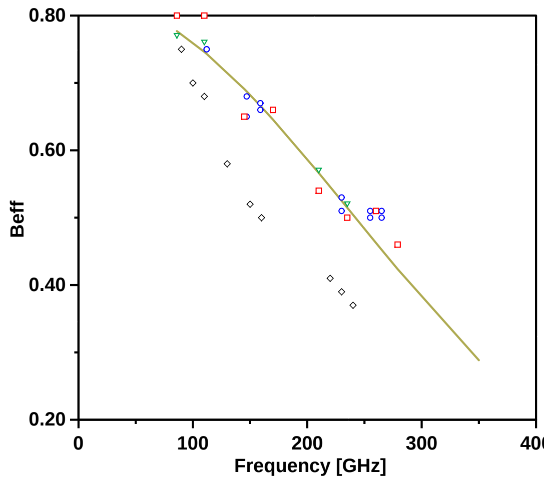

Figure 1: The beam efficiencies measured during the last year together with the best-fit Ruze function. The circles denote measurements carried out in November 2000, triangles and squares measurement done in October 1999 and January 2000 and the diamonds the values of $B_{\rm eff}$ valid before July 1997.

Efficiencies at the 30m telescope

The forward efficiencies, $F_{\rm eff}$, have changed in December 2000 due to the installation of a new reflecting ring around the subreflector. The new values are:

Receiver	$\mathbf{F_{\rm eff}}$
A100/B100	0.95
C150/D150	0.93
A230/B230	0.91
C270/D270	0.88

The beam efficiency, $B_{\rm eff}$, has been measured regularly during the last year. The values can be well fitted (see Fig. 1) by the theoretically predicted Ruze function:

$$B_{\rm eff} = 1.2\epsilon_0 \exp[-(4\pi R\sigma/\lambda)^2] \qquad (1)$$

with $R\sigma = 0.07$, $\epsilon_0 = 0.69$ and λ the wavelength in mm. These are the values recommeded to use. They are automatically set in OBS when defining the receivers in the case you are using the main beam temperature scale (i.e. "set scale MAIN_BEAM").

In Fig. 1 we also include the value of $B_{\rm eff}$ valid before July 1997. The beam efficiency has increased considerably since then, especially at high frequencies due to successful panel adjustment based on the results of the holography measurements during the last years.

A summary of the efficiencies can also be found under the URL http://www.iram.es/Technical/-Telescope_summary/news.html

Ute LISENFELD and Albrecht SIEVERS

Status of the VLBI at Pico Veleta

The October 2000 VLBI campaign was the first time we have used a recording mode of 256 Mbit/second on thin tape. A fringe search done by D. Graham (MPIfR Bonn) shows good quality fringes (SNR 30–100 dB) for different sources and baselines combinations using the 30m telescope as reference. This indicates that both the new recorder r/w head installed last year and the mechanical upgrade to allow thin tape recording are working fine.

Salvador SANCHEZ

OBS News: Equivalent Cold-Load Temperatures

The calibration system for the A, B, C and D receivers has the inconvenient feature that the cold-load temperature "seen" by any of the eight receivers varies with the tuned frequency over several degrees Kelvin.

Since the beginning of this year OBS interpolates this cold-load temperature from tables. Some of the tables do not completely cover all the tuneable frequency range. If this happens OBS gives a warning and takes the first (or the last) value in the table. The tables are used whenever the RECEIVER command is used in OBS. The interpolated cold-load temperatures can then be overwritten with the SET CHOPPER command.

Albrecht SIEVERS

Latest News from the NIC Development Group

The arrival of new instrumentation and observing modes makes it necessary to keep track with software development. You can follow the progress under http://iram.fr/GS/nic.html, the official IRAM web page for bolometer software.

Due to major changes in the near future, we plan to provide NIC users with latest news on software releases and debugging. Therefore, we kindly invite you to subscribe the NIC users list to keep you regularly informed about the latest developments. Your suggestions and comments are welcome.

Dominique BROGUIÈRE, Roberto NERI, Albrecht SIEVERS and Helmut WIESEMEYER

Bad weather at the observatory?

In case of bad weather, your stay at the observatory can still be productive and entertaining. If you need any book from the Granada library, just phone Esther Franzin (franzin@iram.es) and we will send it up with the next transport.

We have some interactive CD-ROMs for learning and practising Spanish or English. There is also a copy of the Encyclopedia Britannica on CD-ROM. Just ask the operator.

Rainer MAUERSBERGER

Souvenirs

T–shirts, polos and sweatshirts are available in the Granada office for purchase. These items are sold at cost price and have printed the 30m logotype. Various ceramic items are also available. Contact either Esther Franzin or Dave John (CdE).

David L. JOHN

Call for Observing Proposals on the 30m Telescope

Summary

The next deadline for the submission of observing proposals for the IRAM 30m telescope is March 1st, 2001 18:00h (MET). The scheduling period extends from May 15, 2001 to Nov 15, 2001, covering roughly the summer period at Pico Veleta.

Two types of proposals will be considered:

1. proposals using the observatory's heterodyne receivers at wavelengths of 3, 2, 1.3 and 1.1 mm.
2. proposals using a 1.2mm bolometer array with 37 pixels.

Emphasis will be put on observations at the longer wavelengths (3 amd 2 mm). In total, about 3000 hours of observing time will be available, which should allow the 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 ?

Encouraged by considerable demand for bolometer observations, the demonstrated success of skynoise suppression algorithms in certain observing modes, and the more stable hard- and software situation available with MAMBO, we invite proposals using the MPIfR 37 channels bolometer array during the summer 2001 semester on an experimental basis.

In view of the less transparent and considerably less stable atmosphere during summer days, bolometer proposals should concentrate on sources stronger than 1 mJy visible during night time. Depending on the demand, we expect that up to 20% of the time available may be allocated to bolometer observations. During some additional time, the bolometer may be kept on standby for target–of–opportunity and other urgent projects. In order to improve the observing efficiency, IRAM staff may propose to combine shorter bolometer proposals and observe them in service mode.

Projects can now be performed remotely from any of our remote observing stations in Granada, Grenoble, Bonn and, with some restrictions, Paris (ENS, contact: David Teyssier, teyssier@lra.ens.fr). As experience shows, remote observing is an interesting alternative if the total observing time is less than about 40 hours.

Applications

Valid proposals consist of the official cover page, up to two pages of text describing the scientific aims, and up to two more pages of figures, tables, and references. The official cover page, in postscript or in LaTeXformat, may be obtained by anonymous ftp from `iram.fr` in directory `dist/proposal`, as well as a Latex style file `proposal.sty`; or through the IRAM 30m web page at URL `http://iram.fr/PV/veleta.html`. In case of problems, contact the secretary, Cathy Berjaud (e–mail: `berjaud@iram.fr`). *Do not use characters smaller than 11pt*, which could make your proposal illegible when copied or faxed.

Proposals may be submitted in one of the three following ways:

– by the web–based electronic submission facility (preferred). Please consult the detailed instructions on the web. The facility will be opened three weeks before the deadline.
– by fax to number: (33/0) 476 42 54 69.
– by ordinary mail addressed to:

IRAM Scientific Secretariat,
300, rue de la Piscine,
F-38406 St. Martin d'Hères, France

We strongly encourage submission through the web–based facility. More than three quarters of the proposals were sent in this way for the last deadline. Proposals sent by E–mail are not accepted.

All proposals must reach the Secretariat before March 1st, 2001 18:00h (MET). The Principal Investigator will receive by return mail an acknowledgement of reception and a proposal number. To avoid the allocation of several numbers per proposal, send *only one copy* of your proposal, either electronically, by ordinary mail, or by fax.

Proposals containing grey scale plots should be submitted electronically to avoid deterioration of image quality in the copying. Color plots will be printed/copied in grey scale. If the proposers want their color plots to be passed on to the program committee, the **entire proposal** must be sent in by ordinary mail in **12 copies**.

On the title page, you must fill in the line 'special requirements' if you request either polarimetric observations, service or remote observing, or specific dates for time dependent observations. If there are periods when you cannot observe for personal reasons, please specify them here; beware, however, that such additional restrictions could make your observations difficult or impossible to schedule.

We insist upon receiving, with proposals for heterodyne receivers, a complete list of frequencies corrected for source redshift (to 0.1 GHz). Also specify on the cover sheet which receivers you 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 in carefully your source list. This list *must contain all the sources* (and only those sources) for which you request observing time. To allow electronic scanning of your source parameters, your list must be typed or printed following the format indicated on the proposal form (no hand writing, please). If your source list is long (e.g. more than 15 sources) you may print it on a separate page keeping the same format.

The scientific aims of the proposed programme should be explained in 2 pages of text *maximum*, plus up to two pages of figures, tables, and references. Proposals should be self-explanatory, clearly state these aims, and explain the need of the 30m telescope. The amount of time requested should be carefully estimated and justified. It should include all overheads (see below).

A scientific project should not be artificially cut into several small projects, but should rather be submitted as one bigger project, even if this means 100–150 hours.

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

In all cases, indicate on the first page whether your proposal is (or is not) the *resubmission* of a previously rejected proposal or the *continuation* of a previously accepted 30m telescope proposal. We strongly recommend to state very briefly in the introduction why the proposal is being resubmitted (e.g. improved scientific justification) or is proposed to be continued (e.g. last observations wiped out by bad weather).

Reminders

A handbook ("The 30m Manual") collecting most of the information necessary to plan 30m telescope observations is available [10]. The report entitled "Calibration of spectral line data at the IRAM 30m telescope" explains in detail the applied calibration procedure. Both documents can be retrieved through the IRAM web pages in Granada (http://www.iram.es) and Grenoble (http://iram.fr/PV/veleta.html). A catalog of well calibrated spectra for a range of sources and transitions (Mauersberger et al. [13]) is very useful for monitoring spectral line calibration.

The On-the-Fly observing mode (OTF) is available for heterodyne observations. Considerable progress was made in making the control of the observations and the data reduction user friendly. Documentation is available on the Granada web page. Due to the complexity of the OTF observing mode we advise proposers without a demonstrated experience of this technique on the 30m telescope to contact, or involve in their proposal, an astronomer with such experience. Ute Lisenfeld of the Granada staff (`ute@iram.es`) serves as the principal contact in OTF matters.

Frequency switching is available. It yields acceptable baselines only for sources with very narrow lines (2 km/s or less) within certain limitations (maximum frequency throw of 45 km/s, backends, phase times etc.; for details see [8]).

Finally, to help us keeping up a computerized source list, we ask you to fill in your 'list of objects' as explained before.

Observing time estimates

This matter needs special attention as a serious time underestimate may be considered as a sure sign of sloppy proposal preparation. Observing time estimates must take into account:

- integration time on source and comparison field(s), including overheads for ON/OFF telescope motions, deadtime for device switching and data transfer.
- pointing, focus, continuum and/or line calibrations
- telescope slew motions
- receiver tunings (for heterodyne observations),

A technical report explaining how to estimate the telescope time needed to reach a given sensitivity level in various modes of observation was published in the January 1995 issue[1] of the IRAM Newsletter [9]. It has been included in the 30m telescope Manual [10].

In order to facilitate the rather complex calculation of observing time we strongly recommend the easy–to–use **Time Estimator** on our web pages. The tool gives sufficiently accurate estimates of the total observing time

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

and handles the vast majority of both heterodyne and bolometer observing modes. Now in its version 2.2, it includes the new 4 MHz filterbanks. Extensive on–line help is provided. Questions can be addressed to P. Hily–Blant (hilyblan@iram.es) *Proposers are asked to use this tool whenever applicable.*

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

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

Service observing

To facilitate the execution of short ($\leq$8 h) programmes, we propose "service observing" for some easy to observe (e.g. short, single source) programmes *with only one set of tunings.* Observations are made by the local staff using precisely laid–out instructions by the principal investigator. For this type of observation, we request an acknowledgement of the IRAM staff member's help in the forthcoming publication. If you are interested by this mode of observing, specify it as a "special requirement" in the proposal form. IRAM will decide which proposals can actually go to that mode.

Remote observing

This observing mode where the remote observer actually controls the telescope very much like on Pico Veleta, is available from the downtown Granada office, from MPIfR in Bonn, from IRAM Grenoble and, with restrictions, from the Radioastronomy Lab at the ENS in Paris. This observing mode is limited to projects without particular technical demands and to experienced 30m users. The prospective remote observer should note "remote observing from Grenoble, Granada, Bonn or Paris" as a special requirement in the proposal cover sheet.

Remote observers affiliated with the MPIfR or other institutes near Bonn should contact F. Bertoldi (bertoldi@mpifr-bonn.mpg.de) or D. Muders (muders@mpifr-bonn.mpg.de) at MPIfR for a short introduction into the remote observing station. Remote observers from Paris should contact David Teyssier (teyssier@lra.ens.fr). The Bonn and Paris stations are not maintained by IRAM. It is therefore the responsibility of the observer to ensure with their local contact that the stations are tested sufficiently in advance, and they have access to the respective offices.

We recommend that remote observers leave their private and/or mobile phone numbers to the operator at Pico Veleta and prepare the catalogs in advance so that in the unlikely case of a failure, the observations can be performed by the astronomer on duty or the operator.

Remote observers in or near Grenoble contact C. Thum or H. Wiesemeyer at IRAM. Observers visiting the 30m might opt to do some of their observing from Granada if it eases their travel constraints. In this case, a Granada astronomer should be contacted as soon as possible.

Technical Information about the 30m Telescope

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

Heterodyne Receivers

Eight new generation 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, being either horizontal or vertical in the Nasmyth cabin. Up to four of the receivers can be combined for simultaneous observations in the four ways depicted in Tab. 1. Also listed are typical system temperatures which apply to normal summer weather (7mm of water) at the center of the tuning range and 45° elevation. All new generation receivers are tuned entirely from the control room. Experience shows that it normally takes about 15 min to tune four such receivers.

General point about receiver operations

We recommend that observers send a list of their frequencies to Granada in time, in particular if frequencies near the edges of the tuning range are requested. For late arrivals (less than 2 weeks in advance), or a large number of frequencies, there is no guarantee for a prior test of the requested tunings.

Polarimeter

The prototypal IF polarimeter is available on a restricted basis. The instrument is designed for narrowband (40 MHz) line and continuum polarimetry. It needs two

Table 1: Heterodyne receivers available for the summer 2001 observing season. Performance figures are based on recent measurements at the telescope. T^*_{sys} is the SSB system temperature in the T^*_A scale at the nominal center of the tuning range, assuming average winter conditions and 45° elevation. g_i is the rejection factor of the image side band. ν_{IF} and $\Delta\nu_{IF}$ are the IF center frequency and width.

receiver	polar–ization	combinations 1	2	3	4	tuning range GHz	T_{Rx}(SSB) K	g_i dB	ν_{IF} GHz	$\Delta\nu_{IF}$ GHz	T^*_{sys} K	remark
A 100	V	1		3		80 - 115.5	45 - 65	> 20	1.5	0.5	120	
B 100	H	1			4	81 - 115.5	60 - 85	> 20	1.5	0.5	120	
C 150	V		2		4	129 - 183	70 - 115	15 - 25	4.0	1.0	200	3
D 150	H		2	3		129 - 183	65 - 150	8 - 17	4.0	1.0	200	
A 230	V	1		3		197 - 266	85 - 185	12 - 17	4.0	1.0	450	1
B 230	H	1			4	197 - 266	95 - 160	12 - 17	4.0	1.0	450	1
C 270	V		2		4	241 - 281	125 - 290	10 - 20	4.0	1.0	1000	2,3
D 270	H		2	3		241 - 281	130 - 300	9 - 13	4.0	1.0	1000	2

1: noise increasing with frequency
2: performance at $\nu < 275$ GHz; noisier above 275 GHz.
3: noise temperatures are preliminary

orthogonally polarized receivers as input and it generates 4 signals from which spectra of all four Stokes parameters can be derived. The tests made so far have demonstrated the viability of the concept for point sources. In particular, drift of the relative phase between the two receivers was found to be sufficiently slow so that it can be calibrated. A preliminary description of the instrument is available on the web at URL http://iram.fr/˜thum.html.

Polarimetry proposals are invited with the restriction that the target sources are not larger than the main beam.

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

MPIfR Bolometer array

The 37–pixel array consists of 3 concentric hexagonal rings of horns centered on the central horn. Spacing between horns is $\simeq 20''$. Each channel has a a HPBW of $11''$. The arrays are mostly used in two basic observing modes, ON/OFF and mapping.[2] We expect that the ON/OFF typically reaches an rms noise of $\sim$ 2 mJy in 10 min of total observing time (about 200 sec of on source integration time) under "normal summer conditions" (pwv 7 mm and a stable atmosphere, i.e. no clouds, no turbulence). This corresponds to a nominal sensitivity of $\simeq$ 40mJy/$\sqrt{\text{Hz}}$. It requires that skynoise can be subtracted, which is efficiently possible only for point sources. For mapping more extended sources, where skynoise cannot be easily removed, the noise is twice as high, and, hence, the integration time must be quadrupled to reach the same signal–to–noise ratio. Please consult the Time Estimator on the Observatory's web page.

The minimum useful integration time per position should be 10 minutes plus an overhead of 10 minutes.

If noise levels (<1 mJy) are requested that may be reachable only in exceptionally stable weather, the proposers must clearly say so in their time estimate paragraph. Such proposals will, however, be particularly scrutinized.

The bolometers are used with the wobbling (typically at a rate of 2 Hz in azimuth) secondary mirror. The orientation of the beams on the sky changes with hour angle due to parallactic and Nasmyth rotation, as the array is fixed in Nasmyth coordinates. Special software is made available at the telescope for data reduction (NIC [11] and MOPSI). Time estimators for planning ON/OFF or mapping observations are also available [11, 17].

Efficiencies and error beam

Extensive work during the last years in measuring and setting the telescope surface has resulted in significantly improved aperture and beam efficiencies which have increased nearly a factor 2 at the highest frequencies accessible to the telescope (see report by U. Lisenfeld and A. Sievers elsewhere in this Newsletter). The current numbers are shown in Table 2.

At 1.3 mm (and a fortiori at shorter wavelengths) a large fraction of the power pattern is distributed in an error beam which can be approximated by two Gaussians of FWHP $\simeq 170''$ and $800''$ (see [16, 1] for details). Astronomers should take into account this error beam when

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

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

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

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

converting antenna temperatures into brightness temperatures.

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

Backends

The following four spectral line backends are available which can be individually connected to any receiver.

- The 1 MHz filterbank consisting of 4 units. Each unit consists of 256 channels with 1 MHz spacing and can be connected to different or the same receivers giving bandwidths between 256 MHz and 1024 MHz. The maximum bandwidth is available for only one receiver, naturally one having a 1 GHz wide IF bandwidth. Connection of the filterbank in 1 GHz mode presently excludes the use of any other backend with the same receiver.
  Other configurations of the 1 MHz filterbank include a setup in 2 units of 512 MHz connected to two different receivers, or 4 units of 256 MHz width connected to up to four (not necessarily) different receivers. Each unit can be shifted in steps of 32 MHz relative to the center frequency of the connected receiver.
- The 100 kHz filterbank, consisting of 256 channels of 100 kHz. It can be split into two halves, each movable inside the 500 MHz if bandwidth, and connectable to two different receivers.
- The autocorrelator backend with up to 2048 channels. Available nominal resolutions are 10, 20, 40, 80, 320 and 1250 kHz. Nominal bandwidths range from 20 MHz to 2 × 512 MHz, depending on resolution. The correlator can be split into 8 independent subbands, each of which can be configured individually, shifted inside a 500 MHz IF band, and connected to the same or different receivers. For the larger bandwidths (i.e. more than one subband of 80 MHz) there is often a problem of platforming, i.e. baselines from the different subbands have slightly different power levels.
- The 4 MHz filterbank is available with a few restrictions. It consists of two units, each with 256 channels (spacing of 4 MHz, spectral resolution 6.2 MHz) covering a total bandwidth of 1 GHz. Each unit can be connected to any spectral line receiver with a bandwidth of 1 GHz (i.e. to all but the A100 and B100 receivers). At the present time, a 4 MHz filterbank cannot be used simultaneously with the autocorrelator or the 100 kHz filterbank on the same receiver.
  There is still no automatic online data reduction for the 4 MHz filterbanks. The raw data from these backends are written to a HP workstation and have to be calibrated off–line. For the basic observing modes (PSWITCH, WSWITCH, RASTER) we have prepared macros in the CAL program to do this job. Frequency switching is not possible with these low resolution backends.

Pointing / Focusing

Pointing sessions are normally scheduled twice per week; at present, the fitted pointing parameters yield an absolute rms pointing accuracy of better than 3″ [14]. Receivers are closely aligned (within < 2″). Checking the pointing, focus, and receiver alignment is the responsibility of the observers (use a planet for alignment checks). Systematic (up to 0.4 mm) differences between the foci of various receivers were noted in the past and may well persist, even with the new generation receivers. In such a case the foci should be carefully monitored and a compromise value be chosen. Not doing so may result in broadened and distorted beams ([1]).

Wobbling Secondary

- Beam–throw is ≤ 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.

References

[1] Appendix I: Error beam and side lobes of the 30 m telescope at 1.3 mm, 2 mm and 3 mm wavelength in: Molecular Spiral Structure in Messier 51, S. Garcia-Burillo, M. Guélin, J. Cernicharo 1993 Astron. Astrophys. 274, 144-146.

[2] A Small Users' Guide to NOD2 at the 30m telescope A. Sievers (Feb. 1993)

[3] Thermal behaviour of mm-wavelength radio telescopes

A. Greve, M. Dan, J. Peñalver 1993, IEEE Trans. Ant. Propag. AP–40, 1375

[4] Interferometric measurement of tropospheric phase fluctuations at 86 GHz
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A. Greve 1992 (IRAM report 253)

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These reports are available upon request (see also previous Newsletters). Please write to Ms. C. Berjaud, IRAM Grenoble (e–mail: `berjaud@iram.fr`).

Clemens Thum, Rainer Mauersberger

News from the Plateau de Bure Interferometer

PdBI Status Report

The observing efficiency of the Plateau de Bure Interferometer has suffered from the exceptionally bad weather conditions which have been prevailing over Western Europe during the last two months. Storms and strong snowfall have significantly delayed the scheduling of a large number of projects. Today, as of January 25, we have observed 8 out of 18 A- and B-rated observing requests, and only 5 have been considered as successfully completed in the C2-configuration.

Taking operational and observational restrictions into account, we now plan to move to the compact array configuration (D) by the middle of February. Priority will be given to projects already observed in the C2 configuration. We will do our best to keep investigators informed about the execution of their projects all along the winter period.

Projects aiming at deep integrations and low-resolution mapping in the D-configuration will definitely not be started before the middle of February, but users of the Plateau de Bure Interferometer should contact their Local Contacts now (if they have not already done it) to have their observing procedures ready in time.

Roberto NERI

Call for Observing Proposals for the Plateau de Bure Interferometer

Conditions for the next summer session

During the summer period, priority will be given to technical activities. We plan to keep improving on the safety at the observatory, to progress on the construction of antenna 6, and to carry out in great detail the maintenance of the Plateau de Bure Interferometer.

All these technical activities will be time consuming and very demanding in terms of manpower. As a consequence, the interferometer will be left most of the summer time with 4 antennas.

Furthermore, scientific activities at the interferometer will need to run at lower pace between May and September. It is difficult to make accurate predictions as to how much time will finally be allocated to astronomical observations, but we are confident to get a good number of scientific observing requests scheduled before the end of the summer session.

Therefore we strongly encourage you to submit proposals that can be executed during the summer period. To keep the procedure as simple as possible, we ask you to focus on:

- observations requesting the use of the 3mm receivers,
- observations that qualify for any non-standard 4 antenna configuration,
- circumpolar sources or sources transiting at night between June and September.

Call for Proposals

Proposers are invited to submit observing proposals for the Plateau de Bure Interferometer for the period May 15, 2001 to Nov 15, 2001. The deadline for applications is March 1st, 2001 18:00h (MET).

Details of the PdBI and the observing procedures are given in the document "The Plateau de Bure Interferometer (PdBI)". A copy can be obtained from the address below or from the World-Wide-Web at `http://iram.fr/PDBI/bure.html`). Proposers should read this document carefully before submitting any proposal.

Proposals may be submitted in one of the three following ways:

- by the web-based electronic submission facility. Please consult the detailed instructions on the web. The facility will be opened three weeks before the deadline.
- by fax to : (+33/0)-476425469
- by ordinary mail addressed to:

IRAM Scientific Secretariat
Interferometer Observing Proposal
300 Rue de la Piscine
F-38406 Saint Martin d'Hères Cédex
FRANCE

We encourage the use of the electronic submission facility. Proposals sent by e-mail, however, will not be accepted.

Do not use characters smaller than 11pt, which could make your proposal illegible when duplicated or faxed. For the same reasons, also avoid sending figures with grey scale maps by fax. In case your proposal reaches us in time, but is incomplete or unreadable when copied, we will try our best to contact you. The Principal Investigator will receive by return mail an acknowledgement of receipt and the proposal number.

Proposal templates as well as the Latex style file `proposal.sty` may be retrieved by anonymous ftp from server `iram.fr` (in directory `dist/proposal`); or from the IRAM web pages under the link `http://iram.fr/proposal/proposal.html`. In case of problems, contact the secretary, Mrs Cathy Berjaud (`berjaud@iram.fr`).

The scientific aims of the proposed programme should be explained in 2 pages of text *maximum*, plus up to two pages of figures, tables, and references. Proposals should be self-explanatory, clearly state their aims, and explain the need of the Plateau de Bure Interferometer.

In all cases, indicate on the first page whether your proposal is the *resubmission* of a proposal or the *continuation* of a previously accepted proposal. In case of a resubmission, state very briefly in the introduction why the proposal is being resubmitted (e.g. improved scientific justification, observational restrictions).

For this call for proposals, please note the following specificities (details on receivers, signal to noise, atmospheric phase compensation, observing modes, data reduction and local contact have not changed and can be found in the January 1999 issue of the IRAM Newsletter):

Configurations

Only 4-antennas will be available during the summer period. The interferometer will mostly be arranged in compact, but non-standard configurations.

Correlator

The new correlator has 8 independent units, each being tunable anywhere in the 110-680 MHz band, and providing 7 different modes of configuration (characterized in the following by couples of total bandwidth/number of channels). In the first 3 modes: 320 MHz/128, 160 MHz/256, 80 MHz/512 the two central channels may be perturbed by the Gibbs phenomenon (depending on continuum strength) like in the old correlator. When using these modes, it is recommended to avoid centering the most important part of the lines in the middle of the band of the correlator unit. In the remaining modes: 160 MHz/128, 80 MHz/256, 40 MHz/512 and 20 MHz/512 the two central channels are not affected by the Gibbs phenomenon and, therefore, these modes should be preferred for spectroscopic studies. The 8 units can be independently placed either on the IF1 (3 mm receiver) or on the IF2 (1.3 mm receiver).

Roberto NERI

PdBI Correlator Status Report

The installation of the new correlator in September 2000 represents a major step in the technical development of the Plateau de Bure Interferometer. Since the last report in Newsletter 45 (August 2000), the installation and testing phase has been completed. A small review is given below.

The correlator has been flown to the Plateau de Bure on September 22nd, 2000 (Fig. 2, 3), and has been rapidly connected to the system (Fig. 4).

Its first light revealed a few minor problems:

1. The analog IF level was higher than expected, and called for the insertion of extra coaxial attenuators. A residual slope across the IF band is present (2-3dB excess at the high end of the band). Part of the problem comes from the recent installation of some length of higher quality cables. A new coaxial cable equalization policy is under study. It will allow some stretching of the usable bandwidth of the coaxial cable signal transport system, since the optic fiber installation is postponed.

2. The VVAs (Voltage Variable Attenuators, IC reference MA/COM AT65-0283) that define the sampling levels come from a poor batch and need a few seconds for stabilizing. The calibration sequence timing has been modified to take this effect into account, until the problem is electrically solved. As usual, this problem was not present on the prototype unit batch, so it remained undetected on the series units.

3. A few microprocessor crashes are still present and being investigated.

In spite of these small difficulties, a substantial improvement in bandwidth and resolution has been achieved, as can be seen from the spectrum in Fig. 5, showing amplitude and phase from 100 to 700 MHz, obtained with only 3 units (out of 8).

The previous correlator has been flown down and is being refurbished in Grenoble to serve as an enhanced line backend for the new receiver setup on Pico Veleta (Fig. 6). More information on this project can be found at the URL http://iram.fr/TA/backend/concepts.html#3.

The new backplanes have been designed and are being manufactured. The control board modifications are set and a small piggyback board needs to be designed. A coaxial distribution box prototype has been built and tested. Many coaxial devices are being ordered. The IF processor rack mechanical and power supply modifications are under design.

Marc TORRES

Figure 2: Transport of the new correlator.

Figure 3: The crates have arrived.

Figure 4: The new correlator after its installation in the PdBI correlator room.

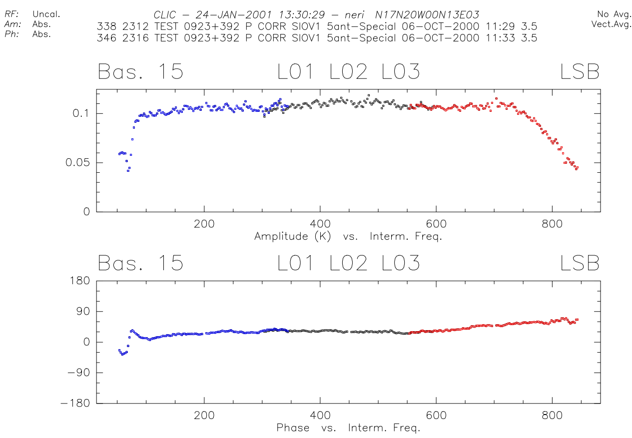

Figure 5: The new bandpass. Note that the practical use is currently limited to below 680 MHz.

Figure 6: View of the rack to be used in the 30-m backend room.

ALMA Band 7 Cartridge - IRAM Development

Band 7 for ALMA Receivers covers the frequency range 275–370 GHz. Our baseline design includes two double side band mixers, i.e. one for each polarization, with waveguide couplers for the local oscillator injection. The polarizations are separated by one grid and the 17 dB cross-guide coupler allows LO injection in a compact configuration. The mixers to be used in the cartridge are fixed-tuned across the RF frequency range and low noise for an IF covering 4 to 8 GHz. Future development involves integrated sideband separation mixers in waveguides.

The full report can be found in the ALMA Project book at the following address:
http://www.tuc.nrao.edu/~demerson/almapbk/-construc/chap5/chap5.pdf, Chapter 5.6.6., p 32.

Matt CARTER, Stephane CLAUDE, Bernard LAZAREFF, Doris MAIER and Alessandro NAVARRINI

ALMA: Kitt Peak tests

The first prototypes of the Alma Common Software (ACS) and the Antenna Mount Software (AMS) have been tested in December at Kitt Peak with the 12m antenna. IRAM is involved in both developments.

ACS will provide a set of tools and services to be used in all Alma applications. The software is based on distributed objects, configuration database, logging and error systems, It adds a layer on top of CORBA to implement the distributed objects architecture.

It is the prototype of this layer (or “wrapper”) which was tested at Kitt Peak. The applications and the graphical user interfaces are developed in C++, JAVA and Tcl/Tk (the latter is an alternative for fast prototyping). IRAM’s contribution has been to test specifically the Tcl language mapping for CORBA and to check Tk as a quick and attractive way to develop user interfaces accessing CORBA services.

The version of AMS developed by IRAM and NRAO provides very simple functionality. It uses ACS to implements the objects and their methods, both defined conjointly between ESO, IRAM and NRAO in IDL (Interface Desciption Language).

Its architecture is build around several loops, and uses messages and events which are available through the object-oriented framework and toolkit ACE (Adaptive Communication Environment). The benefit of CORBA and ACE is to have a portable software: AMS has been developed and tested on Linux, with the antenna simulation and the Graphical User Interface (GUI) in Tcl/Tk running on the same machine. With the 12m antenna AMS has been executed on VxWorks on a VME Motorola CPU board installed in a chassis with either the same GUI or another interface written in JAVA, both executed on Linux. AMS employs SLALIB, the positional astronomy library developed at Rutherford Appleton Laboratory.

At Kitt Peak, all functions defined in the interface have been tested. They include positions in horizontal or equatorial coordinates, offset, tracking, drift and pointing model. It has been possible to calculate the coefficients (limited to 6) of the pointing model by using the optical camera mounted on a telescope finder. The corrections have been processed by TPOINT, widely distributed pointing model analysis package by P.T. Wallace. The result of the pointing session was a blind pointing accuracy of the order of 7″ rms.

Alain PERRIGOUARD

Scientific Results in Press

Topical Review: SIS and bolometer mixers for terahertz frequencies

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(1)Institut de Radio Astronomie Millimétrique, Domaine Universitaire de Grenoble, F-38406 St. Martin d'Hères, France

Abstract:
The need for extremely sensitive heterodyne receivers in the astronomical community has created strong efforts to develop appropriate frequency mixers. Nb/Al–Al_xO_y–Nb tunnel junctions with Nb matching circuits lead to best results up to approximately 700 GHz, the energy-gap frequency of Nb. For higher frequencies the Nb in the matching circuit becomes lossy and is replaced beyond 800 GHz by Al (which operates in the normal conducting state). The gap frequency of NbN is as high as 1.2 THz, but NbN technology is not yet mature. Practical films still have substantial radio frequency losses and the barrier of NbN tunnel junctions is too leaky. More recently, NbTiN, for which the gap frequency is also about 1.2 THz, was found to have very low losses, and is therefore a good choice for tuning circuits. New interesting tunnel junctions for mixers around 1 THz are NbTiN–MgO–NbTiN and Nb/Al–AlN_x–NbTiN. Excellent performance from about 1 THz up to several terahertz can be expected from hot-electron transition-edge bolometer mixers. They consist of NbN or Nb microbridges, they do not need matching circuits and their frequency limit is not determined by the gap frequency.

Appeared in: Supercond. Sci. Technol. **13** *(2000), R171-R187*

Atmospheric Phase Correction for Connected-Element Interferometry and for VLBI

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Abstract:
In observations with the IRAM Interferometer, a clear sky atmospheric phase correction has been applied since 1995. Currently only the improved amplitudes of the interferometric visibilities are used, as total power assisted phase tracking between calibrator and target is not yet reliable. Setting the modeled phases to zero average on a source observation can improve the results, and may even come close to an absolute technique (i.e. phase tracking during source changes). The potential of this method is illustrated with an example of a map without and with phase correction.

An absolute phase correction scheme with cloud correction based on radiometric measurements at the 22 GHz

water vapor line is now under development at IRAM. A prototype receiver for this purpose has been built and tested. Some specially adapted stability criteria are described which were found useful to qualify the instrument.

At the IRAM 30m telescope on Pico Veleta, Spain, the 200 GHz sky emission has been used for phase monitoring during recent intercontinental VLBI experiments. Examples of corrected and uncorrected observed phases indicate that the method is operational.

To appear in: IAU Site 2000 Workshop Proceedings, ASP Conference Series, in prep.

Anatomy of the counterrotating molecular disk in the spiral NGC 3593. ^{12}CO(1–0) interferometer observations and numerical simulations

García-Burillo, S.(1); Sempere, M.J.(2); Combes, F.(3); Hunt, L.K.(4); Neri, R.(5)
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Abstract:
This paper presents high-resolution ($4'' \times 3''$) interferometer observations of the inner disk of the starburst spiral NGC 3593 made in the (1–0) line of ^{12}CO. NGC 3593 is an early-type system known to possess two counterrotating stellar disks of markedly different scale lengths and masses. The CO emission comes from a highly structured molecular gas disk of $M_{\rm gas} \sim 3\,10^8\,M_\odot$, and total radial extent $r \sim 35''$. The observed CO kinematics indicates that the molecular gas is counterrotating at all radii with respect to the most massive stellar disk (disk I).

The bulk of the CO emission arises from a ringed circumnuclear disk (CND) of radius $r \sim 10''$ and mass $M_{\rm gas} \sim 1.5\,10^8\,M_\odot$, which hosts a nuclear starburst. The link between the starburst and the CND is corroborated by high-resolution observations of other star formation tracers (Hα, Paα and $J-K$ color index maps). The starburst episode is fueling the less massive counterrotating stellar disk (disk II). We find extinctions $A_V \sim 1$ mag in the CND based on optical and near-infrared recombination lines, but find > 5 mag from the CO and 100 μm fluxes.

Out of the CND, molecular gas is distributed in a one-arm spiral feature which winds up tightly from the edges of the CND ($r \sim 10''$) up to $r \sim 35''$. The CO one-arm spiral is leading with respect to the gas flow in the southern half of the disk. There is a secondary trailing spiral arc in the northern half. The analysis of streaming motions linked with the passage of the CO one-arm spiral indicates that the southern feature would be a stationary $m = 1$ instability (pattern speed $\Omega_p \sim 0$).

To account for the observed gas response in the disk of NGC 3593, we have run self-consistent numerical simulations, including the stellar and the gaseous components, in a physical scenario which approximates this case of study. We discuss the rapidly changing response of the disk, which evolves from a transitory regime, in which all instabilities are $m = 1$ waves leading with respect to the counter-rotating gas, towards a stationary regime, in which $m = 1$ are mixed with $m = 2$ features, trailing with respect to the gas flow at all radii. In the light of the present simulations, NGC 3593 might be starting to change from the transitory towards the stationary regime.

Appeared in A&A 2000, 363, 869

Methylpolyynes and Small Hydrocarbons in CRL 618

Cernicharo, J.(1),(2); Heras, A.M.(3); Pardo, J.R.(1),(4); Tielens, A.G.G.M.(5); Guélin, M.(6); Dartois, E.(6); Neri, R.(6); Waters, L.B.F.M.(7)
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Abstract:
We report on the detection with the Infrared Space Observatory of strong infrared absorption from NH_3 and C_2H_4 in CRL 618. The observed NH_3 and C_2H_4 bands arise from a region with kinetic temperatures $\simeq 200$ K, i.e. the dense gas in the photodissociation region associated to the dense torus surrounding the central star, as was the case for the polyynes and cyanopolyynes. Several absorption bands, probably arising from small gas-phase hydrocarbons, are observed between 5.5 and 11 μm. Two of these species have been identified with the 30m IRAM telescope as the methylpolyynes CH_3C_2H and CH_3C_4H. However, the absorption around 6.2 μm is particularly broad and could arise from the combination of these small hydrocarbons and from the aromatic *CC* stretching of polycyclic aromatic hydrocarbons of moderate size. These bands and those associated to the polyynes, cyanopolyynes, methylpolyynes, and benzene

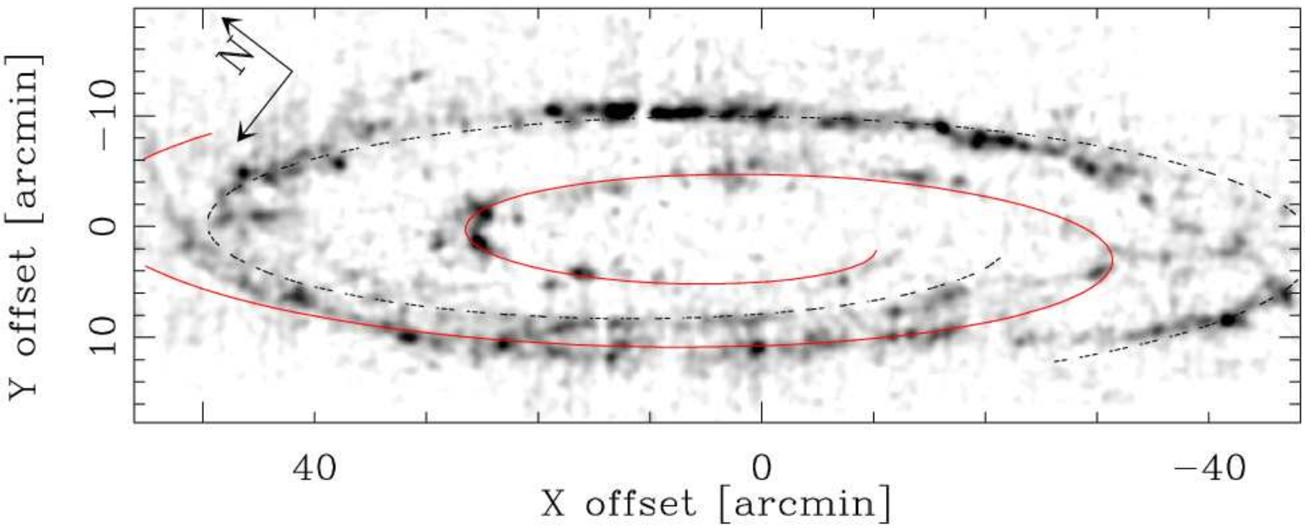

Figure 7: The ^{12}CO (1–0) line integrated intensity, observed with the 30-m telescope, smoothed to a resolution of 45″ (Nieten et al., *in preparation*). The spiral arms drawn here are two trailing logarithmic spirals with pitch angles of 6° and 8°.

are not present in the infrared spectrum of the asymptotic giant branch star IRC+10216.

Appeared in ApJ 2001, 546, L127

Distribution and Properties of the Molecular Clouds in M 31

M. Guélin(1), C. Nieten(2), N. Neininger(3), S. Muller(1), R. Lucas(1), H. Ungerechts(1), R. Wielebinski(2)
(1)IRAM, 300 rue de la Piscine , 38406 St. Martin d'Hères, France, (2)Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, 53121 Bonn, Germany, (3)Radioastronomisches Institut der Universität Bonn, Germany

Abstract:
Although most of our knowledge on the interstellar medium (ISM) comes from the Milky Way, some basic questions on its structure and evolution can be addressed only by studying external galaxies. This is particularly true for the large gas structures, such as spiral arms which are hard to discern in the Milky Way disk and for the properties of distant clouds, which are confused by foreground gas. The Andromeda galaxy, the closest spiral galaxy to our own (D = 0.8 Mpc), is probably the best object where to study these questions. It has been mapped recently in the mm lines of CO with the IRAM 30-m telescope.

Figure 7 shows the map observed in the CO 1–0 line with the IRAM 30-m telescope (Nieten et al *in preparation*, see also Neininger et al. 1998, *Nature* **395**, *871*). It was observed 'On-The-Fly' by using a basket-weaving procedure: The telescope beam (FWHM= 21″) was moved back and forth in the Y direction with steps in X of 9″, until an unit area of $20' \times 20'$ was entirely covered. Then, the same area was scanned in the perpendicular direction, by inverting the X and Y coordinates. The two sets of maps were averaged and de-striped by using the Emerson and Gräve (1988, *AAp* **190**, *353-358*) algorithm adapted to spectral line observations. The fully sampled data cube, which consists of 11 unit areas and 10^5 spectra, has been smoothed from 23″ to 45″ to show more clearly the spiral structure.

Compared to the HI arms, the molecular arms traced by CO are thinner and extend more into the central region (see the discussion by Nieten et al., *this conference*). This allows to recognize more easily the spiral pattern. The question of M 31's spiral structure is an old one which had no clear answer until now. The most elaborate model was proposed by Braun (1991, *ApJ* **372**, *54*) from a detailed analysis of the HI interferometric data. Braun's model, a two armed spiral pattern with a pitch angle changing with radius, is interesting for the outer regions where HI is strong and the gaseous disk is warped. The arms are not constrained to lie in a plane, but rise above, or drop below the mid-plane. Braun's model explains the apparent crowding of the HI arms near the minor axis, but fails to reproduce the main arm features in the southwest part of the disk.

Because CO emission hardly extends to the warped part of the disk, we have fitted our CO map with a very simple two-armed pattern. This pattern is suggested by the spiral pattern of M 81, a galaxy of the the same morphological type as M 31. The model arms are trailing logarithmic spirals with a constant pitch angle; they are located in a plane inclined at i = 78° with respect to the plane of the sky with a position angle PA = 37.7° (the values of i and PA are derived from the kinematics of the HI gas in

M 31's inner disk – Brinks & Shane 1984, *AApS* **55**, *179*). Surprisingly, this simple pattern with few free parameters accounts fairly well for most of the arm segments detected in CO. The agreement is particularly good for the first spiral arm which follows the CO emission over 400° with only minor deviations. The fit is less good for the second arm, mostly because the CO-HI lane is kinked inwards in the vicinity of the giant stellar association NGC 206 ($X = -42', Y = 0$). The origin of the two spirals coincides with M 31's nucleus within few arcmin. The pitch angle is close to 7°.

Published in: The interstellar medium in M 31 and M 33, Proc. 232th WE-Heraeus Seminar, eds. E.M. Berkhuijsen, R. Beck, R.A.M. Walterbos, Shaker Verlag, Aachen 2000.
Reprints are available from: guelin@iram.fr

Astronomical detection of the free radical SiCN

M. Guélin(1), S. Muller(1), J. Cernicharo(2), A.J. Apponi(3), M.C. Mc Carthy(3), C.A. Gottlieb(3), and P. Thaddeus(3)
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Abstract:
We report the detection of the SiCN radical in an astronomical source, the envelope of the C star IRC+10216/CW Leo. The microwave spectrum of SiCN was recently studied by four of us in the laboratory and the rotational transition frequencies were accurately measured. The ground fine structure state, $^2\Pi_{1/2}$, has three rotational transitions, each with λ-doubling in the 80–116 GHz atmospheric window ($J = 7.5 \rightarrow 6.5$, $8.5 \rightarrow 7.5$ and $9.5 \rightarrow 8.5$, at 83.0, 94.0, and 105.1 GHz). The three λ-doublets (six components) are detected at a level of 5 mK with the IRAM 30-m telescope. Judging from the cusped shape of the line profiles, SiCN is largely confined to the outer molecular envelope, like most other radicals. Its abundance relative to H_2 is estimated to be 4 10^{-9}, a factor of 20 lower than that of MgNC.

The isoelectronic radical SiCCH was not detected. We confirm our previous tentative detections of the carbon chain H_2C_6 and of NP in IRC+10216. We report the detection of the SiCN radical in an astronomical source, the envelope of the C star IRC+10216/CW Leo. The microwave spectrum of SiCN was recently studied by four of us in the laboratory and the rotational transition frequencies were accurately measured. The ground fine structure state, $^2\Pi_{1/2}$, has three rotational transitions, each with λ-doubling in the 80–116 GHz atmospheric window ($J = 7.5 \rightarrow 6.5$, $8.5 \rightarrow 7.5$ and $9.5 \rightarrow 8.5$, at 83.0, 94.0, and 105.1 GHz). The three λ-doublets (six components)

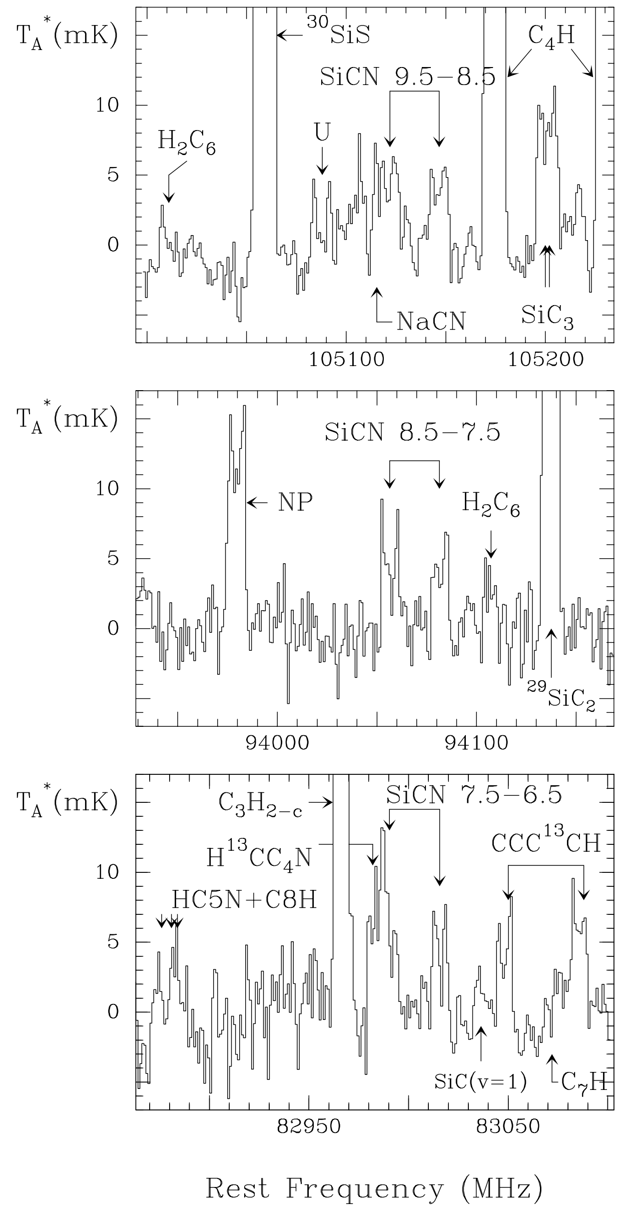

Figure 8: Spectra from the 30-m telescope of three successive rotational transitions of SiCN. The position of the SiCN Λ-doublet components, at the center of each spectrum, and those of other identified lines are indicated by arrows. The lines of C_4H at 105174 MHz and 105231 MHz are the fine-structure components of the $N = 11 \rightarrow 10$ rotational transition in the $\nu_7 = 2$, $l = 0$ bending state. The broad feature around 82880 MHz is a blend of transitions of C_8H and of vibrationnally excited HC_5N (ν_{11}=2); note that the noise is larger on the left side of the bottom spectrum, because the integration time was a factor of 3 smaller below 82960 MHz, than above.

are detected at a level of 5 mK with the IRAM 30-m telescope (Fig. 8). Judging from the cusped shape of the line profiles, SiCN is largely confined to the outer molecular envelope, like most other radicals. Its abundance relative to H_2 is estimated to be 4 10^{-9}, a factor of 20 lower than that of MgNC.

The isoelectronic radical SiCCH was not detected. We confirm our previous tentative detections of the carbon chain H_2C_6 and of NP in IRC+10216.

Appeared in A&A Letters, **363**, *L9*

Millimetric Observations of Plerionic Supernova Remnants

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Abstract:
We present results of observations of the Crab Nebula and G21.5−0.9 performed at 1.3mm with the MPIfR bolometer arrays at the IRAM 30m telescope. In the Crab Nebula we measure spatial variations of the average spectral index between 20 cm and 1.3 mm. Since the electrons emitting at mm wavelengths are affected by negligible synchrotron losses, such variations imply the presence of at least two different populations of injected particles. By subtracting the emission extrapolated from the radio a residual component appears, similar in size and shape to the soft X-ray map as well as to the flatter-spectrum optical component. Moreover near the major synchrotron filaments we measure a spectral bending consistent with a break at a frequency lower than the average break frequency in the Nebula: this indicates that near the filaments the magnetic field is typically 6 times higher than the average. For G21.5−0.9 we derive a spectral break at $\sim$ 540 GHz, in contrast with the previously accepted value of 40 GHz. Therefore this object does not strictly belong to the class of plerions with a low-frequency break.

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