IRAM Newsletter

Contents

Number 45 August 8th, 2000

Calendar

September 11th, 2000 18:00h (MET):
Deadline for the submission of observing proposals for the period Nov 15, 2000 to May 15, 2001

September 17th - 20th: YERAC in Granada

October 9th/10th, 2000:
IRAM Program Committee meeting

October 17th, 2000:
Extraordinary IRAM Council meeting

YERAC in September 2000

The Young European Radioastronomers' Conference (YERAC) will be hosted by IRAM Granada, the Instituto de Astrofisica de Andalucia (IAA) and the University of Granada. It will take place at the end of this summer, on September 17th - 20th. More Information can be found on the IRAM Granada website under the link: http://www.iram.es/yerac/yerac.html

We are sorry to report the death of

JÖRN WINK

on Saturday, August 5, 2000, while he was in the medical centre 'Les petites Roches' in St Hilaire. He leaves his wife and two daughters.

The illness, ALS, which has hit him so suddenly about three years ago, had more and more taken away his physical strength but his mind remained as clear and active as ever.

A ceremony will be held on Friday, August 11, in the 'Centre Funéraire Intercommunal' in La Tronche. It was his wish that instead of flowers donations are made to the ALS foundation.

Jörn Wink had joined IRAM in 1987. His interest soon focussed on the Plateau de Bure Interferometer, and he helped to develop it into the powerful instrument that it today is. An obituary that will cover the different phases of his scientific career will appear in the next IRAM Newsletter.

IRAM Executive Council Meeting on June 22/23, 2000

On June 22/23, 2000 the IRAM Executive Council met in GRENOBLE for its regular annual meeting. Whereas normally the Annual Report 1999, the comments and recommendations from the Scientific Advisory Committee, and the financial statements for 1999, 2000, and 2001, as well as a 5-year forward look would have been the major points on the agenda, the developments on the Plateau de Bure since the extraordinary Council meeting on January 27th, 2000, and the question of IRAM's current and possible future involvement in the ALMA project figured equally highly.

Concerning the Plateau de Bure, the Technical Division of the CNRS-INSU has not only advanced the work on the old cable car system, to use it after detailed checking and repair for the transport of materials to and from the Plateau de Bure, but has, in parallel, prepared and issued a call for tender for a new access study for the site. This study is currently carried out by a consortium of companies led by SCETAUROUTE, Lyon.

For the ALMA project the Council took note of the current level of involvement of IRAM in Phase 1 activities (about 20 man-years, not counting the contributions made by some of the IRAM astronomers) and it discussed possible longer term activities without, however, drawing final conclusions in view of the pending decisions about the distribution of tasks between Europe and the US, and also within Europe.

This year, the running budget proposal for 2001 posed a particular problem because it has, for the first time, to absorb the full impact of the implementation of the new French labour legislation, which limits the average number of working hours per week to 35. Despite the fact that IRAM did not ask to fully compensate the roughly 10% loss of manpower due to this regulation, money must be found for 6 additional positions that are needed to continue 24 hours/day services at the observatories and to strengthen some of the groups in Grenoble who had already reached their capacity limits before. The Council took note of these needs but deferred a final decision about the budget increase for 2001 to its October meeting.

The same holds for the investment budget despite the fact that its situation is quite different. The two accidents that hit the Plateau de Bure in 1999 have caused a delay in the completion of Antenna 6 and a major interruption of the work on the N-S track extension. Money foreseen for these activities has therefore not been spent. On the longer term the investment budget will, however, be under severe pressure if all the projects which are currently under discussion and which are considered as scientifically very valuable would be executed.

Anniversary of the cable car accident of July 1st, 1999

On July 1st, the Association of the Families of the Victims has organised a ceremony at the lower cable car station to commemorate the first anniversary of the Plateau de Bure cable car accident. For this occasion a memorial had been erected, created by a local artist, a relative of one of the victims. The names of all 20 who died are engraved on a stone plate. The official addresses delivered on this occasion all underlined the enormous tragedy that this accident has caused to the families of the victims and to the entire region, but also confirmed the determination to keep the Plateau de Bure Observatory alive.

Official technical report about the cable car accident of July 1st, 1999

A group of three experts had been appointed shortly after the accident of the Plateau de Bure cable car by the examining judge at the Court of Gap. At the beginning of July this year, these experts have delivered their report to the judge, a document of 105 pages with more than 400 pages attached in Annexes. For the time being, these documents can only be accessed through the lawyers representing the families of the victims, IRAM and other parties.

Despite pressure from the media to comment on the report, IRAM saw itself not in a position to reply to questions and accusations before having had an opportunity to study the documents in detail. The direct cause of the accident seems clear, namely the failure of the fixation system that attaches the cabin to the pulling cable. However, answers to the question as to why this fixation system has failed on the day of the accident are much more involved. The report contains detailed technical studies, makes comments on maintenance and control aspects, and comments on the exploitation of the cable car and the legal framework in which this occurred. All this material needs careful analysis, and more studies may be required in the future.

Michael GREWING

News from the 30m Telescope

Staff News

Albrecht Sievers is now working in the Computer Group of IRAM Granada. He will still be available as a Friend of the Telescope and have some time to pursue his scientific projects.

Pointing of the 30m Telescope

A team from the Spanish National Geographical Institute (IGN) has determined the telescope's deviation from the vertical. These data combined with inclinometer measurements will be used to further improve our pointing model.

Access to the 30m Telescope

Large parts of the Sierra Nevada have been declared a Nature Park. This has the consequence that a special identification is required to access the observatory by car. During night time also a key is required to open a gate to the access road. Visitors who want to go to the telescope by taxi or rental car should contact Javier Lobato (lobato@iram.es) or Esther Franzin (franzin@iram.es) several days in advance.

Pico Veleta photos available

Juan Peñalver has compiled a CD-ROM with photos from the Pico Veleta Observatory and the 30-m telescope. If you are interested in a copy, send him an email (penalver@iram.es).

Sideband rejection measurements

The observer can now determine the rejection of the image sideband (G_i) for any of our heterodyne receivers using the OBS command CALIBRATE /SSB rxname. This command measures the value of G_i using a Martin-Puplett-Interferometer (but does not automatically change G_i in OBS).

Under normal circumstances it is not necessary to use this command since a high rejection is obtained in the automatic tuning process. It might be useful if one is looking for very weak lines in "crowded" sources like Orion or SgrB2, for frequencies close to the limits of the tuning range or if an extremely small calibration uncertainty of a few percent is required. For more information use the HELP command in OBS.

Rainer MAUERSBERGER

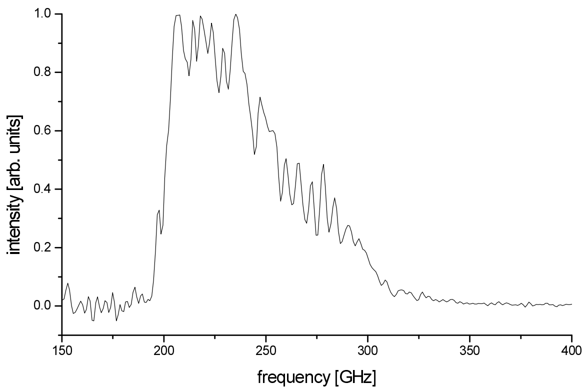

Figure 1: MAMBO central channel spectral sensitivity

Measurements of the Spectral Response of the MPIfR Bolometers

An important property of a bolometer receiver is its spectral response. Knowing this function and the atmospheric transmission, the effective observing frequency for radio sources of given emissivity index can be calculated (see NIC-manual 1.4-07, Appendix C, "Effective observing frequency"). Furthermore this information is essential in order to estimate the line contribution to the bolometer signal.

The spectral response of a bolometer receiver is a function of many parameters. Unfortunately some of them are difficult to determine and a direct measurement of the complete bolometer system is very desirable.

This can be done by using the receiver to take a spectrum of a source of known emissivity (a black body) with a spectrometer of known efficiency (a Martin-Puplett-interferometer). The spectral response is then obtained by dividing the measured spectrum by the source spectrum and the spectrometer's efficiency curve. A relative spectral calibration of this kind is usually done before a new bolometer system is shipped to the telescope.

Figure 1 shows the spectral sensitivity of the central channel of the 37 element 1.2 mm bolometer array used during the observing campaign in winter 98/99 ("MAMBO I"). The variation of the shape of the spectral sensitivities of the different channels is typically below 5% so that this curve gives a good estimate for all channels of this bolometer array. According to ongoing improvements of the bolometers the spectral response of a receiver depends on the year. A compilation of spectral responses of the MPIfR bolometer systems used at the 30 m MRT and the 10 m HHT can be found under:
http://www.mpifr-bonn.mpg.de/div/bolometer/spectra/spectralresponse.html

J. GROMKE and E. KREYSA, MPIfR Bonn, Germany

Call for Observing Proposals for the 30m Telescope

Summary

The *next deadline* for the submission of observing proposals for the IRAM 30m telescope is September 11th, 2000 18:00h (MET). The scheduling period extends from Nov 15, 2000 to May 15, 2001, covering roughly the winter period at Pico Veleta. Two types of proposals will be considered:

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

Roughly 2800 hours of observing time will be available, which should allow the scheduling of a few longer programmes (of the order of 100 hours), with emphasis on 1.3 mm observations.

What is new ?

Two wide band filter spectrometers built by IRAM–Granada are now available for observations with a few restrictions. Each of these spectrometers has 256 channels (channel spacing: 4 MHz; noise equivalent bandwidth: 6.2 MHz) and can be connected to any spectral line receiver that allows a bandwidth of 1GHz (i.e. to all but the A100 and B100 receivers). These two new 1 GHz banks together with our old 1024×1 MHz filterbank make observations of broad lines much more time efficient. The new banks are included in the web–based time estimator (version 2.2). Note that at the time we are writing these lines there is no automatic online data reduction for the 4MHz filterbanks: the raw data are written to a HP workstation and have to be calibrated off–line. For the basic observing modes (PSWITCH, WSWITCH, RASTER), this is done using macros in the CAL program. Note also that the new filterbanks cannot currently be used with on–the–fly observations.

The **37 channel bolometer array** which was used last winter on the telescope with unprecedented sensitivity will be available again. Two bolometer sessions are planned, one before the end of this year and a second one early next year. Proposers are asked to clearly indicate on the proposal cover sheet which of the two sessions they prefer.

Since October 1999, the telescope is fully equipped with 8 new generation receivers which cover nearly all of the 2, 3 and 1.3 mm atmospheric windows. At each frequency two orthogonally linearly polarized receivers are available, and up to 4 receivers can be used simultaneously. The new receivers turned out to work well, with only a few qualifications. At the time of writing, dewar C is being exchanged with a laboratory spare. Although the installation is not yet complete, first tests have shown that the noise temperatures of the new receivers C 150 and C 270 are improved, and their optics fit well with the other receivers.

The new scheme of **priority scheduling** introduced last winter turned out to be largely successful. It will be continued this winter. The scheme applies to the highest rated proposals, up to a total of about 250 hours of telescope time. These proposals will be given a further chance if, because of weather or technical problems, their scientific goals were not obtained when scheduled first. Bolometer proposals which require excellent weather may also profit from the priority scheme if they are rated sufficiently high. If the weather is not good enough when the priority proposals are scheduled, heterodyne proposals at lower frequency or less demanding bolometer proposals will be observed whenever possible. Three remote observing stations which are operational now, support this more complex scheduling scheme.

Applications

Valid proposals consist of the official cover page, up to two pages of text describing the scientific aims, and up to two more pages of figures, tables, and references. The official cover page, in postscript or in LaTeX format, may be obtained by anonymous ftp from `iram.fr` in directory `dist/proposal`, as well as a Latex style file `proposal.sty`; or 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. This could render 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. 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. About 75% of the proposals were sent in this way for the last deadline. Submission through fax will be discontinued. Proposals sent in by E–mail are not accepted.

All proposals must reach the Secretariat before September 11th, 2000 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.

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 out 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]. It has been updated recently, including now a description of the refurbished receiver cabin. 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 since more than two years. Considerable progress was achieved 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 used to yield satisfactory baselines within certain limitations (maximum frequency throw of 45 km/s, backends, phase times etc.; for details see [8]). Little experience exists however with the new generation receivers, but more tests are planned.

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

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

Time Estimator on our web pages. The tool gives sufficiently accurate estimates of the total observing time and handles the vast majority of both heterodyne and bolometer observing modes. 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 their time estimate can be *reproduced*. In particular, the proposal must give values for $T_{\rm sys}$, spectral resolution, antenna temperature of the signal, the signal/noise ratio which is aimed for, all overheads and dead times, and the resulting observing time).

Proposers should base their time request on normal winter conditions, corresponding to 4mm of precipitable water vapor. Sometimes, conditions may be degraded due to anomalous refraction. 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 perfect winter conditions, the proposers must clearly say so in their time estimate paragraph. Such proposals will however be particularly scrutinized.

Service observing

To facilitate the execution of short (≤8 h) programmes, we propose "service observing" for some easy to observe programmes *with only one set of tunings*. Observations are made by the local staff using precisely laid–out instructions by the principal investigator. For this type of observation, we request an acknowledgement of the IRAM staff member's help in the forthcoming publication. If you are interested by this mode of observing, specify it as a "special requirement" in the proposal form. IRAM will 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 the MPIfR in Bonn, and from Grenoble. This observing mode is restricted to projects without particular technical demands and to experienced 30m users. The prospective remote observer should note "remote observing from Grenoble or Granada or Bonn" 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 (dmuders@mpifr-bonn.mpg.de) at MPIfR for a short introduction into the remote observing station. Remote observers in or near Grenoble should 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 winter weather (4mm of water) at the center of the tuning range and at 45° elevation. All new generation receivers are tuned from the control room. Experience shows that it normally takes about 15 min to tune four such receivers.

General point about receiver operations

As receiver tuning is now considerably faster (typically 15 min for four receivers) and more reproducible than before, we do not normally require anymore that observers send a list of frequencies to Granada before their observations. Only in case that a frequency is close to a limit of the tuning range or is otherwise peculiar, we still recommend to check with a Granada receiver engineer before the observations.

Polarimeter

A prototypal IF polarimeter is now available on a restricted basis. The instrument is designed for narrowband (40 MHz) line and continuum polarimetry. It needs two 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 3mm 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`.

Table 1: Heterodyne receivers available for the winter 2000/01 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	80 - 100	15 - 25	4.0	1.0	200	3
D 150	H		2	3		129 - 183	60 - 180	8 - 17	4.0	1.0	200	
A 230	V	1		3		197 - 266	100 - 200	12 - 17	4.0	1.0	450	1
B 230	H	1			4	197 - 266	100 - 250	12 - 17	4.0	1.0	450	1
C 270	V		2		4	241 - 281	130 - 300	10 - 20	4.0	1.0	1000	2,3
D 270	H		2	3		241 - 281	140 - 260	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

Polarimetry proposals are invited with the following restrictions: *(i)* the target sources should not be larger than the main beam and *(ii)* the observing frequency should be in the 3mm tuning range. A few higher frequency proposals may also be accepted on a shared risk basis. They may be observed if the 2 and 1.3mm tests planned later this summer are successful.

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

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 $11''$ and a sensitivity of $\simeq 30$ mJy s$^{1/2}$. This figure applies under "normal bolometric conditions" (pwv 4mm and a stable atmosphere, i.e. no clouds, no turbulence). Often, such bolometric conditions are available only at night. The 37–pixel array was used extensively at the telescope last winter with good success. A second 37 channel array of comparable performance is available as backup.

The arrays are mostly used in two basic observing modes, ON/OFF and mapping.[2] Experience of last winter shows that the ON/OFF reaches typically an rms noise of $\sim$ 1.5 mJy in 10 min of total observing time (about 200 sec of on source integration time) under normal bolometric conditions. Up to 30 percent lower noise may be obtained in perfect weather. In this observing mode, the noise integrates down properly, even on times of several hours, and rms noise levels of under 0.3 mJy have been reached in particular cases.

In the mapping mode the telescope is scanned in azimuth in such a way that all pixels cover the source and fully sample the beam. A typical map covers 4×3 arcmin and takes about 60 min of telescope time. Under normal bolometric conditions, an rms of $\sim$ 3 mJy is thus reached near the map center. Again somewhat better values may be obtained depending on weather and the effectiveness of skynoise suppression. However, attempts to reach significantly lower noise by averaging several maps are fraught with poorly understood problems. Proposers who aim for a rms noise of < 1 mJy (in mapping mode) are therefore asked to indicate how they plan to reach their demanding goal.

Bolometer time requests should be based on normal winter conditions, like requests using SIS receivers. If exceptionally low noise levels are requested which may be reachable only in a perfectly stable winter atmosphere, the proposers must clearly say so in their time estimate paragraph. Such proposals will however be particularly scrutinized, as they may have to be scheduled in our new priority scheme (see above), for which only a small fraction of winter time will be reserved.

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].

[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 at half–power, θ_b.

frequency [GHz]	θ_b ["] [1])	η_F	η_{mb} [2])
86	29	0.95	0.80
110	22	0.95	0.80
145	17	0.93	0.65
170	14.5	0.91	0.66
210	12	0.90	0.54
235	10.5	0.91	0.50
260	9.5	0.88	0.51
279	9	0.86	0.46

[1]) fit to all data: θ_b ["] = 2460 / frequency [GHz]
[2]) measured with receivers B and C. Values from receivers A are less than 3 percent different, values from receivers D not available

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 . 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 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 observatory provides 4 types of spectral line backends which can be individually connected to any receiver.

– The 1 MHz filterbank, consisting of 4 units with 256 MHz each. The units can be connected to different or the same receivers giving bandwidths between 256 MHz and 1024 MHz. The maximum bandwidth of 1 GHz 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 new 4 MHz filterbank built by IRAM Granada is now available with a few restrictions. The new spectrometer 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 with the autocorrelator or the 100 kHz filterbank on the same receiver. Frequency switching and On–The–Fly observations are not yet 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). Ther are systematic differences between the foci of the various receivers: typically 0.1 mm, but reaching 0.3 mm in the worst case. The foci should be carefully monitored and, in the latter case, 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 the 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.

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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 Interferometer

The stop of all the observing activities at the interferometer, which was decided in December 1999 (see Newsletter 43), is still valid.

However, efforts are being made to clarify the conditions under which observations can be resumed after the summer maintenance period. We are aiming at mid-October to restart regular observing sessions.

In the meantime top priority is given to the technical maintenance of the interferometer which started on July 20th after clarifying the related safety aspects. Minor problems and a few potential causes of malfunction of the instrument after the long shutdown have already been identified. All receivers have recently been cooled down again and their performance verified. The antennas have also been tested independently in single-dish mode and all together in interferometric mode.

Further priority will be given to the installation of the new six antenna correlator. According to the planning, about two weeks are required this September to install and test the new correlator.

As a second priority item, some work will be carried out on the insulation of the mount of antenna 6, but major items like the assembly of the reflector have been deferred to 2001.

Observations during the summer period

As stated above, all the regular observing activities are still stopped. Some astronomical tests which are needed to diagnose the state of the instrument have, however, been carried out and will continue as maintenance work progresses. According to the current plans, the execution of proposals submitted for the summer period will not start before October, at the earliest.

Therefore, all of the summer proposals, including A-rated ones, will have to be resubmitted either for the coming winter session, or for the next summer session, unless opportunities still come up in October and before November 15th. The principal investigators of A-rated proposals will be kept informed in the weeks to come about any new development concerning the scheduling of their projects.

Roberto NERI

Status of the new IRAM Correlator

The change from five to six antennas in the IRAM interferometer increases the number of simultaneous baselines by 50%, and requires a major upgrade of the correlator. Additional improvements such as eight instead of six spectral subbands, increased spectral bandwidth and full phased-array capability for VLBI have been included in the new design.

The circular support table and central distribution parts have been built. All eight machines have been installed, loaded with their modules and tested (Fig. 2). The analog modules were pre-tested individually before being loaded, but the digital ones, who need the complete correlator environment to work, were directly inserted in their slots.

The first test was to visually inspect the amplitudes and phases on the FFT's of the 15 baselines. This helped to pinpoint a few minor wiring errors which were corrected individually.

A more refined testing method consisted of using redundant configurations of the correlators and let the software compare the results. This allowed to built evidence that no detectable (+/- 1 count) error occurs in any of the 1920 correlator chips of the system. The 4096 steps of the digital delay lines were verified in the same way by purpose-written software.

Some gain dispersion among the 48 analog channels was detected, which limited the usable dynamic range of the system to 9 dB. After a few manual corrections, the range was extended to 13 dB, which is enough to absorb the level variations usually found in the incoming signal.

The 1MHz comb injecting system was installed and successfully delivered the 10 KHz beacon signal for VLBI. The injection level is quite critical and has to be manually controlled. A detailed report on this issue is available on the IRAM web site (http://iram.fr/TA/backend/vlbi/adder/). The adder module design underwent minor modifications and was sent to production.

Figure 2: Six-Antenna (15 baselines) correlator for the PdBI during the laboratory tests.

Endurance testing has not been done so far because of the high indoor temperature of the lab due to Grenoble summer conditions (25°C to 29°C over the last weeks).

Marc TORRES

Call for Observing Proposals for the Plateau de Bure Interferometer

Conditions for the next winter session

For the next winter period we will still rely on transport by helicopter and on ground transport in a few cases. The number of these transports will be kept to a minimum, and so will be the number of people on the site. This will impact on our ability to do configuration changes.

As a consequence, we strongly encourage the submission of proposals for the next winter period, but insist that these proposals are for the D and C2 configuration only. As changes between compact and extended configurations like CC, BC, BB, AB require a considerable effort in winter, higher resolution observations will not be available.

We therefore ask investigators to submit proposals for the D and C2 configurations only. These configurations offer already a useful palette of possibilities: deep integrations, low and medium resolution observations in the snapshot, mapping or mosaicing modes. When combined, they provide an angular resolution of $\sim 1.8''$ at 230 GHz and 30° declination.

Applications should not yet take into account the capabilities of the new six antenna correlator. Observational procedures will be adapted before scheduling to make best use of its extended capabilities, after consultation with the principal investigators. Please note that the instrumental bandwidth will be limited by the receivers, i.e. the extended bandwidth of the correlator will not yet be fully available on the sky.

Call for Proposals

Observing proposals are invited for the Plateau de Bure Interferometer for the period Nov 15, 2000 to May 15, 2001. The deadline for applications is September 11th, 2000, 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 Internet via the World-Wide-Web (use IRAM's page 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 number: (33/0) 476 42 54 69.
- by ordinary mail addressed to:

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

Do not use characters smaller than 11pt, which could make your proposal illegible when copied or faxed. For the same reason avoid sending by fax figures with grey scale maps. 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 obtained by anonymous ftp from `iram.fr` (directory `dist/proposal`); or from Internet via the World-Wide-Web at http://iram.fr/proposal/proposal.html. In case of problems, contact the secretary, Cathy Berjaud.

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

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 the scientific aims, and explain the need of the Plateau de Bure Interferometer.

In all cases, indicate on the first page whether your proposal is (or is not) the resubmission of a previously rejected proposal, or the continuation of 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).

Details on receivers, signal to noise, atmospheric phase compensation, observing modes, data reduction and local contact have not changed and can be found in Newsletter 41 (August 1999). Correlator configuration choices should also be made according to the capabilities of the current five antenna correlator.

Documentation

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

- An Introduction to the IRAM Plateau de Bure Interferometer.
- IRAM Plateau de Bure Interferometer: Calibration CookBook.
- IRAM Plateau de Bure Interferometer: Mapping CookBook.
- IRAM Plateau de Bure Interferometer: Frequency Setup.
- CLIC: Continuum and Line Interferometer Calibration.

More specialized documents are also available; they are intended for observers on the site (IRAM on-duty astronomers, operators, or observers with non-standard programs):

- IRAM Plateau de Bure Interferometer: OBS Users Guide.
- IRAM Plateau de Bure Interferometer: Amplitude Calibration.
- IRAM Plateau de Bure Interferometer: Flux Measurements.
- IRAM Plateau de Bure Interferometer: Pointing Parameters.
- IRAM Plateau de Bure Interferometer: Trouble Shooting Guide.

All documents can be retrieved on Internet via the World-Wide-Web. IRAM's home page is `http://iram.fr/`

Roberto NERI

Scientific Results in Press

Spectroscopic observations of comet C/1999 H1 (Lee) with the SEST, JCMT, CSO, IRAM and Nançay radio telescopes

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Abstract:
Coordinated spectroscopic radio observations of comet C/1999 H1 (Lee) were undertaken between May 4 and October 26, 1999, using the Swedish-ESO Submillimetre Telescope, the James Clerk Maxwell Telescope, the Caltech Submillimeter Observatory, the 30-m telescope of the Institut de Radio Astronomie Millimétrique, and the Nançay radio telescope.

We report on observations of OH, HCN, CH_3OH, H_2CO, CS and on the evolution of their production rates with heliocentric distance, between 0.8 and 1.7 AU, where the total outgassing rate ranged between 0.2 and 1.6×10^{29} molecules s^{-1}. HNC was detected unexpectedly in this medium activity comet with a relatively large HNC/HCN mixing ratio of 12%, close to that measured in comet C/1995 O1 (Hale-Bopp), which cannot be explained by current chemical models of the coma. CO was tentatively detected with a low abundance around 4% relative to water and is clearly underabundant in comparison to comets Hyakutake and Hale-Bopp. An upper limit of D/H $< 300 \times 10^{-5}$ in water was found from a brief search for HDO.

Molecular abundances relative to water of the other species around 1 AU are similar to those observed in other comets, although CH_3OH (4%) and H_2CO (1%) exhibit some of the largest abundances compared to previous comets.

Astron. J., in press

CO band emission from MWC 349 : I. First overtone bands from a disk or from a wind?

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Abstract:
We observed the near infrared emission in the wavelength range 2.28–2.5 μm from the peculiar B[e]-star MWC 349. The spectra contain besides the strong IR continuum the first overtone CO bands and most of the hydrogen recombination lines of the Pfund series, both in emission. We also modeled the spectra. The Pfund lines have a gaussian profile with a FWHM of $\sim$ 100 km/s, and it turned out that their emission is in LTE and optically thin. To explain the CO bands, several scenarios were investigated. We found that the CO band heads are formed under LTE and that the gas must have a temperature of 3500 to 4000 K. The width of the $2 \rightarrow 0$ band head indicates kinematical broadening of 50 to 60 km/s. We can obtain fits to the measured spectra assuming that the CO gas has a column density of $5 \cdot 10^{20}\,\mathrm{cm}^{-2}$ and is located either at the inner edge of the rotating circumstellar disk. In this case, the disk must have a bulge which partly blocks the radiation so that the observer sees only a sector on the far side where the radial velocities are small. Or the CO emission originates in a wind with gaussian line profiles. Both fits are of equal quality and satisfactory. In a third alternative where the fit is less convincing, the CO emission is optically thin and comes from an extended Keplerian disk.

A&A, in press

The Bright Gamma-Ray Burst 991208 – Tight Constraints on Afterglow Models from Observations of the Early-Time Radio Evolution

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Abstract:
The millimeter wavelength emission from GRB 991208 is the second brightest ever detected, yielding a unique data set. We present here well-sampled spectra and light curves over more than two decades in frequency for a two-week period. This data set has allowed us for the first time to trace the evolution of the characteristic synchrotron self-absorption frequency $\nu_{\rm a}$ and peak frequency $\nu_{\rm m}$, and the peak flux density $\rm F_m$: we obtain $\nu_{\rm a} \propto t^{-0.15\pm0.12}$, $\nu_{\rm m} \propto t^{-1.7\pm0.4}$, and $\rm F_m \propto t^{-0.47\pm0.11}$. From the radio data we find that models of homogeneous or wind-generated ambient media with a spherically symmetric outflow can be ruled out. A model in which the relativistic outflow is collimated (a jet) can account for the observed evolution of the synchrotron parameters, the rapid decay at optical wavelengths, and the observed radio to optical spectral flux distributions that we present here, provided that the jet transition has not been fully completed in the first two weeks after the event. These observations provide additional evidence that rapidly decaying optical/X-ray afterglows are due to jets and that such transitions either develop very slowly or perhaps never reach the predicted asymptotic decay $\rm F(\it t) \propto t^{-p}$.

Accepted for publication in ApJ Letters

High-resolution observations at $\lambda = 3$ mm of the OH 231.8+4.2 molecular outflow

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Abstract:
We present high spatial resolution observations of $\rm HCO^+$ (J=1→0), SO (J=22→11), $\rm H^{13}CN$ (J=1→0), SiO (v=1, J=2→1), and the continuum at 3 mm from OH 231.8+4.2, taken with the IRAM interferometer at Plateau de Bure. We also report the first detection of NS in circumstellar envelopes. The overall distribution of the emission of all molecules (except for $\rm HCO^+$ and the SiO maser) is similar to that of CO. The most intense emission arises from a compact, slowly-expanding component around the central star. The rest of the emission comes from gas distributed in a narrow region along the symmetry axis, that flows outwards following a velocity gradient also similar to that found in CO. Our observations show with high accuracy the distribution of the $\rm HCO^+$ intensity, that is found to be very clumpy and strongly enhanced in the shock-accelerated lobes. We argue that such a distribution is due to the efficient formation of this molecule by shock-induced reactions. An expanding disk or ring around the central star is detected from the SO emission. The characteristic radius and expansion velocity of this structure are $2\,10^{16}$ cm and $6-7$ km s^{-1}, respectively. The SiO maser emission could arise from the innermost parts of such a disk. The 3 mm continuum emission seems to be due to cold dust (∼20 K) distributed in the lobes of object OH 231.8+4.2 as well as from warmer (∼55 K) dust located in a compact region surrounding the central star.

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