IRAM Newsletter

Number 49 August 10, 2001

Contents

Calendar

September 5th, 2001 16:00h (MET): Deadline for the submission of observing proposals for the period Nov 15, 2001 to May 15, 2002

September 14-21 2001: IRAM Summer School in Pradollano (Sierra Nevada, Spain)

IRAM Council Meeting on June 28th/29th, 2001 in Berlin

The 36$^{\mathrm{nd}}$ meeting of the IRAM Executive Council was held on June 28$^{\mathrm{th}}$ and 29$^{\mathrm{th}}$, 2001 in Berlin in the Harnack House of the Max-Planck-Gesellschaft.

After the adoption of the agenda and a review of the action items from previous meetings, the Annual Report 2000 together with an oral report on recent developments were briefly discussed. The Council noted in particular the efforts made by the Plateau de Bure staff to restart scientific activities after the observatory had been put into a safeguarding mode. Prior to the restart of observations, a series of safety audits had been conducted, and the necessary technical maintenance work had been completed.

The Council also noted the report of the Scientific Advisory Committee. At its meeting on May 17$^{\mathrm{th}}$, 2001 the SAC had discussed the current status of the Pico Veleta and Plateau de Bure Observatories as well as the technical developments currently underway, and the plans for future developments.

The ongoing and planned activities have, of course, a direct impact on the 2001 and 2002 budgets that were presented to the Council for approval. The 2001 running budget increases by 5.2% as compared to the year before. This is largely due to the transfer of a significant amount of money from 2000 to 2001 because of the exceptional circumstances. The level of contributions from the CNRS, MPG, and IGN remains, by contrast, constant, and will be constant again for 2002 despite the fact that the 2002 running budget shows an increase of 0.8% as compared to 2001. This implies that an increasing amount of the budget has to be covered by other income, e.g. contracts with third parties. As we have to cope with a number of unavoidable and significant cost increases, we do hope that future contribution levels for the running budget will include at least an inflation correction.

After the special contributions by the IRAM partners for Antenna 6 have come to an end, the investment budget has fallen back to its previous level which has been constant since more than 5 years. This could become worrisome except that for the time being, our development projects are more constrained by manpower than by financial limitations.

Concerning major investment projects, for which funding has been approved, the highest priority for 2001 is the completion of Antenna 6. Other projects that will absorb significant amounts of money are the construction of 9 more channels for the HERA (see status report below), the construction of 7 more filterbanks each covering 1 GHz with 4 MHz resolution (to bring the total number to 9), the construction of more 22 GHz radiometers for the interferometer antennas, and the purchase of components for the next generation Plateau de Bure receivers. Significant funds will also go into the purchasing of urgently needed equipment for the Grenoble laboratories and for the Plateau de Bure. Furthermore, the extension of the workshop in Grenoble is funded as well as the construction of a new building at Enclus, to store materials and equipment that will in the future be used/needed (again) on the Plateau de Bure. For safety reasons, storage of this material at the observatory will be discontinued.

Concerning the longer term planning, IRAM proposed to upgrade the signal transport system, the receivers, and the correlator of the Plateau de Bure Interferometer to handle much wider bandwidths. This has the support of both the SAC and the Council.

Among the options for future investment projects, one question attracted particular attention: would it be scientifically justified, and cost efficient, to add the SEST antenna to the Plateau de Bure array, should its operation on La Silla by ESO and the Onsala Space Observatory one day be stopped? Based on a scenario paper that had been prepared by IRAM, and in line with a recommendation from the SAC, it was considered worthwhile to pursue this issue.

The Executive Council noted the report that had been prepared on IRAM's involvement in the ongoing Phase I activities of the ALMA project, and then continued to discuss ways in which IRAM could be involved in the ALMA project in the longer term. The Council fully supported the proposal for a Europan ALMA Data Analysis Centre in Grenoble. At the same time the Council strongly encouraged the plan of a significant involvement of IRAM in the receiver development, construction, as well as in the integration, testing, and long term upgrading of receiver systems.

Finally, the Executive Council noted the need for a number of administrative changes. These concern IRAM's social capital and corresponding changes in the Statutes due to the arrival of the EURO, as well as changes in the financial and purchasing rules, the latter imposed by recent EU legislation.

Michael GREWING

Personnel Changes

IRAM Grenoble

The receiver group in Grenoble welcomes several new (and old) members: GILLES BUTIN has recently returned from IRAM Spain, and FLORIAN PERRIN and FABRICE COQ will start work at the beginning of September.

Michael BREMER

IRAM Granada

SALVADOR SANCHEZ, previously in the backend group and working as a telescope operator, is now affiliated to the telescope group. He continues to be the contact person for backends and VLBI.

TERESA GALLEGO is working at the 30m telescope as a new operator.

In August, PIERRE HILY-BLANT is leaving IRAM Spain. He has worked as a cooperant and astronomer. We wish him all the best for his future career.

Rainer MAUERSBERGER

News from the 30m Telescope

Improvement of the pointing model due to inclinometers

Since October 1999 inclinometers are used at the 30m telescope. They measure two parameters of the pointing model (P4 and P5) that reflect the tilt of the azimuth axis with respect to the astronomical zenith. P4 and P5 change considerably in time, with daily variations of up to 6″, due to thermal deformations of the concrete pedestal supporting the azimuth bearing. P4 and P5 are being measured every time the telescope moves 50 degrees or more in azimuth, with a precision of better than 1″.

Since January 2000 P4 and P5 have been updated regularly by the AoD as soon as a significant change has been noted. We have compared the average scatter of the pointing offsets for a period of 21 months before October 1999 and for a period of 16 months after January 2000. This average scatter was measured by the scatter of the observations for a pointing model *before* implementing the new model. It represents the state of the pointing model after, on average, 8 days (after January 2000), respectively 12 days (before October 1999).

The precision of the pointing model has clearly improved after January 2000 due to the use of the inclinometers. Whereas the scatter of the pointing offsets was 4.6 ± 2.4 arcsec before October 1999, it is now on average 3.2 ± 1.1 arcsec.

In the near future, the latest values of P4 and P5 will be updated automatically at every pointing measurement.

Ute LISENFELD & Juan PEÑALVER

HERA Installation at the 30m Telescope

In early May 2001 the IRAM 230 GHz SIS **HE**terodyne **A**rray **R**eceiver (HERA) has been successfully installed in its intermediate configuration (single linear polarization, 9 elements) at the 30m telescope. The multi-beam receiver currently undergoes commissioning. HERA is part of the new 30m instrumentation and was included in the new cabin layout from the very beginning. HERA significantly improves the speed for raster and on-the-fly mapping of spectral line emission in the range from 210 to 276 GHz, and will eventually also allow for new observing modes like dual beam wobbler switching or imaging polarimetry.

The receiver with its electronic, optical and cryogenic components has been integrated into a compact mechanical support structure. Its main features include a closed cycle cryostat with modular RF building blocks, a cold internal optic with a single circular cryostat window and a compact K-mirror field de-rotator in front of the cryostat. For more technical information see Schuster et al. (1999) [1]. Due to its particular optic and position in the optical path of the 30m telescope HERA will not be available simultaneously with other receivers, but switching is possible within minutes.

The tuning range of HERA is 210–276 GHz in single (SSB) or double (DSB) sideband mode with an IF bandwidth of 1 GHz. Tuning is automatic but temporarily restricted to a limited set of frequencies (see the "Call for Proposals" later in this Newsletter). Receiver temperatures increase from 110 K T_{SSB} at 210 GHz to 380 K at

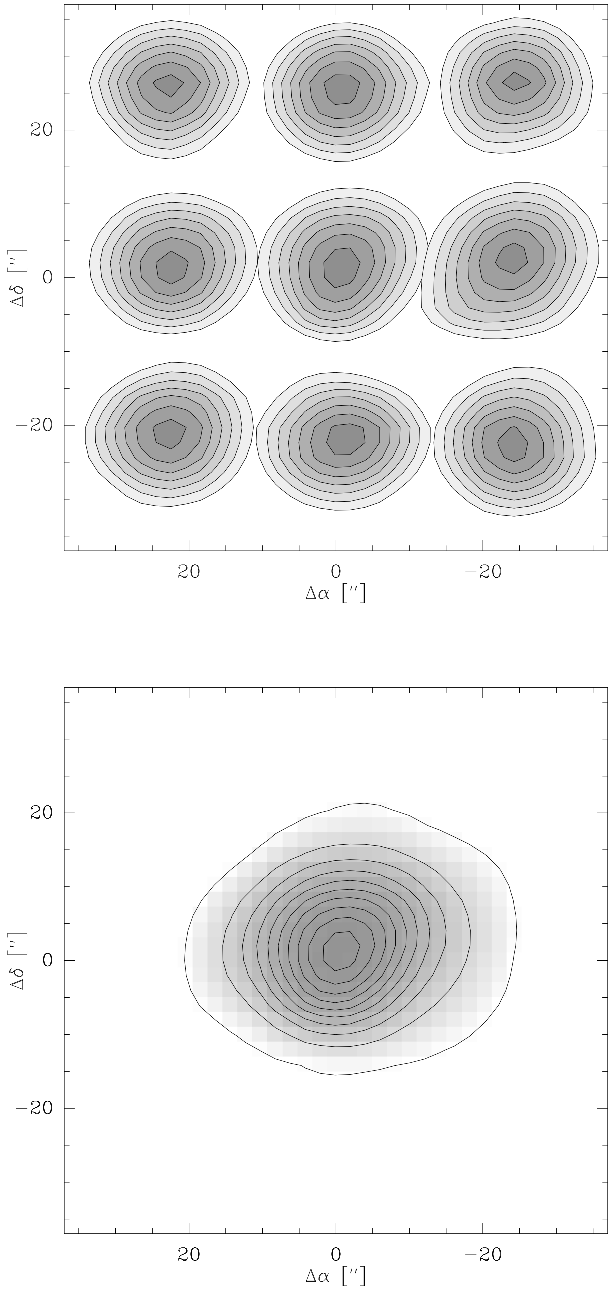

Figure 1: **a)**: HERA sky pattern from OTF measurements on Saturn in 230 GHz continuum (10 % level spacing), The observations were made with tracking derotation to obtain an undeformed pattern in RA and Dec. **b)** Restored continuum image of Saturn (same spacing).

[1] Schuster et al.(1999), "The IRAM 230 GHz Multibeam Receiver", in: Imaging in the Radio Region throughout the Submillimeter Rang, Tucson, June 1999, A.S.P. Conf. Ser. Vol. **XX**, Editors J. Mangum & S.J.E. Radford

270 GHz, equalling the performance of the single-beam receivers. The de-rotator allows to optimize the array orientation for raster mapping and efficient sweeping during OTF observations with high precision. A particular pointing model is not required for HERA.

Figure 1a shows the array pattern on the sky obtained in continuum (1 GHz at 230 GHz) observation and measured with a high signal to noise OTF sweep over Saturn under medium weather conditions. The right element of the center row shows some irregularities due to microphonics of the corresponding mixer at this frequency. The beams have a $24''$ spacing corresponding to 2 beam widths. Due to limited pointing accuracy during the observations the whole array pattern is shifted about $1.5''$ to the north. The restored image of Saturn (Fig. 1b) shows the characteristic deviation from circular symmetry due to the oblation of Saturn itself and emission from the rings.

HERA's second polarization module is currently in preparation. It will have an independent frequency setting and its 9 elements will spatially coincide with those of the 1st polarization. The data acquisition rate of HERA in its dual polarization configuration will be considerable, and a particular effort will have to be made in terms of computer hardware and data reduction software.

The HERA Installation and Commissioning Team :
K.-F. SCHUSTER, C. BOUCHER, W. BRUNSWIG, C.-Y. CHENU, A. GREVE, P. HILY-BLANT, D. JOHN, S. NAVARRO, A. PERRIGOUARD, P. PLANESAS, A. SIEVERS, C. THUM, and H. WIESEMEYER

Better understanding of the 30m telescope's thermal life

Since some time we are studying the telescope's thermal life in order to eventually improve its focus and pointing. For this purpose we have installed 150 temperature sensors, i.e. 105 in the reflector back structure (BUS), and 45 in the box-shaped yoke. The accuracy of the readings is approx. 0.1° C; the data are recorded every 5 minutes. These temperature measurements are used in a finite element model (FEM) to predict the temperature-induced mechanical deformations of the BUS, the yoke, and the subreflector support legs. We are able to use these data in the prediction of the focus and the beam shape; we are not yet fully successful in the prediction of the pointing.

The attached figures give some illustration of the potential of these measurements.

During the comissioning of the 9-channel 1.3 mm (230 GHz) HERA receiver we were confronted to determine the simultaneous focus from a focused ($F = -2.43$ mm), an in-focus ($F = -1.73$ mm), and an out-of-focus ($F = -3.13$ mm) 1GHz-BW continuum map of Uranus (diameter $\approx 2''$). The de-focusing was produced by a displacement of the subreflector of ± 0.7 mm, i.e. approx

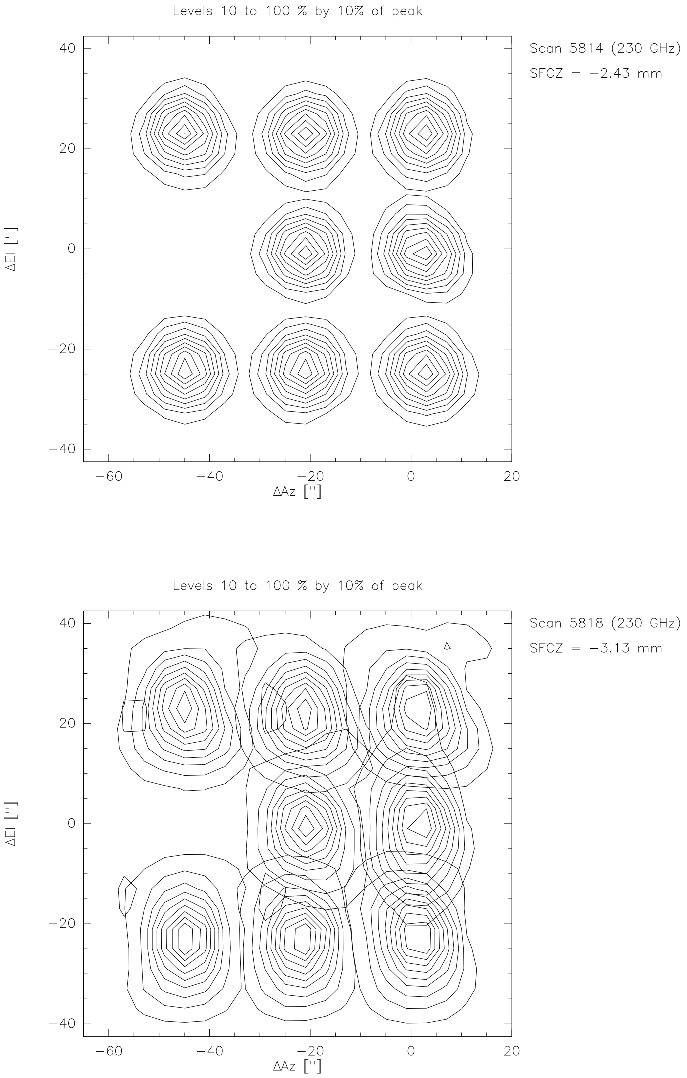

Figure 2: a) Focused HERA (1.3 mm) continuum map of Uranus, b) de-focused HERA continuum map of Uranus (de-focus: 0.5 λ). One channel was not used in this observation because of limited continuum stability.

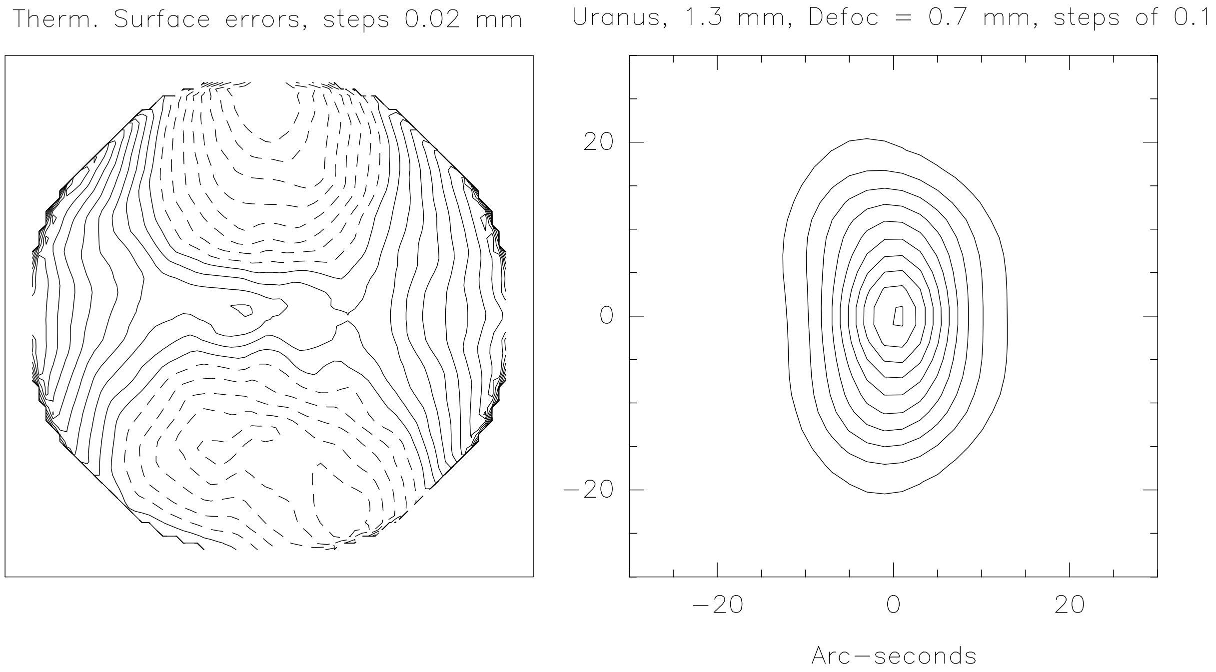

Figure 3: a) temperature-induced main reflector surface deformations predicted from temperature measurements and FE calculations. b) corresponding predicted de-focused beam pattern obtained from a diffraction calculation considering the surface (wavefront) deformations.

0.5 lambda. Figure 2a shows the focused map of Uranus, Fig. 2b the out-of-focus map. The out-of-focus map shows the same astigmatic beam pattern, for all channels.

It is known since some time that the 30m telescope has a time-variable residual thermal deformation which appears primarily as astigmatism with principle axes in the direction up-down (EL) and left-right (AZ). This astigmatism is produced by temperature-induced main reflector surface deformations. The astigmatism during the measurements shown in Fig. 2a-b had an amplitude of 0.08 to 0.09 mm, while most of the time the astigmatism is smaller. This amplitude is determined from the analysis of Fig. 2a-b, and is also obtained from the temperature measurements and the FE calculation, shown in Fig. 3a. The corresponding predicted de-focused beam pattern is shown in Fig. 3b. There exists excellent agreement between the measurements and the prediction from the FEM and beam pattern calculation.

However, the observer at the 30m telescope does not need to worry. Observations are never made with a beam de-focused as shown in Fig. 2b; the focused beam (even with astigmatism) is circular and only $\approx 1''$ broader than the perfect beam; the loss in mainbeam sensitivity is below 5% at 230 GHz. Often the amplitude of the astigmatism is smaller than the value shown in this illustration.

Finally we note that the 30m telescope works already significantly better than the original specifications (for instance the surface accuracy). Further improvements require a detailed understanding of time variable processes, where the FE model - as shown above - can make valuable contributions.

Temp-team: A. GREVE, M. BREMER, J. PEÑALVER,
HERA-team: H. WIESEMEYER, K.-F. SCHUSTER,
P. HILY-BLANT

News from the PdBI

Antenna 6 status

After the thermal insulation of the fork has been finished, work has begun on the assembly of the reflector.

The centre piece for this construction phase is the central hub, a precision-manufactured steel element from which the steel and carbon-fibre rods of the panel support structure radiate outwards.

Its weight of 5 tons posed a logistics problem, as there are few helicopters capable of lifting such a mass in the thin air on 2500 m altitude, and the precision requirements excluded a “cut into pieces and re-assemble later” approach. The problem has been resolved during the commissioning tests for the reconstructed “material transport only” cable car.

After transporting a 7.5 tons beton block as a test mass, the central hub was brought up (this also allowed to verify the handling procedure for heavy loads), and has already

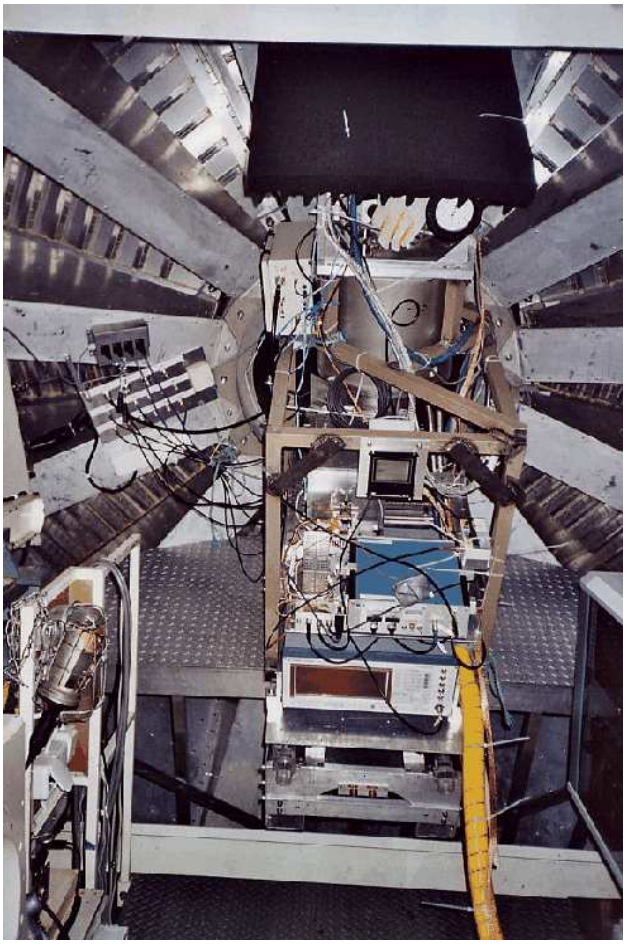

Figure 4: The 'retired' IRAM 2 mm SIS receiver installed at the vertex of the Metsähovi telescope.

taken its place in the centre of a growing reflector support structure.

The completion of the reflector (including the installation of the 176 panels) will take several months. According to the current planning, first light for Antenna 6 will be during this winter session.

Michael BREMER

A 2 mm VLBI experiment between Metsähovi (Finland) - Pico Veleta (Spain) - SEST (Chile)

During the last 10 years, VLBI at 3mm wavelength (86 GHz) on continental and intercontinental baselines of ca 5000 to 10 000 km length (Europe – USA – Chile) has become an established observational tool. Such baselines are equivalent to $4 - 8$ Mega-λ, respectively, the

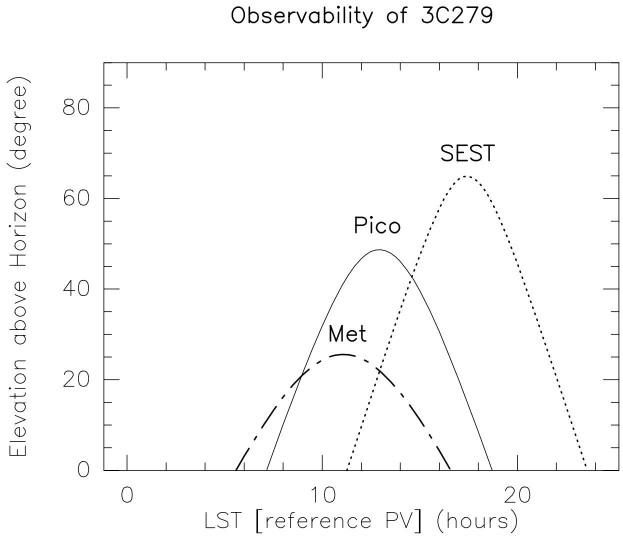

Figure 5: Mutual visibility of 3C279 at Metsähovi, Pico Veleta, and SEST

corresponding angular resolution being $\lambda/B \sim 50 - 100\mu$ arcsec.

Progress of mm VLBI at shorter wavelengths has been slow, not only because of the small number of sensitive and large diameter telescopes or interferometers capable of working at high frequencies, but also because of the stronger influence of atmospheric conditions (phase fluctuations). In addition to the high stability of the masers and LO-chains, the relatively small recorded bandwidth (56 to 112 MHz) limits the sensitivity at wavelengths shorter than 3 mm. Evidently, VLBI at the shorter wavelengths is restricted to the atmopheric windows at $\sim$ 2 mm (i.e. 150 GHz) and $\sim$ 1.3 mm (i.e. 230 GHz).

Several experiments have been made at 2 mm wavelength between Kitt Peak [KP], SEST [SE] and Pico Veleta [PV], and at 1.3 mm wavelength between PV–SE–KP and OVRO–KP–HHT–BIMA. Success so far has only been obtained with the 1.3 mm observation in 1990 between OVRO–KP on a baseline of 845 km (0.6 Mega-λ) leading to a marginal detection of 3C273 (SNR = 5), and the observation in 1995 between PV–Plateau de Bure [PdB] on a baseline of 1150 km (0.9 Mega-λ) leading to the highly significant detections (SNR = 7 to 35) of 3C273, 3C279, a few other QSOs, and SgrA*.

With the installation at the 30-m telescope of the new generation SIS receivers, the old 'work-horse' 2 mm SIS receiver was no longer needed (1998). During the 2nd mm VLBI-workshop (Granada) the idea arose to use this receiver in Finland on the Metsähovi [ME] 14-m telescope for a VLBI test experiment at 2 mm (150 GHz). This radom-enclosed telescope, located at sea level, had never before been used for observations at wavelengths shorter than 3 mm; the use of a He-cooled SIS receiver being a completely new experience. Figure 4 shows the receiver

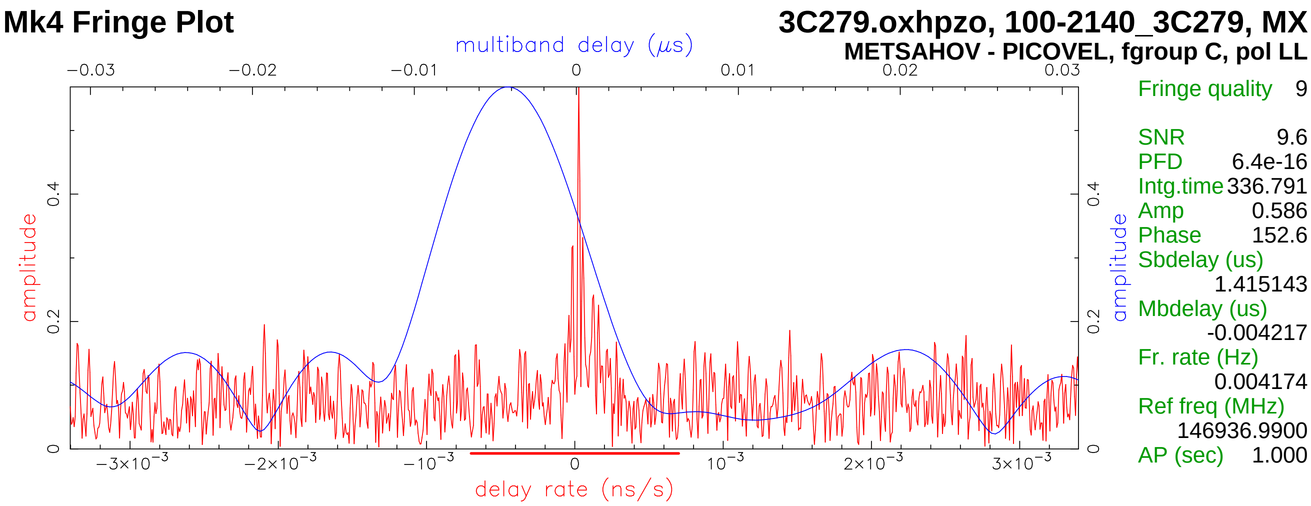

Figure 6: Detection of 3C279 on the ≈ 2500 km baseline ME-PV. The picture (red line) shows the correlated amplitude obtained with the correct delay (correlator diagnostic output).

installed at the vertex of this telescope. The candidate sources 3C279 and 3C273 culminate at Metsähovi only at 25° to 30° elevation, but the expectation of a (very) cold winter made the experiment attractive. The projected baseline PV–ME is 2000–3000 km (1.5 Mega-λ) and thus comparable to the baseline of the successful 1.3 mm PV–PdB experiment (0.9 Mega-λ). This extrapolation gave hope for a detection.

The SEST telescope has had for some time a 2 mm SIS receiver. The telescope became available as partner in this and another experiment concentrating on the baseline SE–PV. The experiment used more or less the same LO-setup as in the earlier 2 mm VLBI experiments. The baseline SE–PV is ca 9000 km (4.5 Mega-λ), the baseline ME–SE is ca 11 000 km (5.5 Mega-λ).

The observations were made in March (2 days: ME–PV) and April 2001 (2 days: ME–PV–SE and PV–SE), under moderate to poor weather conditions: warm in Finland (0° to −10° C), wet at SEST, reasonable to good at PV. The data were correlated on the recently MKIV-upgraded VLBI correlator of the MPIfR at Bonn.

The observations concentrated on the strongest sources, i.e. 3C279 and 3C273, but several QSOs were also observed. The mutual visibility of 3C279 at ME, PV, and SE is shown in Fig. 5.

Fringes with a Signal/Noise-ratio of 9.6 have been found between Metsähovi and Pico Veleta; fringes have not (yet) been found between SEST and Pico Veleta – for unknown reasons, although 3mm fringes between SE and PV were seen a few days before. Figure 6 shows the ME–PV detection of 3C279.

In the near future a 2 mm VLBI experiment could be repeated, perhaps including the HHT (Mount Graham, USA), and the KP telescope. This would include the major part of the telescopes able to observe at 2 mm wavelength. The near future will also see again experiments at 1.3 mm wavelength, in particular when the phased-array PdB and PV can observe mutually in 2002. In the more distant future the LMT, CARMA, and ALMA will play and important role for mm-VLBI.

The VLBI observations involved the efforts of many persons at the observatories and at the correlator; many e-mails and telephone calls; and smoothing of the logistics by the observatory directors (S. Urpo, R. Booth, M. Grewing).

The groups participating in the experiment were:

Seppo, Prisse, Pekka, Eki, Johanni,
Ari, Jouko, ... (Metsähovi-SF);
Kaj .... (Turku-SF);
Dave, Santiago, Salvador, Juan, the telescope operators (IRAM-Spain);
John, Fredrik, Lars-G., Michel .... (OSO+SEST);
David, Thomas, the correlator staff .... (MPIfR);
Albert, Marylène, Bernard, Jean-Yves, ... (IRAM-FR).

A lot of equipment has been transported efficiently by Javier and Gaby and the SF colleagues. The scheduling must have been a nightmare for Clemens and Lars-Åke.

Albert GREVE, on behalf of the VLBI collaboration.

Call for Observing Proposals on the 30m Telescope

Summary

The *next deadline* for the submission of observing proposals for the IRAM 30m telescope is **September 5th, 2001 16:00h (MET)**. The scheduling period extends from Nov 15, 2001 to May 15, 2002, covering roughly the winter period at Pico Veleta. Proposals for three types of receivers will be considered for the coming winter semester:

1. the new 9 pixel heterodyne receiver array, HERA, operating at 1.3 mm wavelength,
2. a 1.2mm bolometer array with at least 37 pixels,
3. the observatory's set of eight heterodyne receivers at wavelengths of 3, 2, 1.3, and 1.1 mm.

Roughly 2800 hours of observing time will be available, which should allow scheduling of a few longer programmes (of the order of 100 hours). Emphasis is on observations in the 1mm window.

What is new ?

The new 1.3mm **HE**terodyne **R**eceiver **A**rray, **HERA**, built by IRAM, is being commissioned in its intermediate configuration (only one polarization) during this summer. The results are so far very encouraging. The instrument has 9 pixels separated by 24″ and arranged in a center–filled square. Each pixel has a diffraction–limited (11″ at 230 GHz) and linearly polarized beam. HERA will be available for the coming winter semester with some restrictions (see below) in tuning, backend coverage, and observing modes.

Updates on the progress with HERA will be posted on the Grenoble 30m web page at URL http://iram.fr/PV/veleta.html. The time estimator available on the Granada web page at URL http://www.iram.es will be updated to include the basic observing modes of HERA.

The 37–pixel bolometer array **MAMBO** which was used during the two previous winter semesters with excellent sensitivity is made available again by the MPIfR. A new array consisting of 117 pixels will be tested in autumn. If its sensitivity is found to be comparable to MAMBO, the new array may be used throughout this winter. Time estimates should be based on the 37–pixel system (MAMBO–37). If the 117–pixel array (MAMBO–117) should become available, the time allocation for approved proposals may be revised.

Experimentation with new **flexible observing** schedules will continue this winter. A suitable mix of proposals with high and moderate demands on atmospheric quality may be scheduled in several pools of a few weeks duration. Although priority will be given to high frequency proposals in general terms, lower frequency weather tolerant proposals are encouraged, since these programmes have good chances to be scheduled as backups in such pools. IRAM will contact the principal investigators of accepted proposals which could be scheduled in this way.

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 or express mail addressed to:
  IRAM Scientific Secretariat,
  300, rue de la Piscine,
  F-38406 St. Martin d'Hères, France
  (tel. +33-(0)476-824900)

We strongly encourage submission through the web–based facility. More than 75% of the proposals were sent in this way for the last deadline. Submission through fax will be discontinued in the future. Proposals sent in by E–mail are not accepted.

All proposals must reach the Secretariat before **September 5th, 2001 16:00h (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 for both HERA and the observatory's standard SIS receivers. This observing mode is interesting for projects not demanding very flat baselines. Certain limitations exist with respect to maximum frequency throw ($\leq 45\,\mathrm{km/s}$), backends, phase times etc.; for details see [8]. Little experience exists however with HERA, but more tests are planned. Please check our web pages for news on this topic.

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 and handles the vast majority of both heterodyne and bolometer observing modes. Now in its version 2.4, it includes the new HERA receiver array. Extensive on–line help is provided. Questions can be addressed to P. Hily–Blant (hilyblan@iram.es) or to his successor, F. Damour (damour@iram.es). *Proposers are asked to use this tool whenever applicable.*

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

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_{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 ($\leq$8 h) programmes, we propose "service observing" for some easy to observe programmes *with only one set of tunings*. Observations are made by the local staff using precisely laid–out instructions by the principal investigator. For this type of observation, we request an acknowledgement of the IRAM staff member's help in the forthcoming publication. If you are interested by this mode of observing, specify it as a "special requirement" in the proposal form. IRAM will 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 ENS in Paris (often restricted to nighttime hours), and from IRAM in Grenoble. This observing mode is available to projects without any particular technical demands and to experienced 30m users. The prospective remote observer should note "remote observing" as a special requirement in the proposal cover sheet.

After time has been awarded to a remote proposal, the P.I. is requested to give sufficient detail to the Station Manager (mauers@iram.es) on how the remote observer can be contacted. Please note that IRAM is not responsible for the remote stations in Paris or Bonn.

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 the Paris area may contact D. Teyssier (teyssier@lra.ens.fr) for arrangements. Remote observers in or near Grenoble contact C. Thum (thum@iram.fr) or H. Wiesemeyer (wiesemey@iram.fr) at IRAM. Observers visiting the 30m might opt to do some of their observing from Granada if it eases their travel constraints. In this case, a Granada astronomer should be contacted as soon as possible, arrangements on very short notice may not always be possible.

Technical Information about the 30m Telescope

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

HERA

The new **HE**terodyne **R**eceiver **A**rray is now available for the first time. The 9 pixels are arranged in the form of a center–filled square, and are separated by 24″. A derotator optical assembly keeps the 9 pixel pattern stationary on the sky. Each pixel has a diffraction limited (11″ at 230 GHz) and linearly polarized beam. Receiver characteristics are listed in Tab. 1.

Frequency tuning of HERA, although fully under remote control and automatic, is substantially more complicated than for the observatory's other SIS receivers. So far, only the following frequencies can be tuned:

- ▷ CO isotopes at 230.5, 220.4, and 219.6 GHz
- ▷ CS($5 \rightarrow 4$) at 244.9 GHz
- ▷ HCN($3 \rightarrow 2$) at 265.9 GHz
- ▷ HCO^+($3 \rightarrow 2$) at 267.6 GHz

Proposals for HERA at other frequencies within its nominal tuning range of 210 – 276 GHz are nevertheless invited, but we cannot guarantee at this moment that these proposals can actually be done. Uninterrupted coverage of the nominal tuning range depends on additional hardware which is expected to become available sometime in the winter semester.

Owing to ongoing work on a significant expansion of the autocorrelator, we expect that the HERA user will have the following backend options next winter, all with the new extended autocorrelator: two independent subbands connectable to each pixel, where the subbands have channel spacings between 40 kHz and 1.25 MHz and corresponding bandwidths between 20 and 160 MHz. Thus a maximum nominal bandwidth of 320 MHz is available per pixel, but note that platformimg cannot be excluded in this configuration. Software for the extended correlator may still be somewhat experimental early in the winter semester.

In case we run into severe problems with the upgrading of the correlator, the following two well tested sets of backends can always be used with HERA: *(i)* 8 autocorrelator sections of 80 kHz channel spacing and 40 MHz bandwidth combined with the narrow filterbank (128 channels of 100 kHz resolution), and *(ii)* 8 AC sections of 1.25 MHz channel spacing and 160 MHz bandwidth combined with one section of the wide filter bank (256 channels of 1 MHz resolution).

HERA is now operational in two basic spectroscopic observing modes: *(i)* raster maps of areas typically not smaller than $1'$, in position, wobbler, or frequency switching modes, and *(ii)* simple on–the–fly maps of moderate size (typically $2' - 10'$). Other observing modes are conceivable and/or under tests, but they may not be ready this winter. For details, please contact the project scientist, Karl Schuster (schuster@iram.fr), Helmut Wiesemeyer (wiesemey@iram.fr), or Pierre Hily–Blant (hilyblan@iram.es).

HERA proposers are invited to check the IRAM web page at Grenoble at URL http://iram.fr/PV/veleta.html for updated information on the progress of the commissioning work. In particular, HERA proposers should use the web–based time estimator (Granada web page at URL http://www.iram.es.

The Observatory Heterodyne Receivers

Eight SIS receivers are available at the telescope for the upcoming observing season. They are designated according to the dewar in which they are housed (A, B, C, or D), followed by the center frequency (in GHz) of their tuning range. Their main characteristics are summarised in Tab. 1. All receivers are linearly polarized with the E–vectors, before rotation in the Martin–Puplett interferometers, 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. Note that they cannot be combined with HERA. Also listed are typical system temperatures which apply to normal winter weather (4mm of water) at the center of the tuning range and at 45° elevation. All receivers are tuned by the operators from the control room. Experience shows that it normally takes about 15 min to tune four such receivers.

General point about receiver operations

As receiver tuning is now considerably faster 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 at least two weeks before the observations.

Polarimeter

An IF polarimeter is available for observations of compact sources. The instrument is designed for narrowband (40 MHz) line and continuum polarimetry. It takes the IF signals from 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 at 3 and 1.3 mm have demonstrated that the drift of the relative phase between the two receivers is often very small and always calibratable. Data reduction software using CLASS enhanced with a graphical user interface is now available. Please contact H. Wiesemeyer (wiesemey@iram.fr). 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 be 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 winter.

MPIfR Bolometer arrays

The 37–pixel MAMBO array consists of 3 concentric hexagonal rings of horns centered on the central horn. The spacing between horns is $\simeq 20''$. Each pixel has a HPBW of $11''$ and a sensitivity of $\simeq 30$ mJy s$^{1/2}$. This figure applies for "normal bolometric conditions" (pwv 4mm and a stable atmosphere, i.e. no clouds, little turbulence, high elevation, application of skynoise reduction alogrithms). Often, such bolometric conditions are only found between sunset and noon.

The 37–pixel array was used extensively at the telescope last winter with good success. A second 37 pixel array of comparable performance or a new 117 pixel array will be available as backup. Further tests of the 117–pixel array are planned this autumn. If successful, the new big array may be used throughout this winter, making mapping observations of large areas more efficient. Proposers should however base their time request on MAMBO–37. If MAMBO–117 should indeed become available, the program committee may suggest to adjust accordingly the time allocation of mapping proposals.

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 ~ 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 with time as $t^{\frac{1}{2}}$ to rms noise levels below 0.3 mJy.

In the mapping mode the telescope is scanned in azimuth, the direction of the wobbler throw, in such a way that all pixels cover the source. A typical single map covering 4×3 arcmin with a scan speed of $4''$/sec and a raster step of $4''$ in elevation takes about 60 min of telescope time. Under normal bolometric conditions and assuming

[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 1: Heterodyne receivers available for the winter 2001/02 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. Note that the 8 standard receivers can be combined in 4 different ways, but HERA cannot be combined with any one of them.

receiver	polar–ization	combinations 1	2	3	4	5	tuning range GHz	T_{Rx}(SSB) K	g_i dB	ν_{IF} GHz	$\Delta\nu_{IF}$ GHz	T^*_{sys} K	remark
A 100	V	1		3			80 - 115.5	45 - 65	> 20	1.5	0.5	120	
B 100	H	1			4		81 - 115.5	60 - 85	> 20	1.5	0.5	130	
C 150	V		2		4		129 - 183	70 - 115	15 - 25	4.0	1.0	200	
D 150	H		2	3			129 - 183	60 - 150	8 - 17	4.0	1.0	200	
A 230	V	1		3			197 - 266	85 - 185	12 - 17	4.0	1.0	420	1
B 230	H	1			4		197 - 266	95 - 160	12 - 17	4.0	1.0	420	1
C 270	V		2		4		241 - 281	125 - 290	10 - 20	4.0	1.0	900	2
D 270	H		2	3			241 - 281	130 - 300	9 - 13	4.0	1.0	900	2
HERA	H					5	210 - 276	110 - 380	~ 10	4.0	1.0	400	1, 3

1: noise increasing with frequency.
2: performance at $\nu < 275$ GHz; noisier above 275 GHz.
3: so far only 10 frequencies available, see text.

effective skynoise suppression, an rms of $2-4$ mJy is thus reached in the inner $2' \times 1'$. Maps may be co–added to reach lower noise levels. Mosaicing is also possible to map larger areas. Attempts to reach map noise levels below 1 mJy are still fraught with poorly understood problems and require sophisticated data reduction. If such observations are proposed, the proposers must indicate how they plan to reach this demanding goal.

Another note of caution: mapping of extended sources cannot rely on the sky-noise reduction algorithm (simple subtraction of correlated sky-noise) presently available, and the noise level reached may be at least twice as high as that quoted above.

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.

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 by nearly a factor of 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

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

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 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.
  There is still no automatic online data reduction for the 4MHz 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 and On–The–Fly are 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 $\leq$ 240″ depending on wobbling frequency. At 2 Hz, the maximum throw is 90″.
- Standard phase duration: 2 sec for spectral line observations, 0.25 sec for continuum observations.

References

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[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
L. Olmi, D. Downes 1992 (IRAM report 238)

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A. Greve 1992 (IRAM report 253)

[6] Astigmatism in reflector antennas: measurement and correction
A. Greve, B. LeFloch, D. Morris, H. Hein, S. Navarro 1994, IEEE Trans. Ant. Propag. AP–42, 1345

[7] Design parameters and measured performance of the IRAM 30m millimeter radio telescope
J. Baars, A. Greve, H. Hein, D. Morris, J. Peñalver, C. Thum 1993, Proc. IEEE 82, 687

[8] Frequency switching at the 30m telescope
C. Thum, A. Sievers, S. Navarro, W. Brunswig, J. Peñalver 1995, IRAM Tech. Report 228/95.

[9] Cookbook formulae for estimating observing times at the 30m telescope

M. Guélin, C. Kramer, and W. Wild (IRAM Newsletter January 1995)

[10] The 30m Manual: A Handbook for the 30m Telescope (version 2)
W. Wild 1995, IRAM Tech. Report 377/95, also available on http://www.iram.es.

[11] NIC: Bolometer User's Guide
D. Broguière, R. Neri, A. Sievers, and H. Wiesemeyer 2000, IRAM Tech. Report (http://iram.fr/GS/nic/nic.html); see also the NIC home page at http://iram.fr/GS/nic.html with further relevant technical reports.

[12] Pocket Cookbook for MOPS software
R. Zylka 1996 (http://www.iram.es/manuals/-Datared/pockcoo.ps).

[13] Line Calibrators at $\lambda = 1.3$, 2, and 3mm.
R. Mauersberger, M. Guélin, J. Martín–Pintado, C. Thum, J. Cernicharo, H. Hein, and S.Navarro 1989, A&A Suppl. 79, 217

[14] The Pointing of the IRAM 30m Telescope
A. Greve, J.–F. Panis, and C. Thum 1996, A&A Suppl. 115, 379

[15] The gain–elevation correction of the IRAM 30m Telescope
A. Greve, R. Neri, and A. Sievers 1998, A&A Suppl. 132, 413

[16] The beam pattern of the IRAM 30m Telescope
A. Greve, C. Kramer, and W. Wild 1998, A&A Suppl. 133, 271

[17] A Time Estimator for Observations at the IRAM 30m Telescope
D. Teyssier 1999, IRAM/Granada Technical Note (http://iram.fr/PV/veleta.html)

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

Call for Observing Proposals on the Plateau de Bure Interferometer

Conditions for the next winter session

The construction of the sixth antenna is progressing well, but the antenna should become operational by the end of the year, at the earliest. Investigators are therefore asked to submit proposals on the availability of five antennas only. Projects will be properly adjusted in observing time and uv-coverage as soon as the sixth antenna should become available.

As last winter, we will still rely on ground transport and transport by helicopter. This will limit the number of people on the site and so our ability to carry out configuration changes under typical winter conditions. We therefore ask investigators to submit proposals for the D, C2 and B1 configurations only. The D and C2 configurations have already been offered last winter. These configurations provide already a large number of possibilities: deep integrations (D), low (CD) and medium to high (BC) resolution observations in the snapshot, mapping or mosaicing modes. The BC set of configurations, for instance, provides an angular resolution better than $1''$ at 230 GHz and $30°$ declination. The scheduling priority is expected to be on the D configuration until December and towards end of the winter session, more extended configurations (C2 and B1) are likely not to be scheduled before.

Applications should also take into account the capabilities of the new six antenna correlator. 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, 2001 to May 15, 2002. The deadline for applications is **September 5th, 2001 16:00h (MET)**.

Under normal operating conditions, IRAM schedules and completes between 30 and 50 projects during the winter period, with an elapsed time of at least two months between start and end of any given project. Selection is based on scientific merit, technical feasibility, and adequacy to the instrument.

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.

We strongly encourage the submission via the electronic submission facility available at `http://iram.fr/submission/submission.html`. Note that applications sent by e-mail will not be accepted. Applications sent by fax or postal mail should be addressed to:

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

Proposal templates `proposal.tex` as well as the Latex style file `proposal.sty` can be retrieved by anonymous ftp from `iram.fr` (in directory `dist/proposal`); or from the Internet via the World-Wide-Web at http://iram.fr/proposal/proposal.html. In case of problems, contact the scientific secretary, Mrs Cathy Berjaud (berjaud@iram.fr).

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.

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 (or is not) the *resubmission* of a proposal or the *continuation* of a previously accepted proposal. In the 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 guidelines.

Proposal category

Proposals should be submitted for one of the five categories:

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

3mm: Proposals that ask for 3mm data *only*. 1.3 mm receivers can still be used to provide either phase stability information or purely qualitative information such as the mere existence of fringes.

dual freq.: Proposals that ask for dual-frequency observations (i.e. simultaneous observations at 3mm and 1.3mm).

time filler: Proposals that have to be considered as background projects to fill in periods where the atmospheric conditions do not allow mapping, or eventually, to fill in gaps in the scheduling, or even periods when only a subset of the standard 5-antenna configurations will be available. These proposals will be carried out on a "best effort" basis only.

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

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

Configurations

The configurations for the winter period will be:

5 Antenna configurations	
Name	Stations
D	W05 W00 E03 N05 N09
C2	W12 W09 E10 N05 N15
B1	W12 E18 E23 N13 N20

Projects will be properly adjusted in observing time and uv-coverage as soon as the sixth antenna becomes available. Investigators are asked to indicate possible tradeoffs should the requested configuration not be available.

The following configuration sets are available:

Set	Configs	Main purpose
D	D	Detection, "Low" resolution mapping at 1.3 mm
CD	D, C2	3.5″ resolution at 3mm, 1.8″ resolution at 1.3 mm
BC	B1, C2	2″ resolution at 3 mm

Enter ANY in the proposal form if your project doesn't need a particular configuration.

Receivers

All antennas are equipped with fully operational dual frequency receivers. The available frequency range will be 82 GHz to 116 GHz for the 3mm band, and 205 to 245 GHz for the 1.3 mm band. The 3mm and 1.3mm receivers are aligned to within $\approx 2''$.

Below 105 GHz, receivers offer best performances in LSB tuning with high rejection (20 dB): expected system temperatures are (in T_R^* scale) 100 to 150 K for the winter time. Above 110 GHz, best performances are obtained with USB tuning, low rejection (4 to 6 dB): expected system temperatures are 250 K at 115 GHz.

The 1.3 mm receivers give DSB tuning with typical T_{REC} below 50 K. Expected SSB system temperature are 250 to 350 K. The guaranteed tuning range is 205-245 GHz, but it may be possible to reach lower frequencies for specific cases. Higher frequencies are not feasible because of limitations in the triplers.

Atmospheric phase compensation

Software is available to provide real-time atmospheric phase compensation on spectral and continuum data, as well as a-posteriori processing for continuum data. Experience shows that a final phase noise below 30° at 230 GHz may be obtained under good circumstances.

Signal to Noise

The rms noise can be computed from

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

where

- T_{SYS} is the system temperature in T_r^* scale (150 K below 110 GHz, 300 K at 115 GHz, 500 K at 230 GHz)
- J_{pK} is the conversion factor from Kelvin to Jansky (22 at 3mm, 35 at 1.3mm)
- η is an efficiency factor due to atmospheric phase noise (0.9 at 3 mm, 0.8 at 1.3 mm)
- N_{a} is the number of antennas (5), and N_{c} is the basic number of configurations (1 for D, 2 for CD, 2 for BC)
- T is the integration time per configuration in seconds (3 to 8 hours, depending on source declination)
- B is the channel bandwidth in Hz (500 MHz for continuum, 40 kHz to 2.5 MHz for spectral line, according to spectral correlator setup)

Investigators have to specify the one sigma noise level which is necessary to achieve each individual goal of a proposal, and in particular for projects aiming at deep integrations.

Coordinates and Velocities

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

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

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

Correlator

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 pairs of numbers giving the total bandwidth/number of channels). In the first 3 modes: 320MHz/128, 160MHz/256, 80MHz/512 the two central channels may be perturbed by the Gibbs phenomenon (depending on continuum strength). 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: 160MHz/128, 80MHz/256, 40MHz/512 and 20MHz/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 (3mm receiver) or on the IF2 (1.3mm receiver).

Sun Avoidance

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

Mosaics

The PdBI has mosaicing capabilities, but the pointing accuracy may be a limiting factor at the highest frequencies. Please contact R. Neri in case of doubts.

Data reduction

Proposers should be aware of constraints for data reduction:

- In general, data should be reduced in **Grenoble**. Proposers will not come for the observations, but will have to come for the reduction.
- We keep the data reduction schedule very flexible, but wish to avoid the presence of more than 2 groups at the same time in Grenoble. Please contact us in advance.
- In certain cases we give the possibility to eavesdrop on the uv-tables obtained on a project shortly after the observations. Please contact us if you are interested in this option.
- IRAM may consider splitting the data reduction in two phases: intermediate calibration and final mapping. Such a splitting is often necessary for the high

resolution images. In such a case, the proposers must be ready to come at IRAM for fast data reduction of the "compact" configurations.
- CLIC is still evolving to cope with the evolution of the PdBI array. The newer versions are upward compatible with the previous releases, but the reverse is not true. Observers wanting to finish data reduction at their home institute should obtain an updated version of CLIC, which is now available. Because differences between CLIC versions may potentially result in imaging errors if new data is reduced with an old package, we insist that observers using a copy of CLIC take special care in maintaining it up-to-date.

Data reduction will be carried out on the dedicated HP workstations.

Local contact

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

Technical pre-screening

All proposals will be reviewed for technical feasibility in parallel to being sent to the members of the programme committee. Please help in this task by submitting technically precise proposals. Note that your proposal must be complete and exact: **velocities, position and frequency setup must be exactly specified**.

Non-standard observations

Please contact R.Neri or R.Lucas in case of doubt about the feasibility of a non-standard program.

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/`

Finally, we would like to stress again the importance of the quality of the observing proposal. The technical preparation of observing proposals is unfortunately often insufficient. In the past, proposals were received which did not even include exact observing frequencies or even source coordinates, or worse, revealing coordinates with the wrong epoch !... The IRAM interferometer is a powerful, but complex instrument, and proposal preparation requires special care. Information is available in the documentation and at http://iram.fr/PDBI/bure.html. The IRAM staff can help in case of doubts if contacted well before the deadline. Note that the proposal should not only justify the scientific interest, but also demonstrate how the Plateau de Bure interferometer will bring new information.

Roberto NERI

Scientific Results in Press

An extended Sunyaev-Zel'dovich map of the most luminous X-ray cluster, RXJ1347-1145

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Abstract:
The Sunyaev-Zel'dovich (SZ) effect is the Compton scattering of the 3K photons by the hot electrons in clusters of galaxies. It is now becoming a standard tool for the study of the baryonic diffuse matter in clusters (see e.g. the review by Birkinshaw (Phys. Rept. 310 (1999) 97-195).

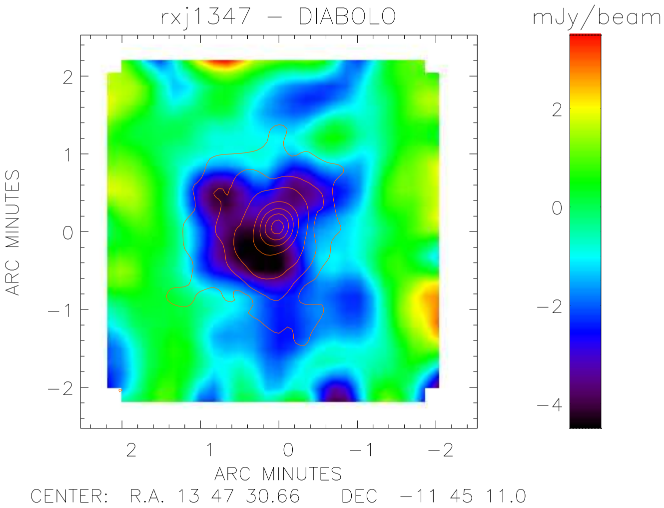

Figure 7: SZ map of the z=0.51 cluster RXJ1347-145 in colours. X-ray contours from Rosat. The SZ effect shows up as a 3K background local brightness decrement at 2.1mm.

In a recent paper (ApJ (2001) **552**, 42), we have presented a high resolution (22″ FWHM) extended map at 2.1mm of the SZ effect toward the most luminous X-ray cluster, RXJ1347-1145. These observations have been performed with the Diabolo photometer working at the focus of the 30m IRAM radiotelescope. We have derived a projected gas mass of $(1.1 \pm 0.1) \times 10^{14}\, h_{50}^{-5/2} \mathrm{M}_{\odot}$ within an angular radius of $\theta = 74''$ (ie: projected radius of 0.6Mpc, $H_0 = 50$km/s/Mpc, $\Omega_m = 0.3$, $\Omega_\Lambda = 0.7$). This result matches very well the expected gas mass from the cluster models of X-ray data. With an unprecedented sensitivity level our measurement does not show significant departure from a spherical distribution.

The data analysis also allows us to characterize the 2.1mm flux of a well known radio source lying in the center of the cluster: $F_{RS}(2.1\mathrm{mm}) = 5.7 \pm 1.6$mJy. Hence we have demonstrated the usefulness of 2D information for SZ measurements, with respect to comparing to X-ray data and excluding point sources from the analysis. These data were obtained after 16 hours of integration time with a 3 beam dual channel photometer. Clearly the way forward is now to build 1 and 2mm fully sampled arrays of 100 to 1000 pixels in order to search for inhomogeneity in the SZ effect in clusters, peculiar velocities and complement Chandra and XMM-Newton data on clusters of galaxies. We are now actively working on such millimeter detectors that could be put on the 30m in the years to come.

Summary of an article published in ApJ **552***, 42*

An interferometric study of the HH 288 molecular outflow

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Abstract:
We present an interferometric study of the CO (j= $1-0$) line emission in the HH 288 molecular outflow. The IRAM Plateau de Bure interferometer was used to obtain an 11–field mosaic covering the whole flow (∼2 pc) with an angular resolution of about 3.5″ (7000 AU at a distance of 2 kpc). The data were complemented with short-spacings derived from IRAM 30–m observations. The exciting source of HH 288, IRAS 00342+6347, is a young (dynamical age of the outflow $\simeq$ a few 10^4 years) intermediate-mass (bolometric luminosity $\simeq 500\mathrm{M}_{\odot}$, envelope mass $\simeq 6$ to $30\mathrm{M}_{\odot}$) embedded protostar. This source is likely to be an intermediate-mass counterpart of a classical Class 0 low-mass protostar. HH 288 is actually a quadrupolar outflow, and the angular resolution provided by the interferometric observations allows us to rule out models involving limb-brightened walls of a wide-angle single flow to explain such a morphology. The presence of two protostars in the central condensation is the most appealing explanation to account for the presence of the two flows. While the small East-West flow has a quite simple morphology and kinematics, the large North-South flow includes several overlapping structures, created by successive ejection events. Large collimated limb-brightened cavities are observed, with high-velocity material located along or near the flow axis. The internal structure of HH 288, including

morphological coincidence between the CO and H_2 emission, supports prompt entrainment at the head of large bow-shocks as the main formation process of molecular outflows from intermediate-mass protostars.

Accepted for publication in A&A

A 1.2mm MAMBO/IRAM-30m Survey of Dust Emission from the Highest Redshift PSS Quasars

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Abstract:
We report 250 GHz (1.2mm) observations of redshift ≥ 3.8 quasars from the Palomar Sky Survey (PSS) sample, using the Max-Planck Millimetre Bolometer (MAMBO) array at the IRAM 30-metre telescope. Eighteen sources were detected and upper limits were obtained for 44 with 3σ flux density limits in the range $1.5-4$mJy. Adopting typical dust temperatures of 40-50K, we derive dust masses of $\approx 10^8 - 10^9 M_\odot$ and far-infrared luminosities of order $10^{13} M_\odot$. We suggest that a substantial fraction of this luminosity arises from young stars, implying star formation rates approaching $10^3 M_\odot$/yr or more. The high millimetre detection rate supports current views on a connection between AGN and star forming activity, suggesting a parallel evolution of the central black hole and of the stellar core of a galaxy, although their growth-rate ratio seems higher than the mass ratio observed in nearby galaxies. The observed, exceptionally bright objects may trace the peaks of the primordial density field, the cores of future giant ellipticals.

Accepted for publication in A&A, preprints are available at astro-ph/0107005

Star formation in the bright rimmed globule IC1396N

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Abstract:
We report mm-wave multiline and continuum observations of IC1396N, a conspicuous bright rimmed globule excited by the O6.5 star HD206267 in the Cep OB2 association. Single-dish high resolution observations in CO and CS lines reveal the cometary structure of the globule with unprecedented detail. The globule head contains a dense core of 0.2 pc, whereas the tail, pointing away from the exciting star, has a total length of 0.8 pc. Two high velocity bipolar outflows have been identified in the CO maps: the first one is located around the position of a strong IRAS source in the head of the globule, and the second one, which was previously unknown, is located in the northern region. The outflows emerge from high density clumps which exhibit strong line emission of CS, HCO^+, and DCO^+. Within these clumps, the sources driving the outflows have been identified thanks to mm-wave continuum observations. The globule head harbors two YSOs separated by about 10^4 AU.

SiO line observations of the central outflow unveals a highly collimated structure with four clumps of sizes ≤ 0.1 pc, which are located along the outflow axis and suggest episodic events in the mass loss process from the central star. Kinetic temperatures of $\sim$ 50-100 K and hydrogen densities of fews 10^6 cm^{-3} have been estimated in the shocked regions traced by the strong SiO emission. The jet is also exposed to view by the means of interferometric HCO^+ observations that confirms that it is very narrow (≤ 0.02 pc wide).

The detection of blue- and redshifted CO emission along the globule rim suggests that IC1396N is in a transient phase, undergoing one of the expansions or compressions predicted by theoretical models describing the evolution of cometary globules. Moreover, the CO data, together with near IR observations reported elsewhere, indicate that the star forming process is occurring also in the northern part of IC1396N, at 0.5 pc from the central CS peak. The present observations provide evidence that several star forming sites can develop even in a moderately massive globule like IC1396N.

Accepted for publication in A&A

The highly collimated bipolar outflow of OH 231.8+4.2

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Abstract:
We present high spatial resolution observations of the CO molecular emission (J=$1-0$ and J=$2-1$ lines) in the post-AGB bipolar nebula OH 231.8+4.2. High-quality NIR images (J, H, K$'$ bands) of light scattered by grains were also obtained. Our observations probe the bulk of the nebular material, providing maps with a resolution $\sim 1''$ of the mass distribution, both CO and NIR images being very closely coincident. The combination of the two ^{12}CO lines has been used to measure the distribution of the kinetic temperature in the nebula, which is found to be very low, ranging between 8 K, in the outer southern clumps, and 35 K, in the central region. A relative temperature increase is found in the northernmost condensation, probably associated to a strong bow-like shock. Since velocities are also measured in CO, the dynamic parameters (kinetic momentum and energy) are also measured with high resolution. Most of the nebular mass ($\sim 0.64\,M_\odot$) is located in the central condensation and flows at expansion velocities $\leq$ 40 km s^{-1}. The rest of the gas, $\sim$ 0.3 $M_\odot$ almost equally distributed in the two lobes, flows along the nebular axis at high velocities, that increase proportionally to the distance to the central star reaching values as large as 430 km s^{-1}, as a result of a sudden acceleration happened about 770 yr ago. The general mass distribution in OH 231.8+4.2 is found to be clumpy and very elongated, with a length/width ratio reaching a factor 20 in the southern tail. In the center, however, we find a double hollow-lobe structure, similar to those found in other well studied protoplanetary nebulae. We stress the enormous kinetic linear momentum carried by the molecular nebula, about 27 $M_\odot$km s^{-1} ($5.5\,10^{39}$ g cm s^{-1}). The kinetic energy is also very high, $\sim$ 1700 $M_\odot$km^2 s^{-4} $\sim$ $3.4\,10^{46}$ erg. Given the short time during which the acceleration of the molecular outflow took place, we conclude that the linear momentum carried by the stellar photons is about a factor 100 smaller than that carried by the outflow, even if the effects of multiple scattering are taken into account. We independently argue that radiation pressure directly acting onto grains (the mechanism thought to be responsible for the mass ejection in AGB envelopes) cannot explain the observed bipolar flow, since this would produce a significant shift between the dust and gas features that is not observed. Finally, we review the uncertain nature and evolutionary status of this unique object.

Appeared in A&A, 2001, 373, 932

New Preprints

559. STAR FORMATION IN THE BRIGHT RIMMED GLOBULE IC1396N
C. Codella, R. Bachiller, B. Nisini, P. Saraceno, L. Testi
2001, *Astronomy and Astrophysics*

560. A 1.2 MM MAMBO/IRAM-30M SURVEY OF DUST EMISSION FROM THE HIGHEST REDSHIFT PSS QUASARS
A. Omont, P. Cox, F. Bertoldi, R.G. McMahon, C. Carilli, K.G. Isaak
2001, *Astronomy and Astrophysics*

Vacant Positions

IRAM invites applications for two

SUPPORT SCIENTIST POSITIONS
in mm-wave radio astronomy
(starting date October 2001 or later).

1. Support Scientist for IRAM and ALMA Software Development in Grenoble

In the past, IRAM together with the Grenoble Observatory, has developed a versatile software package for mm-wave interferometry. The new position is created in order to enhance this activity in view of the needs for new calibration and data analysis software, and the plans for a European ALMA Data Center.
Candidates for this position should have a PhD in astronomy, physics, or mathematics and several years of postdoctoral experience. They should have a strong interest in interferometry, mm-wave research, and image restoration techniques. They should have a good experience in software installation and programming.
The appointed scientist will belong to the IRAM astronomers' group and can spend up to 50% of his/her time on own research. The current research activities at IRAM include the study of line and continuum emission from galaxies (including high redshift objects), of circumstellar disks and envelopes, as well as studies of the structure and chemistry of the interstellar medium, using the IRAM instruments (see their description on the IRAM web site http://iram.fr).
The position is open at the IRAM Headquarters, Grenoble, for an initial period of 3 years and can be extended up to 5 years. Tenure is possible and could be considered earlier in exceptional cases. The salary will depend on experience and family situation. It includes an expatriation premium for non-French citizens.
The candidates are asked to send to the address below an application with their CV, publication list, a brief description of their research interests for the coming 3 years and three letters of recommendation.

2. Support Scientist at the 30m-Telescope in Granada/Pico Veleta

IRAM (http://iram.fr) wants to further improve the efficiency of the 30-m telescope on Pico Veleta (Spain) (http://www.iram.es) by offering more service observations as well as flexible/pool observing. The new position has been created to support these activities at the telescope.
The successful candidate will spend up to 100 days per year at the Pico Veleta Observatory giving support to visiting astronomers and organizing and performing absentee observations (including quality control). He/she will participate in general support duties such as ensuring the pointing and calibration quality of the telescope, writing documentation, commissioning of new instruments etc. Depending on his/her qualification he/she may participate in developing new software or hardware for the telescope.
Candidates should have a Ph.D. in astronomy and strong observing interests. Ability to work at 2900 meters altitude is required. The working language is English, but the candidate should be willing to learn Spanish. Up to 50% of the working time may be used for personal research. Further information can be obtained from the station manager of the 30-m telescope, Dr. Rainer Mauersberger (mauers@iram.es, phone: +34 958 805461).
The position is open for an initial period of 3 years with the possibility of renewal. The salary will depend on experience and family situation. It includes an expatriation premium for non-Spanish citizens.
Candidates are asked to send to the address below an application with their CV, publication list, a brief description of their observing experience and their research interests for the coming 3 years and three letters of recommendation.

Applications should be sent to:

Prof. Dr. M. Grewing
IRAM
300 rue de la Piscine
F-38406 St. Martin d'Hères
FRANCE

The IRAM Newsletter is edited by Michael Bremer at IRAM-Grenoble (e-mail address: `bremer@iram.fr`). In order to reduce costs we are now sending paper copies of this Newsletter to astronomical libraries only. The IRAM Newsletter is available in electronic form:

- by using the World Wide Web: from the IRAM home page (`http://iram.fr/`), click on item "Newsletter" and follow the links...
- by means of an anonymous `ftp` account, opened at IRAM for Internet users. To access those files, please connect through `ftp` to `iram.fr` (or `193.48.252.22`) and read the `README` file. Several subdirectories are available:

Directory	Contents
`/dist/newsletter`	Recent issues of this Newsletter (one subdirectory per issue)
e.g. `/dist/newsletter/jul95`	jul95.ps is the Postscript file for the July 1995 issue.
`/dist/doc`	Documentation on IRAM telescopes and software
`/dist/proposal`	Proposal forms and Latex files to aid proposal preparation
`/dist/soft`	distribution files for reduction software

- by means of an electronic mail file server installed at IRAM (on iraux2). This file server is a file distribution service that uses electronic mail facilities to deliver files. To communicate with it you should send a message to the electronic address:

  `listserv@iram.fr`

  On the first time you should send a message: `SUBSCRIBE IRAMNEWS` *your name*

  in order to subscribe to the mailing list IRAMNEWS. You will then receive an acknowledgement from the server. Then, for instance, to obtain a copy of the January 1999 issue, just send the one line message:

  `GET IRAMNEWS JAN99.PS`

  to the above electronic address. You will receive later a mail message containing the IRAM Newsletter in Postscript code. Please discard all the e-mail header information with a text editor, and send the file to a Postscript printer. More information may be obtained by sending the one line message:

  `HELP`

  Note that this file server also contains the proposal forms.

The e-mail list IRAMNEWS is used to send warning messages when the Newsletter is available, but also to provide fast information, if needed.

Please keep M. Bremer informed of any problem you may encounter.

IRAM Addresses:

	Address:	Telephone:	Fax:
Grenoble	Institut de Radioastronomie Millimétrique, 300 rue de la Piscine, Domaine Universitaire, 38406 St Martin d'Hères Cedex, France		
	from abroad:	(33) 476 82 49 00	(33) 476 51 59 38
	from France:	0 476 82 49 00	0 476 51 59 38
Plateau de Bure	Institut de Radioastronomie Millimétrique, Observatoire du Plateau de Bure, 05250 St Etienne en Dévoluy, France		
	from abroad:	(33) 492 52 53 60	(33) 492 52 53 61
	from France:	0 492 52 53 60	0 492 52 53 61
Granada	Instituto de Radioastronomía Milimétrica, Avenida Divina Pastora 7, Núcleo Central, 18012 Granada, España	(34) 958 80 54 54	(34) 958 22 23 63
Pico Veleta	Instituto de Radioastronomía Milimétrica, Estación Radioastronómica IRAM-IGN del Pico Veleta, Sierra Nevada, 18012 Granada, España	(34) 958 48 20 02	(34) 958 48 11 48

E-Mail Addresses:

- IRAM-Grenoble: `username@iram.fr`
- IRAM-Granada: `username@iram.es`

The `username` is generally the last name of the person to be contacted.