IRAM Newsletter

Number 24–25 February 1, 1996

Calendar

March 4th, 1996: Deadline for the submission of observing proposals for the period May 15, 1996 to Nov. 15, 1996.

May 6-7th, 1996: IRAM User Meeting in Grenoble, France.

Editorial Note

Due to the strikes in France last December, the November 1995 issue (number 24) could not be mailed (it was however distributed electronically). The present issue will thus combine excerpts from the November issue with the most recent information.
The User Meeting had also to be postponed to May 6-7th (see below).
Please accept our apologies.

Robert LUCAS

Contents

Invitation: IRAM User Meeting at Grenoble

May 6-7th, 1996

The difficult conditions for travel during the period of strike last December had forced us to postpone the User Meeting. This meeting will now take place on May 6th and 7th, 1996. It is intended to provide a forum for discussing the current status of the 30m telescope and the Plateau de Bure Interferometer, the development projects which are under way, and the options for future developments. Also, there will be an opportunity to highlight recent scientific results. Both, short contributions and posters are foreseen.

If you are interested in attending the meeting, you are kindly asked to fill in the questionnaire at the end of this Newsletter and to return it before April 1st, 1996 to Mrs.G.Matoso, 300 rue de la Piscine, F38406 St.Martin d'Heres, France (FAX: 33-76 51 59 38, e-mail: Matoso@iram.fr).

Preliminary Agenda

(see next page)

30m Telescope

Second 3 mm SIS receiver available: first four receiver operation at Pico Veleta

A second 3 mm SIS receiver has been installed on October 18/19. This is the first time that four receivers (two 3 mm and two 1.3 mm receivers) can be used simultaneously at the 30m telescope. The 2 mm receiver can be used, as before, in combination with 3mm1 and 1.3 mm G1.

The receiver construction was done mostly in Granada with components manufactured in Grenoble. Receiver temperatures (SSB) across the tuning band (82 - 116 GHz) are in the range 55 - 85 K (Figure 1). The receiver is tuned under remote control, and has very high sideband rejection (up to 40 dB). Laboratory measurements

User Meeting: Preliminary Agenda

May 6th (morning) CHAIRMAN : J.Martin Pintado

10:30-10:45	Opening of the meeting	M.Grewing
10:45-11:30	Status report on the 30m Telescope	W.Wild
11:30-11:45	Discussion	
11:45-12:05	Spectral-line on-the-fly observations with the 30m Telescope: Tests — Current Capabilities — Future plans	H.Ungerechts
12:05-12:15	Discussion	
12:15-12:30	Short spacings using the IRAM 30m Telescope	F.Viallefond
12:30-12:40	Discussion	

May 6th (afternoon) CHAIRMAN : R.Wielebinski

14:00-14:20	Status Report on VLBI Observations	A.Greve,T.P.Krichbaum
14:20-14:30	Discussion	
14:30-15:15	Status report on the PdB Interferometer	S.Guilloteau
15:15-15:30	Discussion	
15:30-16:00	Future heterodyne receivers for the 30m and the PdB Telescopes	J.Lamb
16:00-16:10	Discussion	
16:10-16:30	Status of the heterodyne multibeam project	K.Schuster
16:30-16:45	Future backends	M.Torres
16:45-17:00	Coffee break	
17:00-17:30	Ongoing/Future bolometer developments for the 30m Telescope	
	Development work at the MPIfR	N.N.
	DIABOLO - A dual-channel photometer	J.-L.Puget
	Perspectives	B.Lazareff
17:30-17:45	Discussion	
17:45-18:15	Time Allocation Statistics and Discussion	M.Grewing
18:15-19:00	Options for IRAM's participation in future projects and General Discussion	
19:00-	Informal Reception at IRAM	

May 7th CHAIRMAN : F.Viallefond

09:00-09:30	Status report on the key project	E.Falgarone
09:30-09:45	Discussion	
09:45-10:45	Short contributions	
10:45-11:00	Coffee break	
11:00-12:15	Short contributions	
12:15-14:00	Lunch Break	
14:00-16:00	Short contributions	
16:00	End of User Meeting	

New contributions are welcome. The short contributions already foreseen include:

PdB interferometric survey of discs around T Tauri stars in the Taurus-Auriga cloud at 2.7mm	A.Dutrey
Evolution of outflow activity around low-mass embedded young stellar objects	S.Bontemps
Herbig-Haro jets. CO flows and CO bullets: The case of HH111	J.Cernicharo
Density structure of protostellar envelopes at 1.3mm	F.Motte
Low-mass star formation: Observations and non-LTE modelling	H.Wiesemeyer
Recent results of cometary line observations	D.Despois
The 12C/13C abundance in the far-outer Galaxy	J.Brand
PdB observations of hot cores	R.Cesaroni
Molecular gas dynamics at the center of spirals revisited: New high-resolution observations	S.Garcia-B.
First mm-mapping of M87 at 89 GHz	D.Fraix-Burnet

showed very good stability which seems to be reproduced at the telescope.

Figure 2 shows the result of a pointing scan across Saturn with the two 3 mm receivers. Antenna temperatures and beam widths of the first ("old") 3 mm receiver (now called 3mm1) and the second (new) 3 mm receiver (called 3mm2) are almost identical. The relative alignment of the two receivers is better than $2''$.

30m Manual available

A handbook for the 30m telescope, "The 30m Manual", is available now. This handbook has been written for both first time users and experienced users of the telescope. The manual does not intend to replace other, more detailed manuals (like the OBS manual, GAG software manuals etc.). It is rather a collection of useful information about the 30m telescope. Among other things, it describes antenna parameters, the receiver and backend system, data backup, and typical observing sessions. It also contains information about atmospheric opacities in the various frequency ranges, the pointing catalogue, and travel information to and from Granada.

Version 1.0 of the 30m Manual has been sent to the institutes and individuals who regularly receive the IRAM preprints. Updates of the manual will not be sent automatically in paper form. The latest version can be retrieved via WWW and Mosaic by connecting to the IRAM Grenoble home page (`http://iram.fr/`) and following the links, or via anonymous ftp. Connect through `ftp` to `iraux2.iram.fr` (or 193.48.252.22), user name *anonymous*. Go to the directory `/dist/30m` and get the postscript file `manual.ps` (file size ~1.6 Mbyte). On a postscript printer you can print the file.

1 GHz bandwidth for the 1.3 mm G2 receiver

The 1.3 mm G2 receiver is now available with a 1 GHz bandwidth in combination with the 1 MHz filter banks. A new down converter and IF processor for the 1 MHz filter banks has been built and installed. The 230G2 receiver can be operated in two modes: narrow (512 MHz bandwidth) and wide (1 GHz bandwidth). The narrow mode is identical to the old mode of operation. The wide mode allows only the 1 MHz filter bank to be connected, no other backend can be connected at the same time to 230G2. This is due to a necessary shift of center frequency of the receiver. The mode is specified in the command
`RECEIVER 230G2 [`*options*`]`.
The default is narrow mode (512 MHz).

More flexible configurations of the 1 MHz filter banks possible

A new IF processor allows to use the 1 MHz filter banks in a more flexible way: the 1 MHz filter banks are now split into 4 parts of 256×1MHz channels each. Any combination (*e.g.* 4×256MHz = 1024 MHz, or 2×512MHz etc.) and any shift of the 4 subbanks relative to each other (in steps of 32 MHz) is possible. Each part can be connected to a different (or the same) receiver. Connecting the four parts in series provides a 1 GHz wide backend (at present only usable with 230G2). The distinction between "first" and "second" 1 MHz filter bank is not necessary any more. The previous OBS commands `1_1MHZ` and `2_1MHZ` are replaced by a single command `1MHZ`. The syntax is similar to the autocorrelator command.

Extended tuning range for the first 3 mm receiver (3mm1)

The tuning range of the 3mm1 receiver has been extended towards the lower end. Sky frequencies can now be tuned from 81 GHz to 116 GHz.

More flexible narrow band continuum pointing mode

The narrow band continuum pointing mode has been changed. It can be used with the 1 MHz filter bank *only* and provides selectable band widths from 2 MHz to 32 MHz in steps of 2 MHz. This allows to choose the band width for the signal according to the velocity width of the emission (of an SiO maser for example). The syntax to select this pointing mode is:
`CONTINUUM` *nnn* `SWITCH/RECEIVER` *rx*
where *nnn* is the selected band width in MHz plus 100 and can be between 102 and 132 (in steps of 2). 102 means a bandwidth of 2 MHz, 104 of 4 MHz etc.

The 100 kHz filter bank cannot be used for narrow band continuum pointing.

Winter conditions at Pico Veleta

During winter conditions the transport between Granada and the 30m telescope cannot be as flexible as during summer. We ask observers to take this into account when planning their trips to the 30m telescope, and allow for delays. The following table gives the transport times when the ratrac is used (i.e. when the Sierra Nevada is covered by snow):

Transport to and from the 30m telescope: Winter schedule (typically Nov – May, depending on snow conditions).

	Departure from	
	Granada Office	Telescope
Monday	08:15	10:45
Tuesday	08:15	10:45 and 16:15
Wednesday	No transport *	No transport *
Thursday	10:00	15:00
Friday	08:15	10:45 and 16:15

* Person transport (morning hours) may be available after contact and agreement with IRAM Granada (Javier Lobato).

Wolfgang WILD

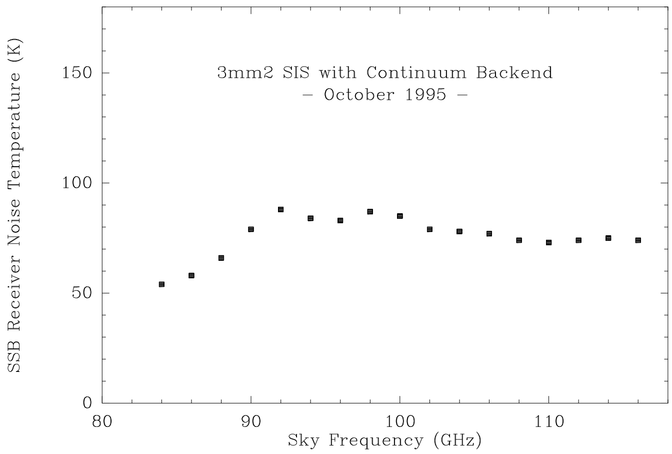

Figure 1: Single sideband receiver temperature of the newly installed second 3 mm SIS receiver (3mm2) at Pico Veleta. Temperatures were measured with the telescope calibration system and include optical losses and spillover. Image sideband rejection ranged from 25 dB to 40 dB.

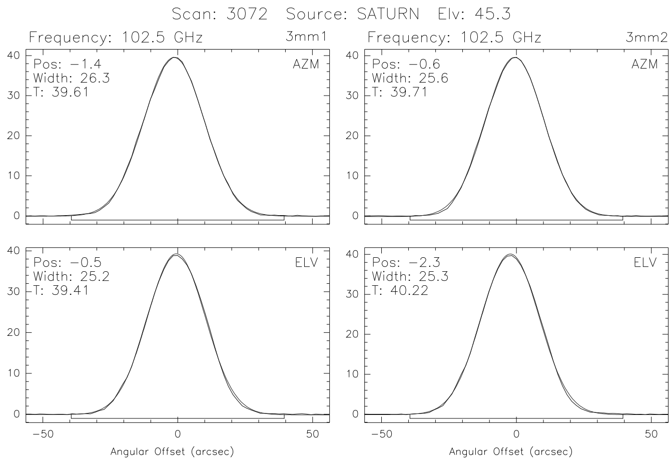

Figure 2: Result of a pointing cross scan on Saturn using both 3 mm receivers. Note the excellent agreement of antenna temperatures and beam widths between the first 3 mm receiver (left hand side) and the newly installed second 3 mm receiver (right hand side). The relative alignment of both receivers is better than $2''$.

IRAM 30m Telescope System Summary

(January 1996)

Table 1: Antenna-related parameters

Receiver	Freq. [GHz]	HPBW θ_b [$''$]	Aperture eff. η_A	Main beam eff. $B_{\rm eff}$	Forward eff. $F_{\rm eff}$	S/T_A^* (Jy/K)
3mm1 SIS	90	27	0.60	0.75	0.92	6.0
3mm2 SIS	100	24	0.58	0.70	0.92	6.2
	110	22	0.57	0.68	0.92	6.3
2mm SIS	130	18	0.47	0.58	0.90	7.5
	150	16	0.43	0.52	0.90	8.2
	160	15	0.41	0.50	0.90	8.6
1.3mm G1 SIS	220	10.9	0.35	0.41	0.86	9.6
1.3mm G2 SIS	230	10.4	0.32	0.39	0.86	10.5
	240	10.0	0.29	0.37	0.86	11.6

The flux density to antenna temperature ratio S/T_A^* is given for a point source.
Conversion from antenna temperature to main beam temperature: $T_{\rm mb} = (F_{\rm eff}/B_{\rm eff}) \times T_A^*$.

Table 2: Overview of spectral line SIS receivers

Name	Simultaneous use			Range [GHz]	IF band [GHz]	Rejection [dB]	Frequ. [GHz]	$T_{\rm rec}$ (SSB) [K]	Remark
3mm1	X	X	X	82–116	0.5	≥ 25	86	90	
							115	110	
3mm2	X			82–116	0.5	≥ 25	86	60	
							115	75	
2mm		X		129–183	0.5	6–8	129–150	100–170	
							>150	>170	
230G1	X	X	X	204–245	0.5	6–20	204–230	110–130	
							230–245	130–180	
230G2	X			210–267	0.5/1.0	20	210–232	100	1 GHz BW available
							245	200	*only* with 1 MHz filters
							267	350	
0.8mm			X	320–360	0.5	~1	330	65 (DSB)	available in dedicated
							345	95 (DSB)	periods in winter
							355	130 (DSB)	

Receivers can be tuned to low image band rejection on request.
MPIfR bolometers are announced in the IRAM Newsletter.

Table 3: Spectral line backends

Backend	Resolution	Bandwidth	Remark
1 MHz filters	1 MHz	4 x 256 MHz	max. 4 parts; series, parallel or mixed mode possible
100 kHz filters	100 kHz	2 x 12.8 MHz	max. 2 parts; series or parallel mode possible
Autocorrelator	10 kHz – 1.25 MHz	17 – 510 MHz	max. 8 parts with different BW and resolution
AOS	1.1 MHz	500 MHz	

Spectral line observing capabilities

Position switching: absolute and relative OFF positions possible
Raster mapping: position switching with several ON's (on a regular grid) per OFF
Wobbling secondary: max. $4'$ throw in azimuth at 0.25 Hz
Frequency switching: max. 45 km/s throw at max. 0.5 Hz, with 100 kHz filters and autocorrelator only
On-the-fly mapping: under development at the time of writing
Pointing: offset pointing = $0.5''$ rms (sources within $10°$), absolute pointing = $3''$ rms, check every 2 hours.
Focus: residual errors $\leq$1 mm may need correction; receivers have the same focus except 230G2 (–0.5 mm difference). Check the focus at least at sunrise and sunset.

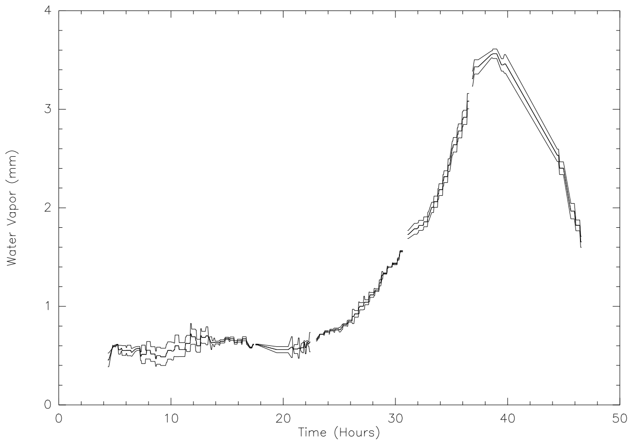

Figure 3: Water vapor content measured on Plateau de Bure between Nov 5 and Nov 7 (see text)

Interferometer

Program Committee Recommendations

Observing proposals were discussed by the last program committee, for the scheduling period Nov 15, 1995, to May 15, 1996 (see details on Table 4). A programs will be scheduled in priority. Further time, if it becomes available, will go to B programs, taking into account scientific merit, crowding in certain right ascension ranges and general aspects of balance. B proposals will only be started in case of available observing time. Special recommendations have also been made for some of the "A" and "B" projects: the authors will be contacted directly by IRAM.

Please note that because of our lack of specific experience and also because of scheduling constraints, 1.3mm and long baselines observations will be performed on a "best effort" basis, *without guarantee of result*. We remind you that B projects which have not been started are no longer automatically resubmitted: authors have to resubmit them explicitly.

Weather conditions on Plateau de Bure

Figure 3 shows the water vapor content measured on Plateau de Bure between Nov 5 and Nov 7 (the various curves correspond to the different antennas). Very low water vapor content (less than 0.7 mm) persisted when the outside temperature was about $-12°$ C. With the upcoming of warmer air (about 0 degrees), the water vapor content increased to about 3 mm.

Water vapor content well below 2mm is expected to occur frequently in winter, since the mean outside temperature is $-10°$ C.

Receivers and Antennas

The 3 mm and 1.3 mm receivers of all antennas have now been re-aligned to within $2''$, thereby removing the pending limitations on dual-frequency observations. Surface adjustments and optimization of the subreflector position have also been performed to improve the overall efficiency.

The subreflector of antenna 3 has been exchanged with that foreseen for Antenna 5, and is currently being resurfaced by MAN.

Thorough investigations have improved the 1.3mm total power stability: a level of 2-3 10^{-4} is now reached. This allows phase compensation to about 20 degrees rms at 230 GHz under clear sky conditions.

230 GHz observations on Plateau de Bure

Figure 4 is a result of observations at 230 GHz obtained on Nov 9, 1995. The array was in the most compact configuration (baselines from 24 to 64 meters), which already gives about $3''$ resolution at the CO J=2-1 frequency. The figure shows images of the integrated intensity of the CO J=2-1 line, of the velocity field and of the line width of a proto-planetary disk around the T Tauri star GM Aur. The integrated spectrum is also shown. The data were obtained in snapshot mode (4 sources were observed during the same transit), so that the total integration time on source is less than 1.5 hours.

Keplerian rotation had been previously detected by aperture synthesis observations of ^{13}CO J =2-1 performed at OVRO (Koerner, Sargent & Beckwith 1993, Icarus 106, 2), with an angular resolution of $6''$ by $3.5''$. Despite the very short integration time, the Plateau de Bure data significantly improve the angular resolution and unambiguously confirm the Keplerian rotation.

Control System and Acquisition Software

We had anticipated to replace the central computer, a VAX-3100 from DEC, by an HP workstation, in order to provide a possibility to perform *a posteriori* phase correction on short time scales. Software preparation of this major change has been progressing well, but unfortunately major hardware components are still missing. In order to avoid immobilizing the interferometer in winter time, we now have decided to keep the VAX-3100 for this winter.

Software modifications have been implemented to allow real-time atmospheric phase correction based on the monitoring of the total power from the 1.3mm receivers. Due to CPU limitation in the correlator microprocessors, this is only possible for the 80 and 160 MHz bandwidths. More powerful processors had been ordered, but their installation was delayed because the delivery of software components was blocked by the December Post Office strike.

Table 4: Plateau de Bure: project status A: Accepted, B: Backup if available time, C: Rejected.

Project	Rate	Project	Rate	Project	Rate	Project	Rate	Project	Rate
F018	C	F022	C	F029	B	F030	A	F031	C
F032	B	F033	B	F034	B	F035	A	F036	C
F037	C	F038	A	F039	C	F040	C	F041	B
F042	B	F043	B	F044	A	F045	C	F046	A
F047	B	F048	C	F049	A	F050	A	F051	A
F052	B	F053	C	F054	A	F055	A	F056	A
F057	C	F058	A	F059	C	F060	B	F061	A
F062	A	F063	C	F064	A	F065	A	F066	C
F067	C	F068	A	F069	C	F070	C	F071	C
F072	C	F073	A	F074	B	F075	B	F076	C
F077	B	F078	A	F079	A	F080	C	F081	A
F082	A	F083	A	F084	B	F085	C	F086	A
F087	A	F088	C	F089	A	F090	C	F091	C
F092	C	F093	C	F094	C	F095	C	F096	B
F097	B	F098	A	F099	C	F100	C	F101	C
F102	C	F013	A						

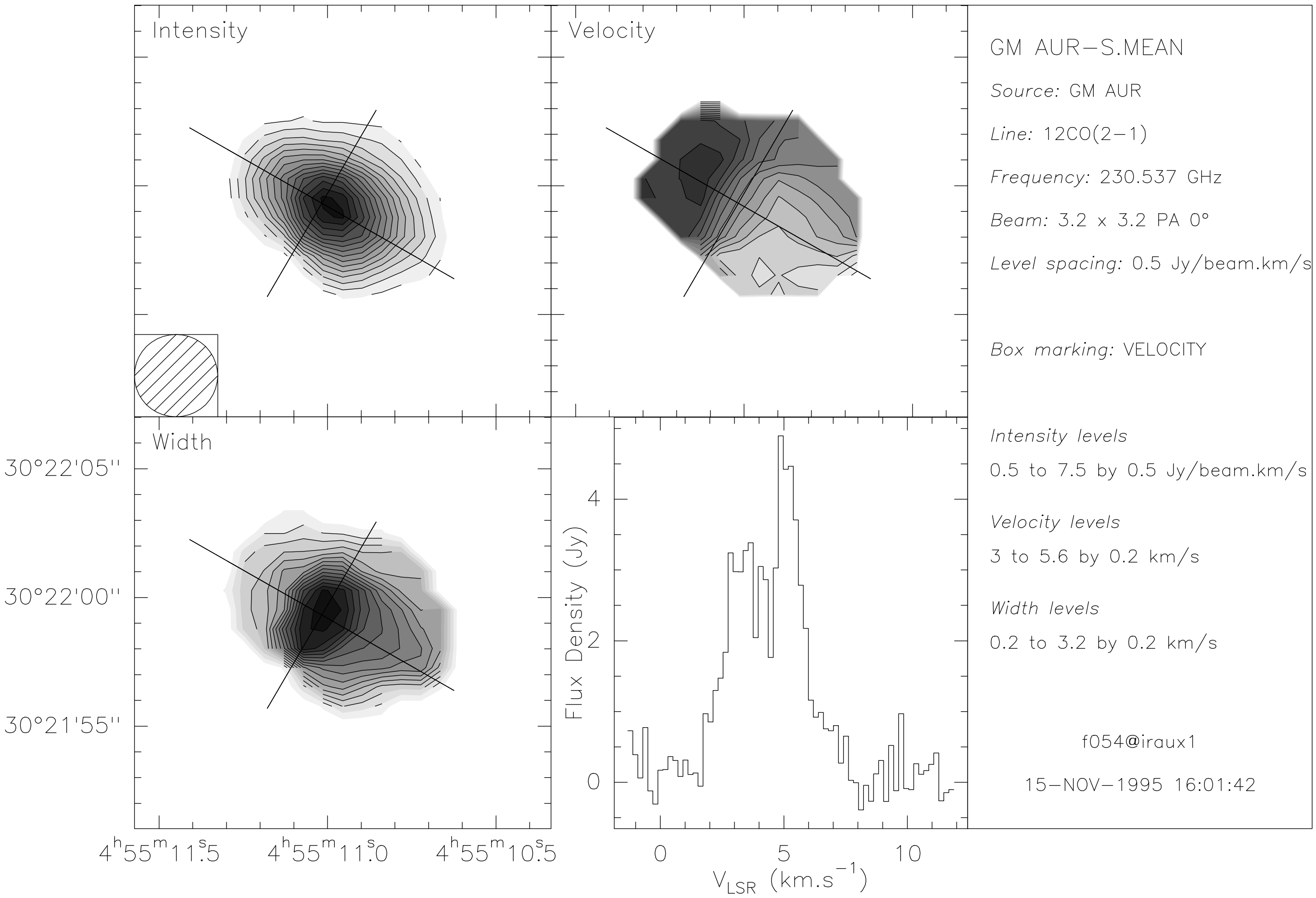

Figure 4: The proto-planetary disk around the T Tauri star GM Aur, observed with the Plateau de Bure interferometer on Nov 9, 1995 (1.5 hours of integration).

New configurations for 5 Antennas

Antenna 5 delivery is foreseen for April-May. With one more antenna, the configurations will change again. The new list is given in Table 5.

- **D** – the compact configuration D yields a beam size twice that of the CC configuration set. The goal of this is to enable studies of CO(2–1) and CO(1–0) at virtually the same (moderate) resolution.
- **CD** – the next most compact configuration set which combines C2 and D. One 24 meter baseline is duplicated but the beam is generally quite circular. The pair C1 + D could also be used and yields a marginally lower resolution and less circular beam but has slightly lower sidelobes.
- **CC** – a relatively compact configuration set using C1 and C2, which gives a resolution similar to that of the current 4-antenna CD configuration set,
- **BC** – a combination of B1 and C2 which gives a resolution almost identical to that of the current 4-antenna BC configuration set, with 4 baselines less. It is to be used for relatively strong sources.
- **BB** – the B1, B2, and C2 configurations are combined for a total of 30 baselines (as opposed to the current 4-antenna BC with 24 baselines).
- **AB** – the most extended configuration set, made up of A1, B1 and B2, gives a resolution of $\sim 1.2''$ at 115 GHz ($0.6'$ at 230 GHz). Several short baselines (32m, 40m, 56m, 64m) have been included to facilitate calibration and give some sensitivity to extended structure.

Note that the C2 configuration plays a central role, since it is included in both very compact and large configuration sets. B1 plays a similar role for higher resolutions.

Because of antenna maintenance, the 4-antenna configurations (see the Call for Proposals) will still be used during the summer.

Expected beam sizes are given in Table 5.

Stéphane GUILLOTEAU

Atmospheric Phase Correction: from random phase down to 20 degree r.m.s. at 230 GHz

We have continued experimenting with the atmospheric phase compensation under various atmospheric conditions.

At the beginning of October, an analog/digital converter in the detector chain was found to dominate the noise of the total power signal. This was limiting the overall relative stability of the detection system to about 10^{-3}, thereby limiting the accuracy of the phase compensation to about 20-30 degrees rms in the 84-116 GHz band. Proper electronic grounding of the A/D converter has reduced its noise contribution by a factor 6, and the stability of the complete total power acquisition chain is now about 2 10^{-4}.

As a consequence, the rms of the corrected phase has been improved sufficiently to be of interest in the 210-248 GHz band. An example is given in Fig. 5, which shows a sequence observed on October 21st, after the passage of clouds, while the phase stabilized over a time interval of about 1.5 hours for a baseline of 176 m (the correction is independent of baseline length). Opacity was low, with a total amount of precipitable water around 3 mm.

The time resolution of the correction is one second, and it is exclusively based on the optical path predicted by the atmospheric model (M.Bremer & J.Cernicharo) from the calibrated total power. Phase noise histograms have been calculated to illustrate the effect of the correction. The scan based distributions peak in the $5-10°$ and $20-25°$ rms bins for 91.2 and 230.5 GHz, respectively.

The observed phase at 1.3mm moves too fast to be continuously traced; the atmospheric phase predicted from the total power fluctuations has indeed an r.m.s. of 196°. For an integration time of one minute, the gain in coherence of the 230 GHz continuum signal is spectacular.

Implementation of the phase correction software in the CLIC calibration program is under way. A full correction, with phase continuity from one source to another, is not possible because of slight, but significant, receiver gain variations for large telescope motions in elevation. Accordingly, the phase correction will be made with a zero mean. This can be done *a posteriori* for the continuum data which are sampled every second. This is not possible for the spectral line data which have an averaging interval of 1 or 2 minutes. Since the correction breaks down in the presence of clouds, we are currently working on a scheme which will provide both corrected and uncorrected spectral line data in real time.

Michael BREMER, Stéphane GUILLOTEAU, Robert LUCAS

Table 5: Plateau de Bure configurations with 5 antennas

Configuration	AB	BB	BC	CC	CD	D	Stations				
D					o	o	E03	W00	W05	N05	N09
C1				o			E10	W01	W05	N07	N13
C2		o	o	o	o		E10	W09	W12	N05	N15
B1	o	o	o				E23	E18	W12	N13	N20
B2	o	o					E12	W12	W23	N17	N29
A	o						E24	E16	W23	W27	N29

Beam sizes for configuration set AB							
	85 GHz		115 GHz		230 GHz		
Dec.	Maj.	Min.	Maj.	Min.	Maj.	Min.	PA
-20	4.14	1.42	3.06	1.05	1.53	.52	7.
0	2.75	1.54	2.03	1.14	1.02	.57	14.
20	2.12	1.63	1.57	1.21	.78	.60	24.
40	1.87	1.66	1.38	1.23	.69	.61	41.
60	1.77	1.61	1.31	1.19	.65	.60	67.
80	1.75	1.66	1.30	1.23	.65	.61	81.

Beam sizes for configuration set BB							
	85 GHz		115 GHz		230 GHz		
Dec.	Maj.	Min.	Maj.	Min.	Maj.	Min.	PA
-20	5.14	1.94	3.80	1.43	1.90	.72	7.
0	3.29	2.09	2.44	1.54	1.22	.77	15.
20	2.66	2.19	1.96	1.62	.98	.81	27.
40	2.42	2.17	1.79	1.61	.89	.80	58.
60	2.35	2.10	1.74	1.55	.87	.78	77.
80	2.34	2.19	1.73	1.62	.86	.81	85.

Beam sizes for configuration set BC							
	85 GHz		115 GHz		230 GHz		
Dec.	Maj.	Min.	Maj.	Min.	Maj.	Min.	PA
-20	6.46	2.03	4.78	1.50	2.39	.75	11.
0	4.16	2.16	3.07	1.59	1.54	.80	21.
20	3.25	2.27	2.40	1.68	1.20	.84	30.
40	2.78	2.35	2.06	1.74	1.03	.87	44.
60	2.62	2.33	1.94	1.73	.97	.86	62.
80	2.57	2.42	1.90	1.79	.95	.90	75.

Beam sizes for configuration set CC							
	85 GHz		115 GHz		230 GHz		PA
Dec.	Maj.	Min.	Maj.	Min.	Maj.	Min.	PA
-20	8.09	3.37	5.98	2.49	2.99	1.24	6.
0	5.19	3.57	3.83	2.64	1.92	1.32	13.
20	4.20	3.65	3.10	2.70	1.55	1.35	32.
40	3.97	3.61	2.93	2.67	1.47	1.34	68.
60	3.94	3.51	2.91	2.59	1.46	1.30	80.
80	3.94	3.69	2.91	2.73	1.46	1.36	86.

Beam sizes for configuration set CD							
	85 GHz		115 GHz		230 GHz		
Dec.	Maj.	Min.	Maj.	Min.	Maj.	Min.	PA
-20	9.85	4.38	7.28	3.23	3.64	1.62	0.
0	6.20	4.57	4.59	3.38	2.29	1.69	2.
20	4.93	4.72	3.65	3.49	1.82	1.74	13.
40	4.93	4.46	3.65	3.30	1.82	1.65	89.
60	4.97	4.33	3.68	3.20	1.84	1.60	91.
80	5.00	4.64	3.69	3.43	1.85	1.71	92.

Beam sizes for configuration D							
	85 GHz		115 GHz		230 GHz		
Dec.	Maj.	Min.	Maj.	Min.	Maj.	Min.	PA
-20	12.16	7.90	8.99	5.84	4.49	2.92	7.
0	8.21	7.58	6.07	5.60	3.04	2.80	64.
20	7.99	6.40	5.91	4.73	2.95	2.37	83.
40	8.01	6.13	5.92	4.53	2.96	2.27	86.
60	7.97	6.32	5.89	4.67	2.95	2.33	87.
80	7.91	7.12	5.85	5.26	2.92	2.63	88.

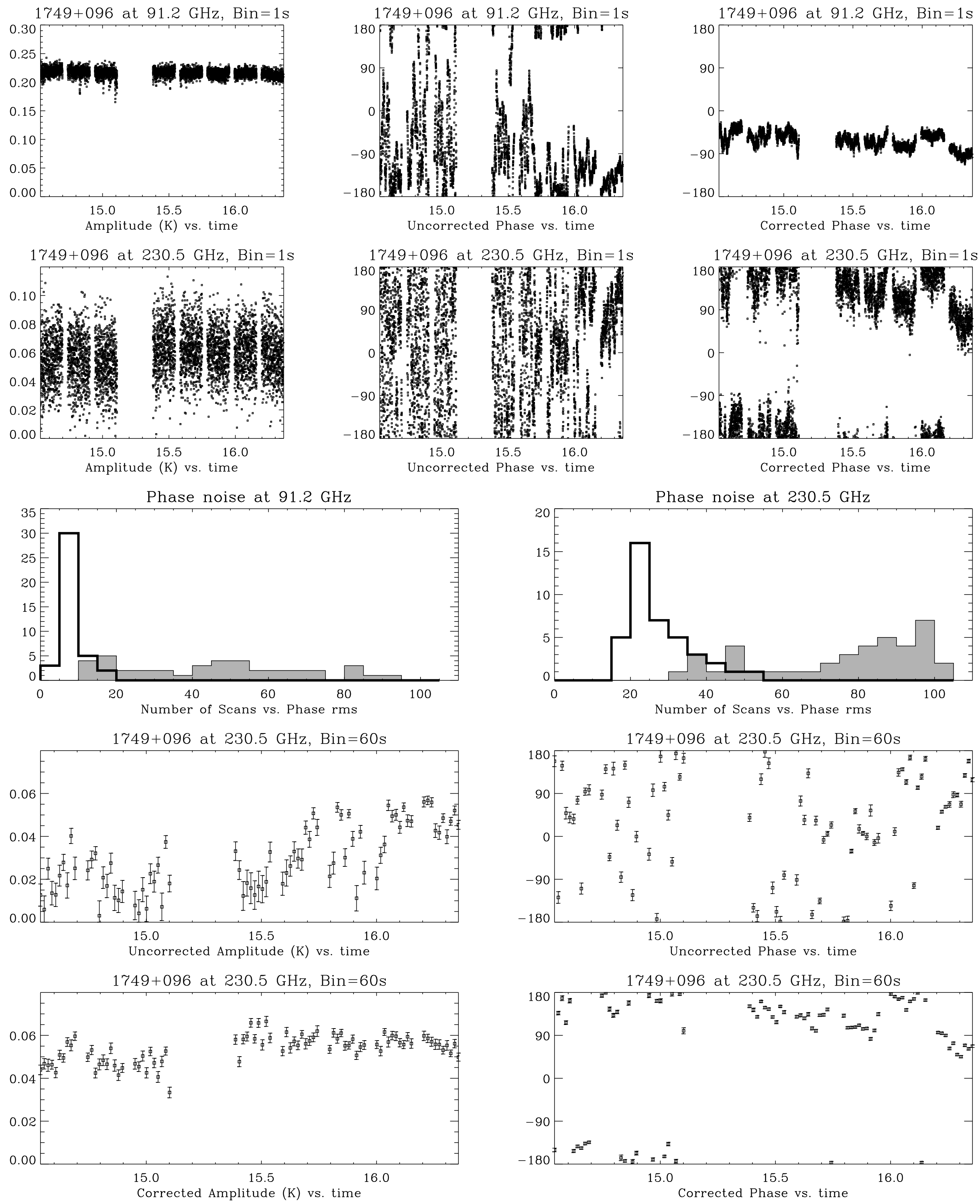

Figure 5: Model based phase correction at 91.2 and 230.5 GHz on October 21, baseline 176 m. *First two rows*: Amplitude, uncorrected and corrected phases for 91.2 and 230.5 GHz, respectively. *Third row*: Phase noise histograms of uncorrected phase (shaded) and corrected phase (thick line). One scan corresponds to 120 s of integration. *Last two rows*: amplitude and phase at 230.5 GHz have been vector-averaged over time bins of one minute. The bars mark the $\pm 1\sigma$ error of the average.

Call for Observing Proposals on the 30m Telescope

The *next deadline* for the submission of observing proposals for the IRAM 30 m telescope is March 4th, 1996, midnight. The observing session will extend from May 15, 1996 to Nov. 15, 1996 and cover roughly the 'summer' period at Pico Veleta. Only proposals at 3 mm, 2 mm and 1.3 mm wavelength using heterodyne receivers will be considered. There will be no observing session with the bolometers.

In total, roughly 3000 h of observing time will be available. This should allow to schedule at least some bigger programmes needing in the order of 100 hours (or even more). No new call for 'key programmes' is issued for this period.

Please, find below some relevant information as well as a copy of the proposal form.

New Features

1. The second 3 mm receiver (3mm2) is now available. Its performance is superior to that of 3mm1 (see below). It is usable simultaneously with the present 3 mm receiver (3mm1) and, with some extra losses, with 230G1 and 230G2. In the 4-receiver operation mode, the noise of 230G2 is significantly increased due to losses in the frequency splitter. For the sake of simplicity, we ask you to consider only three receivers (e.g. 3mm1 + 3mm2 + 230G1, or 3mm1 + 230G1 + 230G2) in the telescope time calculations.

2. An On-the-Fly observing mode (OTF) has been implemented for heterodyne observations. In this mode, the telescope beam drifts continuously across the source, while data is dumped every 1 or 2 s (depending on the number of frequency channels). Any scanning direction can be chosen and successive scans can be concatenated to make a map (like in the bolometer 'mapping' mode). Individual drift scans can have any length; they are interleaved with OFF source reference subscans of any duration. This mode ensures a better homogeneity of the data and can make a much more efficient use of observing time.

Up to 4 receivers can be used simultaneously. The backends can be the filter banks and/or the autocorrelators. OTF observations were carried out successfully in December 1995 on two test programs (M 31 and Cep B). The large acquisition rate has however caused data storage and handling problems: although a new version of CLASS has been developed, the software is not yet user-friendly and remains experimental. Because of these shortcomings, we intend to open the OTF observing mode on a restricted basis only, for the coming May-November session. Only a limited number of new OTF programs will be accepted and all of them should be co-signed by an astronomer of the IRAM-Granada team, who should be responsible for the technical aspects and for the data reduction. You may contact Drs. H. Ungerechts and W. Wild at IRAM-Granada for more information.

3. A handbook collecting most of the information necessary to plan and reduce 30m telescope observations is now available [10].

Reminders

Recent improvements in hardware, software and mixers have made possible frequency switching with satisfactory baselines. Several limitations exist e.g. in terms of frequency throw (max. 45 km/s), backends, phase times etc. For details see [8]. Frequency switching is now open for public use. The receivers 3 mm, 230G1 and 2mm can be frequency switched simultaneously. However, baselines may be better when using only the 3 mm and/or the 230G1 receiver(s) due to the different optical setup.

An instantaneous IF bandwidth of 1 GHz is available for the 230G2 receiver. The two 1 MHz filter banks (512 MHz each) can be combined to provide 1 GHz bandwidth. The use of the 1 GHz wide filter bank excludes the simultaneous use of any other backend with the 230G2 receiver (the other receivers are not affected).

Most proposals submitted for the 30 m telescope underestimate the observing time needed to carry out the programme, even under excellent weather conditions. We ask you to pay special attention to this matter *as time underestimation is now a major criterion for proposal rejection* (several programmes have recently been rejected by the Program Committee on that ground). A technical report has been issued to assist you [9], and you may also ask for IRAM's assistance (but well before the deadline!).

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

Applications

Your applications should be addressed as usual to:

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

All proposals should have *reached* the Secretariat by March 4th, 1996, midnight. (Proposals sent by Fax will be accepted, provided they arrive by that time in a readable form; Fax (33) 76 42 54 69). Except for a duplicate of the source list (see below), no proposal should be sent by e-mail. You (i.e. the Principal Investigator) will receive by return mail an acknowledgement of reception and a proposal number.

To avoid the allocation of several numbers per proposal, send *only one* copy of your proposal, either by mail or by fax. In case your fax reaches us in time, but incomplete or unreadable, we will try our best to contact you (your responsibility, however).

Your proposal will only be evaluated if submitted in the correct format (these forms are available by anonymous ftp from `iram.fr` in directory `dist/proposal`, as well as a Latex style file `proposal.sty`; or with the World Wide Web al URL `http://iram.fr/`). *Do not use characters smaller than 11pt*, which would make your proposal unreadable if we had to fax it to the members of the P.C.

On the title page, you must fill out the line 'special requirements' if you request the polarimeter, 'service 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 they could be a motive for proposal rejection!).

We *insist* upon receiving, with proposals for heterodyne receivers, a complete list of frequencies *corrected* for source redshift (to 0.1 GHz, unless your frequencies are confidential). You should specify which receivers you plan to use. *Note that the use of the 2 mm receiver prevents the use of the second 3 mm and 1.3 mm receivers, which, otherwise, can be used in parallel with receiver 3mm1 and 230G1 (see below).*

In order to avoid useless duplication of observations and to protect already accepted proposals, we keep up a computerised list of targets. We ask you to fill out carefully your source list. This list must imperatively contain *all the 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 (please, *do not hand write*). 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 one page of figures and tables. 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 (see below); it should include pointing, focussing, and calibration checks and allow for receiver tunings (on average 20 min. per receiver).

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 hrs.

If time has already been given to one 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 or the continuation of a previously submitted 30 m telescope proposal.*

Observing time estimates

Observing time estimates must take into account:

- receiver tunings,
- pointing, focus, continuum and line calibrations (be aware that receiver alignment corrections, if needed, will eventually be counted against your observing time),
- telescope motions when changing sources as well as dead times due to telescope motion and/or data writing between ON and OFF subscans,
- integration time on source and comparison field(s).

The total integration time should be derived using the standard formula:

$$\Delta T_{MB} = \frac{\eta_{\rm F}}{\eta_{\rm B}} \frac{2T_{\rm sys}}{\sqrt{Bt}}$$

where $\eta_{\rm F}$ and $\eta_{\rm B}$ are the telescope forward and main beam efficiencies, $T_{\rm sys}$ is the system temperature above the atmosphere (in the antenna temperature scale), B the channel noise bandwidth, and t the total (ON + OFF) integration time. $T_{\rm sys}$ should be estimated for an 'average' summer humidity for 3mm, 2mm and 1.3mm observations (7 mm of precipitable water, or $\tau_{\rm zenith} = 0.5$ at 230 GHz).

We ask you to specify in your proposal the parameter values ($T_{\rm sys}, \Delta T_{MB}, B$, total integration time, overheads and dead times) adopted in your calculation of the needed telescope time.

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 of the IRAM Newsletter [9] [1]. *You are asked to follow the guidelines given in this report (or to justify particular requirements) in your proposal.*

Long programmes

This observing session offers the opportunity to schedule a few bigger programmes (typically 90–120 h). These 'long' programmes should mostly be centered on 3 mm spectral observations and should use at least 10h per day; they should have a large astronomical interest and be well explained. Careful time estimates will be of crucial importance for their acceptance.

Service observing

To facilitate the execution of short ($\leq$8 h) programmes, we propose "service observing" for some easy to observe (e.g. short, single source) programmes *with only one set of tunings.* Observations are made by the local staff. This is a passive way of observing, no direct interaction with the telescope through OBS being possible. For this type of observation, we request an acknowledgement of the

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

IRAM staff member's help in the forthcoming publication. Please, if you are interested by this mode of observing, specify it as a "special requirement" in the proposal form (IRAM will decide which proposals will actually go to that mode).

Programmes accepted for the Nov. 1995 – May 1996 period

A total of 152 proposals were submitted for the deadline of September 1995. 56 proposals were rated "A", 36 "B", the others "C" or "D". All the "A" and about half of the "B" programmes will actually get time on the telescope, some, however, with less time than requested. The telescope schedule is made until mid-March (and a tentative schedule until mid-April); the programme PIs have been or are being notified.

Principal Investigators of accepted proposals receive with the telescope schedule a *Confirmation of Observing Time* form which we ask you to return, properly filled, by Fax to IRAM Granada *and* IRAM Grenoble (Scientific Secretariat, Fax (33) 76 42 54 69, attention Mrs. C. Berjaud). The list of frequencies to be observed (normally, the same as in the proposal) should arrive in Granada at least two weeks in advance. It is also only after we receive your confirmation in Grenoble that we will send out duly signed mission forms to those of you entitled to travel reimbursement.

If you have questions, please contact Mrs. C. Berjaud at IRAM Grenoble.

Relevant Information about the 30 m Telescope

(Please, see additional information in the IRAM Newsletters and in the internal reports listed below).

Receivers

The IF bandwidth of all heterodyne receivers is 500 MHz, except for 230G2 which has 1 GHz. The following table lists the present possible receiver combinations:

	Rec. Combinations			
Receivers	4-Rec.	3-Rec.		
3mm1	*	*	*	*
3mm2	*		*	
2mm				*
230G1	*	*	*	*
230G2	*	*		

The second 3 mm receiver (3mm2) can be used simultaneously with the 3mm1 receiver and the 230G1 with a high efficiency. Four receiver operation (3mm1+3mm2+230G1+230G2) is possible, but it results in a significant increase in the noise of 230G2.

3 mm SIS receivers

The tuning band of the 3mm1 receiver is 81 – 116 GHz; its receiver temperature is between 100 and 140 K, the image side band rejection is between 25 dB and 30 dB. The tuning band of the 3mm2 receiver is 82 – 116 GHz; its receiver temperature is between 70 and 90 K with the same range of image side band rejection.

The high rejection of the USB improves the system temperature and the calibration accuracy, particularly for 115 GHz observations, for which the receiver image side band sees the bright oxygen 118.75 GHz atmospheric line.

It is important to check your calibration on strong reference sources (see IRAM line catalog and updates). Beware also of possible interference between the 'second' 1.3 mm receiver, 230G2, and this receiver when operating at harmonic frequencies (the two receivers receive the same polarization; the interference will be a strong and narrow line).

This receiver is also used as the standard pointing receiver.

2 mm Receiver

Good and reliable performance over most of the band. Tunable from 129 GHz to 183 GHz with SSB; receiver temperatures of 70 to 150 K (130 to 155 GHz), and 150 to 400 K (155 to 183 GHz).

1.3 mm Receivers

- 230G1: Operating band: 203.4 – 246 GHz. The SSB receiver temperature is 100 – 180 K in the standard reference plane.
- 230G2: The SSB receiver temperature over the nominal tuning range (210–250 GHz) is 100–130 K in the standard reference plane. The upper side band can be rejected by typically $\gtrsim$ 16 dB over this range. This receiver can be tuned to 267 GHz, although with a higher noise temperature ($T_{\rm SSB} \sim 600$ K). See the March 1994 Newsletter for more details.

Beware of possible interference of the 230G2 LO into the 3 mm receivers. *The 230G2 receiver cannot be operated with the 2 mm receiver*, since both receivers use the same control box and polarization. Switching from one receiver to the other is not straightforward. Please specify in the proposal form whether you choose to use the 2 mm receiver or 230G2.

At 1.3 mm (and *a fortiori* at shorter wavelengths) a large fraction of the receiver radiation pattern is distributed in an error beam (which can be approximated by two Gaussians of HPW $\simeq 170''$ and $800''$ — see A&A 274, p.144-146 for more details). Astronomers should take into account this error beam when converting antenna temperatures into brightness temperatures.

Polarimeter

A polarimeter has been constructed by IRAM for measurements of *circular* polarization. It has been used on the telescope. (see e.g. the March 1994 issue of the IRAM Newsletter). The main technical features of the polarimeter are briefly described below.

The polarimeter consists of a dielectric quarter-wave plate working in transmission. It is rotated between two positions at $\pm 45^o$ by a motor, the switching time is $\simeq 0.3s$, and the phase time is adjustable. From the point of view of data acquisition, it functions like other switching devices, i.e. the chopper or the wobbler, and the *difference* between the RCP and LCP intensities is acquired.

The present quarter-wave plate has been designed for 113.3 GHz. Its transmission loss is $\simeq 2\%$, and its cross-polarization below 20 dB. Similar plates could be fabricated for other frequencies if needed. Proposals for projects requiring the polarimeter can be submitted. They should clearly state the degree of technical performance that they demand. Besides the scientific evaluation, the acceptance and scheduling of such proposals will depend on their feasibility as judged from their requirements.

General point about receiver operations

We urge observers to restrict their frequency lists as much as possible and to send them early to Granada and Grenoble. For late arrivals (less than 2 weeks in advance), or a large number of frequencies, there is no guarantee for a prior test of the requested tunings.

Backends

There are 4 backends which can be individually connected to any receiver.

- The 1 MHz filterbanks, consisting of 4×256 channels each. The four parts can be combined to give a 1 GHz (4×256 MHz) wide filterbank (at present only usable with 230G2, no other backend can be connected to 230G2 in this case), or two filterbanks of 512 MHz each. Any shift of the four subbanks relative to each other is also possible in steps of 32 MHz. Each part can be connected to a different (or the same) receiver.
- The 100kHz filter bank, consisting of 256 channels of 100 kHz (splittable into two halves movable inside the 500 MHz instantaneous bandwidth, and connectable to two different receivers)
- The 500 channel AOS: (*Under repair*)
  Bandwidth 500 MHz; actual spectral resolution 1.5 MHz. Using the AOS with the 3 mm SIS receiver results in higher noise at the band edges, so the combination 3 mm SIS + AOS is not recommended.
- The autocorrelator: The software treats the autocorrelator as one unit although physically it consists of two identical machines. The following numbers are to be understood for the complete autocorrelator setup. Available resolutions are 10, 20, 40, 80, 320 and 1250 kHz. The bandwidth is between 20 MHz and 2×512 MHz, depending on resolution. The correlator can be split into 8 independent subbands, each of which can be configured individually and connected to the same or different receivers. For the larger bandwidths (i.e. more than one subband of 80 MHz) a problem of platforming may exist (i.e. baselines from the different subbands have slightly different levels).

Pointing / Focussing

Pointing sessions are made every one to two weeks; at present, the fitted pointing parameters yield an absolute pointing accuracy better than $3''$ (r.m.s.). We also try to keep the receivers as closely aligned as possible (to about $2''$, however, alignment can be lost occasionally). Checking the pointing, focus, and receiver alignment is the responsibility of the observers (use a planet for alignment checks). Note that 230 G2 and 230 G1 have foci differing by 0.4 mm. Using both receivers, you should carefully monitor the focus and choose a compromise value. Not doing so may result in broadened beams (e.g. HPW $15''$ and non-gaussian beams on one receiver [1]).

Wobbler

- Beam-throw: from 0 to $240''$ on either side of the source (avoid small amplitudes for line work).
- Standard phase duration: 2 s for spectral line observations.

References

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

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

[3] Thermal behaviour of mm-wavelength radio telescopes
A. Greve, M. Dan, J. Penalver 1992 (IRAM report 233)

[4] Interferometric measurement of tropospheric phase fluctuations at 86 GHz
L. Olmi, D. Downes 1992 (IRAM report 238)

[5] Thermal design and thermal behaviour of Radio Telescope structures
A. Greve 1992 (IRAM report 253)

[6] Astigmatism in reflector antennas: measurement and correction
A. Greve, B. LeFloch, D. Morris, H. Hein, S. Navarro 1993 (IRAM report 289)

[7] Design parameters and measured performance of the IRAM 30-m millimeter radio telescope
J. Baars, A. Greve, H. Hein, D. Morris, J. Penalver, C. Thum 1993 (IRAM report 298).

[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, W. Wild (IRAM Newsletter January 1995)

[10] The 30m Manual: A Handbook for the 30m Telescope
W. Wild 1995, IRAM Tech. Report 377/95.

These reports are available upon request (see also previous Newsletters). Please write to Mrs. C. Berjaud, IRAM Grenoble.

Michel GUÉLIN, Wolfgang WILD

Call for Observing Proposals on the Interferometer

Observing proposals are invited for the IRAM Plateau de Bure Interferometer (PdBI), for the period May 15, 1996 to Nov. 15, 1996. The deadline for applications is March 4th, 1996. The available frequency range will be 82 GHz to 116 GHz for the 3mm band, and initially 210 to 245 GHz for the 1.3 mm band.

Details of the PdBI and the observing procedures are given in the document "An Introduction to the IRAM Plateau de Bure Interferometer" (copies can be obtained from the address below, or from Internet via the World-Wide-Web; use IRAM home page `http://iram.fr/`). Proposers should read this document carefully before submitting any proposal.

Proposals should be sent to

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

IRAM expects to schedule and complete between 20 to 30 projects in this period, with an elapsed time of at least two months between start and end of any given project. Selection will be based on scientific merit, technical feasibility, and adequacy to the instrument.

For this call for proposals, please note the following specificities:

Proposal Category: Proposals should be submitted in one of the 4 **strict** categories defined below:

- **Category 1** : Proposals requiring 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. The maximum available baseline length will be about 300 m.
- **Category 2** : Proposals requiring 1.3mm data *only*. 3mm receivers will be used for pointing and calibration purposes, but cannot provide any imaging. The maximum available baseline length will be about 200 m.
- **Category 3** : Proposals requiring dual-frequency observations. The maximum available baseline length will be about 200m.
- **Category 4** : Exploratory proposals. The scientific interest of these proposals should justify the attempt to use the PdB array beyond its guaranteed capabilities. This category includes for example long baseline observations (A configurations at 3mm, B configurations at 1.3mm), non standard

frequencies for which tuning cannot be guaranteed, and more generally all non standard observations. These proposals will be carried on a "best effort" basis.

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

Antenna 5 Antenna 5 will come into operation in May 1996. However, because maintenance is required on the other antennas, the semester will be divided in two periods:

- May-June-July, when only 4 antennas will be available. The other antenna will be under maintenance.
- Aug-Sep-Oct, when we will have the 5 antenna array.

Configurations Because of the advent of antenna 5, configurations will again change (Table 6).

With 5 antennas, the PdB interferometer will offer 6 possible configuration sets listed in Table 6. For some projects in which the choice of resolution is unclear, it will still be possible to choose between CD and CC sets after observations on the C2 configuration have been performed first. At a higher resolution level, a similar choice between CC and BC or BB is possible.

1.3 mm band: All antennas are now equipped with fully operational dual frequency receivers. Since our knowledge of phase stability at 1.3 mm is based on the extrapolation of 3mm observations over the last years, no real guarantee about 1.3mm performances can be given yet. Note that even the "compact" CD configuration set would give a resolution better than $2''$ at 1.3mm. Therefore, the very compact D configuration should be considered.

Note that the field of view at 1.3 mm is very restricted (about $20''$).

Because of weather conditions, 1.3 mm observations are usually only feasible for objects transiting during the night in the Aug.-Oct. period.

Dual-frequency operation: The 3mm and 1.3mm receivers are aligned to within about $2''$.

Because of weather conditions, dual-frequency observations are only feasible for objects transiting during the night in the Aug.-Oct. period.

Very long baselines: configuration A: The A configuration will not be scheduled for next session.

Signal to Noise: The rms noise can be computed from

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

where

- $T_{\rm SYS}$ is the system temperature in T_r^* scale (150 K below 110 GHz, 300 K at 115 GHz, 500 K at 230 GHz)
- $J_{\rm pK}$ is the conversion factor from Kelvin to Jansky (30 at 3mm, 50 at 1.3mm)
- η is an efficiency factor due to atmospheric phase noise (0.9 at 3 mm, 0.6 at 1.3 mm)
- $N_{\rm a}$ is the number of antennas (4 or 5), and $N_{\rm c}$ is the basic number of configurations (with 4 antennas: 2 for D, 3 for CD, 4 for BC; with 5 antennas 1 for D, 2 for CD, 3 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)

Receivers: Below 110 GHz, receivers offer best performance in LSB tuning with high rejection (20 dB): expected system temperatures are (in T_r^* scale) 150 to 200 K for the summer time. Above 110 GHz, best performances are obtained with USB tuning, low rejection (4 to 6 dB): expected system temperatures are 300 K at 115 GHz. DSB tuning is possible over the whole frequency range, but the system temperature may degrade significantly.

The 1.3 mm receivers give DSB tuning with typical T_{rec} below 50 K. Expected SSB system temperature are 400 to 500 K. However a relatively narrow resonance significantly degrades the performance near 245 GHz. The guaranteed tuning range is 210-245 GHz, but it may be possible to reach lower frequencies for specific cases. Higher frequencies are not feasible because of limitations in the triplers.

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 correlator has 6 independent units, each being tunable anywhere in the 110-610 MHz band, and providing 4 choices of bandwidth/channel configuration: 160 MHz/64, 80 MHz/128, 40 MHz/256 and 20 MHz/256. For the 40, 80 and 160 MHz bandwidths, the two central channels may be perturbed by the Gibbs phenomenon (depending on continuum

Table 6: Available configurations

4 Antenna configurations	
Name	Stations
D1	W05 W00 E03 N05
D2	W10 W01 E03 N09
C1	W20 W05 N09 N17
C2	E10 W09 N03 N15
B1	E16 E24 N11 N17
B2	W12 W09 E24 N20
A1	W27 W20 E23 N29
A2	W23 E04 E24 N29

5 Antenna configurations	
Name	Stations
D	W05 W00 E03 N05 N09
C1	W05 W01 E10 N07 N13
C2	W12 W09 E10 N05 N15
B1	W12 E18 E23 N13 N20
B2	W23 W12 E12 N17 N29
A	W27 W23 E16 E24 N29

Configuration set	4 ant Config.	5 Ant Config.	Main purpose
D	D1, D2	D	"Low" resolution at 1.3 mm
CD	D1, C1, C2	D, C2 or C1	$3.5''$ resolution at 3mm, $1.8''$ resolution at 1.3 mm
CC	n.a.	C1, C2	Slightly higher resolution than CD.
BC	C1, C2, B1, B2	B1, C2	$2''$ resolution at 3 mm
BB	n.a.	B1, B2, C2	Better sensitivity than BC
AB	B1, B2, A1, A2	A, B1, B2	$1''$ resolution at 3 mm

strength): it is recommended to avoid centering the most important part of the lines in the middle of the band of the correlator unit.

The 6 units can be independently connected either to IF1 (3 mm receiver) or to IF2 (1.3 mm receiver).

40 kHz resolution: One (and *only one*) of the 6 units has been retrofitted to offer a higher frequency resolution (40 kHz instead of 80 kHz). This is obtained by operating at half clock speed and inserting an anti-aliasing filter of effective bandwidth 8 MHz. Because the filter reduces the input power to the sampler, this unit should be placed near the maximum of the IF amplitude bandpass: band edges must be avoided.

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

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

Data reduction: Proposers should be aware of constraints for data reduction:

- In general, data will 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.
- IRAM may consider splitting the data reduction in two phases: intermediate calibration and final mapping. Such a splitting is often absolutely 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 fast 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 are reduced with an old package, we insist that observers having 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: Depending upon the program complexity, IRAM may require an in-house collaborator instead of the normal local contact.

Technical pre-screening: All proposals will be reviewed for technical feasibility in parallel to being sent to the members of the program committee. Please help in this task by submitting technically precise proposals. Scientific justification should be kept within 2 pages. Note that your proposal must be complete and exact: **velocities, positions and frequency setup must be exactly specified**.

Non-standard observations:
Please contact S.Guilloteau in case of doubt about non-standard program feasibility.

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 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, with coordinates with the wrong epoch !... The IRAM interferometer is a powerful, but complex and unique instrument, and proposal preparation requires special care. Information is available in the documentation, and 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.

Stéphane GUILLOTEAU

Report on Recent Observations

First Observations of Comet Hale-Bopp at the IRAM 30-m telescope

Report by: N. Biver([1]), D. Bockelée-Morvan([1]), P. Colom([1]), J. Crovisier([1]), D. Despois([2]), L. Jorda([1]), R. Moreno([3]), G. Paubert([3]), H. Rauer([1])
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When comet C/1995 O1 Hale-Bopp was discovered in late July at 7 AU from the Sun, it was already very bright: its magnitude was $m_v = 10.5$, which is about *250 times brighter* than comet Halley at the same heliocentric distance. Comet Hale-Bopp is a long-period comet, with a period of about 3000 years. It will reach perihelion on April 1, 1997 at 0.91 AU from the Sun and, although predictions of cometary evolution are highly unreliable, it might be at that time a very bright object, with possibly a negative magnitude. We could then have an unprecedented opportunity to investigate a very bright comet with modern instrumentation.

Comet Hale-Bopp is already an interesting object worth of detailed studies. Its coma shows rapidly evolving dust jets. The reason for this activity cannot be sublimation of water — which is the driver of cometary activity at small heliocentric distances — because it is inefficient at this distance.

Thanks to the IRAM staff and to observers who accepted last-minute changes to their observing schedule, observations of comet Hale-Bopp could take place as early as mid-August. We searched for volatile species in the coma. The CO $J(2-1)$ line was already marginally detected on Aug. 16 and 23. It was then confidently detected on Sept. 20 and 21 (Rauer *et al.* 1995, *IAU Circ.* No 6236) and observed at several subsequent periods. The same line was also independently detected at the JCMT (Matthews *et al.* 1995, *IAU Circ.* No 6234).

This CO spectrum resembles the one observed in another exceptional object, the short-period comet P/Schwassmann-Wachmann 1, which harbours gaseous activity although located beyond Jupiter on a nearly circular orbit (Crovisier *et al.* 1995, *Icarus* **115**, 213; also *IRAM Newsletter* No. 19). The line is blue shifted by 0.4 km s^{-1}, which indicates outgassing from the day-side of the nucleus. This anisotropic outgassing can be related to the dust jets seen in the visible images of the comet. Assumming a CO rotational temperature of 10 K — as was retrieved from observations of the $J(1-0)$ and $(2-1)$ lines in P/Schwassmann-Wachmann 1 — the CO production rate ranges between 1.3 and 4.2×10^{28} molec. s^{-1} (on the order of one ton per second), with indications of time variations, for our observations between Aug. 16 and Oct 22, 1995.

Although important, this CO production may not be sufficient to explain the huge dust production of this

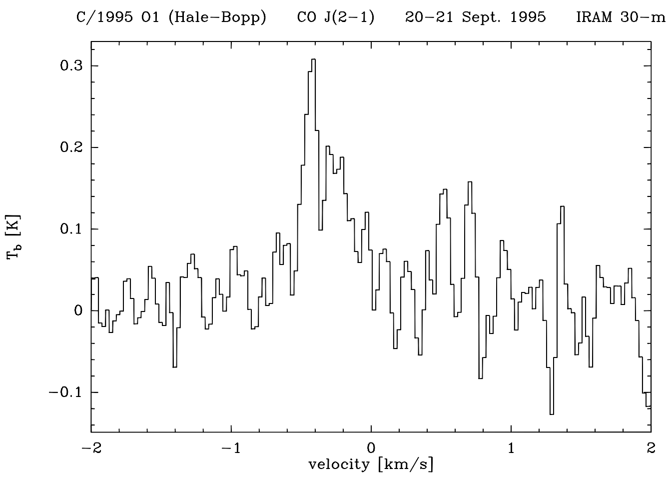

Figure 6: The CO $J(2-1)$ line observed in comet Hale-Bopp, average of September 20-21, 1995.

comet observed in the visible. We also searched for other volatiles: HCN, H_2CO, CH_3OH, which have sublimation temperatures between those of CO and H_2O. The search was negative, with upper limits corresponding to a few percent the production rate of CO.

An open question is whether the activity of comet Hale-Bopp is due to the sublimation of carbon monoxide ice, or triggered by the amorphous-to-crystalline water ice transition, an exothermic process which induces the release of trapped volatiles. This would have different implications on the physical state of cometary ices and on their formation scenarios.

We plan to monitor the CO production of this comet and to watch for the onset of sublimation of other species as the comet approaches the Sun. Very sensitive spectral observations could be undertaken at IRAM in one year if this comet becomes indeed very bright. They would allow us to investigate the composition of the cometary ices and to obtain clues to their outgassing processes.

Scientific results

Dust and Gas Distribution around T Tauri stars in Taurus-Auriga. I. Interferometric 2.7mm continuum and ^{13}CO J=1-0 observations

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Abstract: We present new ^{13}CO $J = 1 \rightarrow 0$ and 2.7 mm continuum interferometric observations of 33 young star systems located in Taurus-Auriga. Our goal was to compare the distribution, and hence the evolution, of the circumstellar material around young star singles and binaries. The sample included 2 triples, 16 binaries, 14 singles, and one object of unknown multiplicity.

We detected 2.7 mm continuum emission in 12 systems at S/N > 5 and have probable detections for another 5. V 773 Tau, a weak emission line binary system, is remarkable in that its 2.7 mm continuum decreased from $\sim$ 30 mJy to $\sim$ 0 mJy in less than six months. We find that the singles are, on average, stronger 2.7 continuum sources than the multiples, consistent with Osterloh & Beckwith's (1995) finding at 1.3 mm. Significant estimates of the sizes have been obtained for 8 singles. They imply large ($R > 150$ AU) disks, with relatively flat density distribution (emissivity flatter than $r^{-1.5}$). The spectral energy distributions in the millimeter range can be fitted using a dust emissivity law $K_\nu \propto \nu^\beta$ with value of β in the range 0.5 to 1.

Only DG Tau, Haro 6-5b and UY Aur have detectable ^{13}CO $J = 1 \rightarrow 0$ emission. ^{13}CO emission, but no 2.7 mm continuum, is also found in the LkHα 332 region and near FS Tau; however, it does not appear to be associated with the known stars. Interpreting the observational results in terms of the circumstellar disk scenario, we find that, in all cases, disk masses derived from the dust emission at 2.7 mm are more than a factor of about 20 larger than the masses derived from the ^{13}CO $J = 1 \rightarrow 0$ upper limit.

To appear in A&A main journal.
The full preprint is available as a postscript file on the WWW:
`http://iram.fr/papers/papers.html` *or by an anonymous ftp at:*
`iram.fr (/dist/pub/papers/e021.ps.Z).`

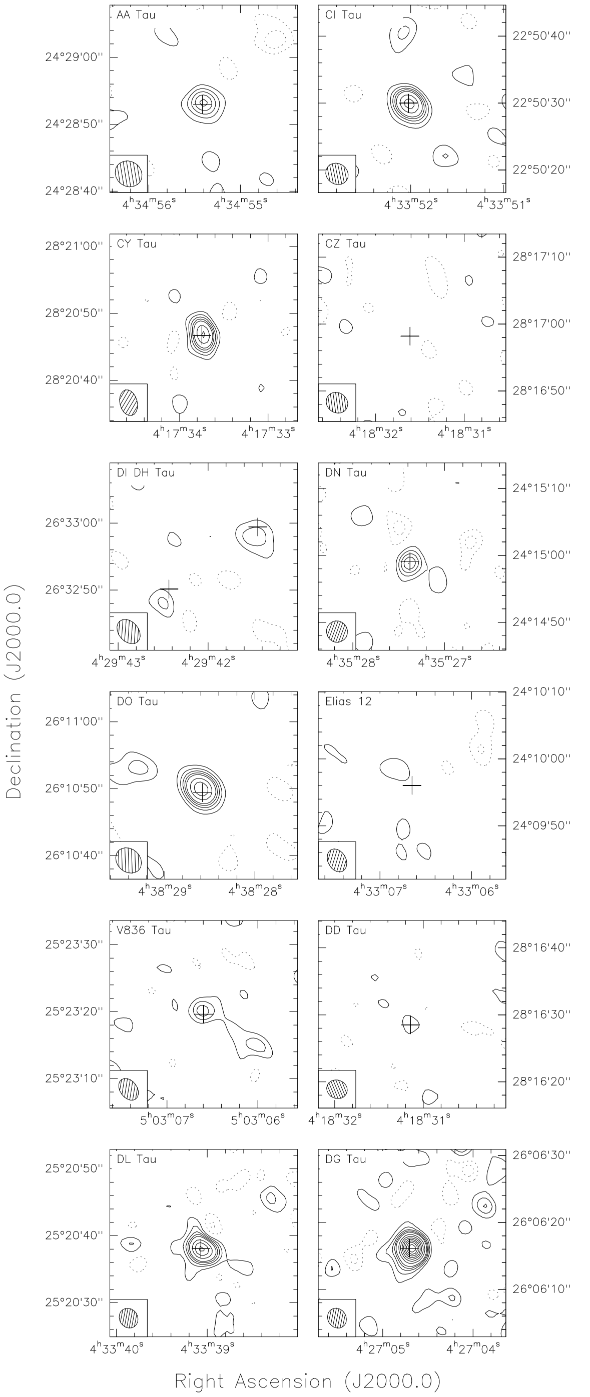

Figure 7: Continuum images of the observed stars. Contour steps are -4, -2, 2, 4, 6, 8 and then 10 to 50 by 5 mJy/beam. The name of the source is indicated in upper left corner, and the beam size in lower left. The crosses indicate the nominal position of the stars from HBC. Coordinates are in the J2000 system. Positions have been corrected for proper motions according to measurements by Jones and Herbig (1979) and Hartmann et al. (1991).

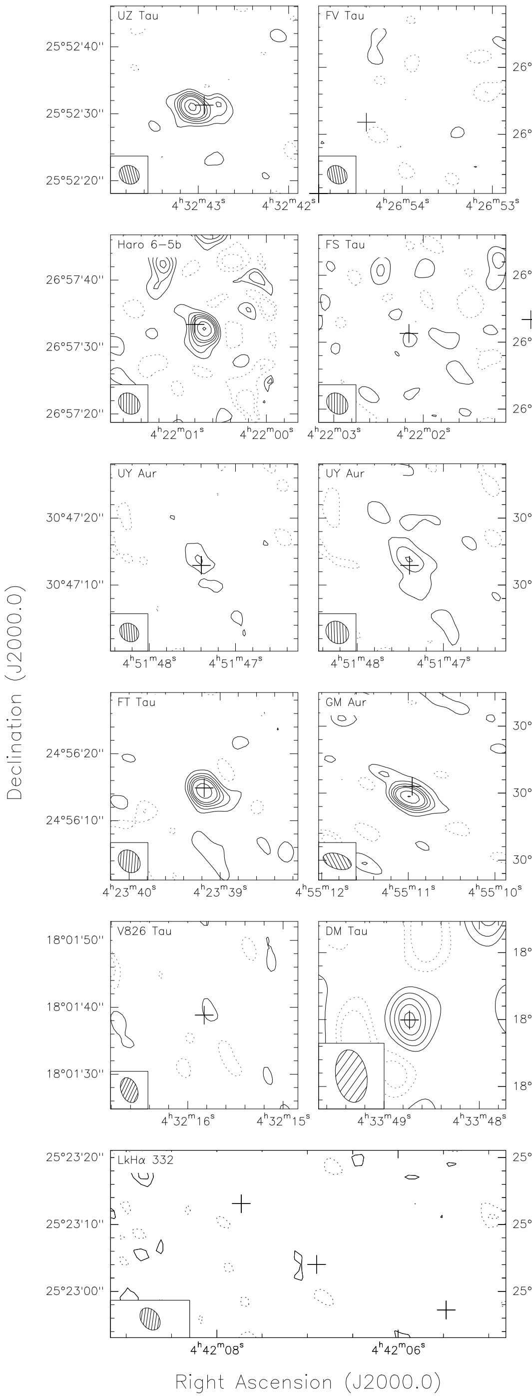

Figure 8: Continuum images of the observed stars (cont.). The upper limits for IW Tau, IS Tau, GH Tau, GK Tau and LkCa 3 (not shown here) were obtained with a beam similar to that of DM Tau. For UY Aur, we show two maps, one obtained at full resolution (left), the other (right) done with a 150-m taper. Since Haro 6-5b is displaced from the pointing center FS Tau, the map has been corrected from the primary beam attenuation. The S/N in this map decreases towards the north-west of the map, and contours to the north and north-west of Haro 6-5b are noise peaks. Note that GM Aur position has not been corrected for proper motion.

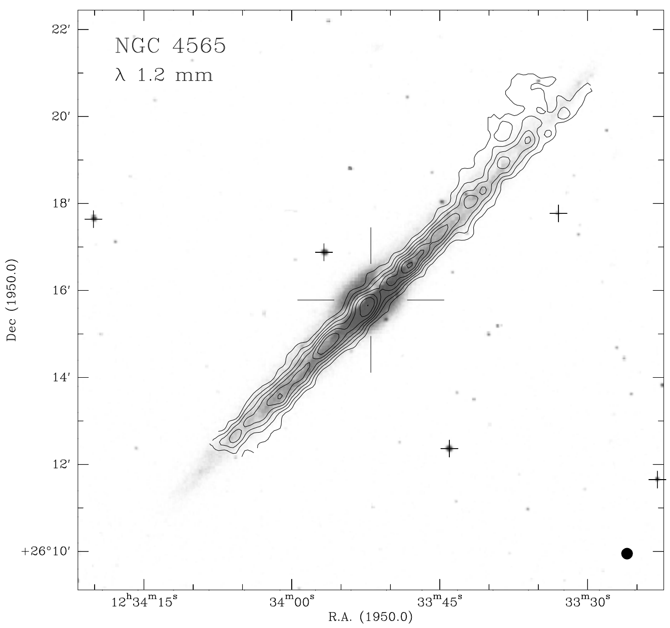

Figure 9: The λ 1.2 mm continuum emission, smoothed to an angular resolution of 20″ and superimposed on a optical photograph of NGC 4565 (Lick Observatory). The contour levels are 3.0 (3σ), 6.0, 9.0,... 21 mJy/20″ beam. The noise level increases by about 30% towards the outer parts of the map. Note the warp of the continuum contours to the NW.

Cold dust and molecular line emission in NGC 4565

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Abstract: Using the IRAM 30-m telescope, we have mapped the λ 1.2 mm continuum emission and the ^{12}CO J= 1→0 and 2→1 line emissions in the edge-on spiral galaxy NGC 4565. We selected NGC 4565 because it is strong in the HI line, but weak in CO, contrary to the galaxies mapped so far at 1.2 mm.

The CO emission in NGC 4565 resembles that in the Milky Way. It shows a compact central source surrounded by a 'molecular ring'. The molecular ring peaks between 1′ and 1.5′ from the center ($3-5$ kpc) and has an outer radius of $\simeq 3'$. It is twice smaller than the broad 'plateau' observed in HI and shows narrow structures which could be spiral arms.

The λ 1.2 mm continuum follows CO near the center and HI at the periphery. It shows, like CO, a central peak and an inner ring and, like HI, a weaker, extended plateau. This is the first time that dust emission is unambiguously detected in extragalactic HI clouds. Like HI, the 1.2 mm contours are warped near the NW edge of the galaxy. The warp, already apparent at half the optical radius, reaches a height of 50″ (2.4 kpc) at the edge of the optical disk (Fig. 9).

The average dust temperature is 18 K near the center and 15 K in the HI plateau. From the 1.2 mm continuum intensity and the HI line integrated intensity, we derive a dust absorption cross section per H atom $\sigma^{\rm H}_{1.2\rm mm} = \tau/N_{\rm H} = 5\times10^{-27}$ cm^2 in the plateau. This value is very close to that predicted by Draine & Lee (1984) for the local diffuse clouds.

The velocity field derived from CO can be described by rotation (solid body rotation between 0 and 4 kpc, constant velocity further out) plus non-circular motions. The non-circular motions are observed mostly near the 'arms' and near the nucleus. They are are probably the signature of a spiral density wave and/or of a central bar. The presence of a bar could explain the boxy shape of the central bulge on optical photographs.

CO in the Barred Galaxy NGC 1530

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Abstract: We present observations of the barred spiral NGC 1530 in CO(1–0) with the IRAM Interferometer and in CO(1-0) and (2-1) with the IRAM 30 m telescope. Along the bar there is abundant molecular gas associated with the dust lanes seen on optical images. Near the nucleus, the interferometer maps show strong shock fronts and a nuclear ring. *There appears to be very little or no gas at the nucleus itself.* Perpendicular to the bar, the shock fronts are barely resolved and extend $< 3''$. Most of the molecular gas in the galaxy is in a central ellipse with a major axis of 3.5 kpc. This major axis and the strongest velocity gradients are *perpendicular* to the bar. Position-velocity diagrams are consistent with the molecular gas following elliptical orbits along the bar, but show important deviations at the strong shock fronts and close to the nucleus, where the gas follows orbits perpendicular to the bar. We also detect giant molecular complexes near the ends of the bar and much fainter CO in molecular clouds in the SE spiral arm. In spite of its high CO luminosity and great central concentration of molecular gas, the galaxy has only a modest $L_{\rm FIR}/L_{\rm CO}$ ratio, which suggests a relatively low rate of star formation. Although the molecular gas has a latent capacity to fuel a large starburst, further infall to the center is probably hindered by

the closed orbits 1.5 kpc from the nucleus. Hence most of the gas cannot attain the critical density needed for a large starburst.

New observations and a new interpretation of CO(3-2) in IRAS F 10214+4724

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Abstract: New observations with the IRAM interferometer of CO(3-2) from the highly luminous galaxy IRAS F 10214+4724 show the source is $1.5'' \times \leq 0.9''$; they display no evidence of any velocity gradient. This size, together with optical and IR data that show the galaxy is probably gravitationally lensed, lead to a new model for the CO distribution. In contrast to many lensed objects, we have a good estimate of the intrinsic CO and far IR surface brightnesses, so we can derive the CO and far IR/sub-mm magnifications. The CO is magnified 10 times and has a true radius of 400 pc and the far IR is magnified 13 times and has a radius of 250 pc. The true far IR luminosity is $4-7\times10^{12}\mathrm{M}_\odot$ and the molecular gas mass is $2\times10^{10}\mathrm{M}_\odot$. This is nearly an order of magnitude less than previously estimated. Because the far IR magnification is lower than the mid and near IR magnification, the intrinsic spectral energy distribution now peaks in the far infrared. That is, nearly all of the energy of this object is absorbed and re-emitted in the far infrared. In CO luminosity, molecular gas content, CO linewidth, and corrected far IR luminosity, 10214+4724 is a typical, warm, IR ultraluminous galaxy.

First millimeter mapping of the jet and nucleus of M87

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Abstract: Observations of M87 at 89 GHz (3.4 mm) with the IRAM Plateau de Bure interferometer are presented. This is the first image of an extragalactic jet at this frequency with such a resolution ($2.9'' \times 1.8''$). Knots A, B, C and G in the jet are clearly seen. The photometry of the knots reveals that, within the error bars, the millimetric intensity is that expected from a linear interpolation between the radio and optical values. An extended feature

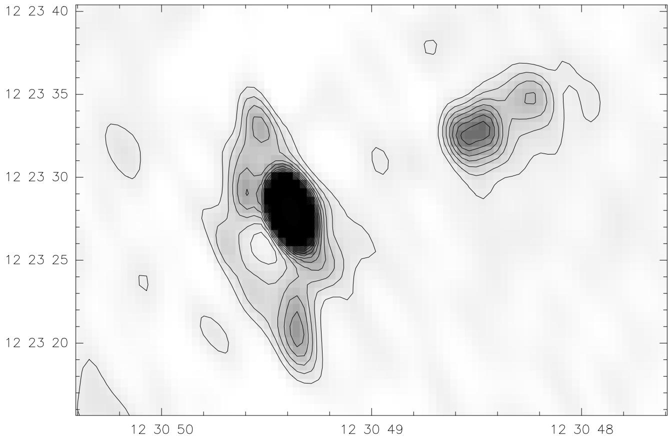

Figure 10: Grey map of M87 with contour level spacing of 35 mJy/beam and a peak intensity of 1.67 Jy/beam. The beam width is $2.9'' \times 1.8''$ at PA=22°.

of about $13'' \times 7''$ appears around the nucleus, which we were not able to attribute to an artifact. It is elongated perpendicular to the jet and its offset from the nucleus is symmetric to that of the well known H_α emission-line features in M87. If interpreted as very cold gas ($T \lesssim 10$ K), this extended structure would then have a total mass of $\simeq 10^{12}$ $\mathrm{M}_\odot$.
Astronomy & Astrophysics, in press

80 - 360 GHz very wide band millimeter wave network analyzer

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Abstract: Millimeter receivers made for the Radio Astronomy use devices and materials whose transmission, and reflection properties have to be known over a 40% bandwidth. We have made a millimeter extension to an HP8510C vector analyzer, which at present allows magnitude and phase measurement between 80 and 360 GHz with a sensitivity of ±0.2 dB and ±1 deg rms respectively over 30% instantaneous bandwidth for the transmission, and 23% for the reflection. Improvements relative to the first version include new harmonic mixers, and an active doubler. Dynamic ranges up to 60 dB in transmission and 50 dB in reflection are obtained up to 280 GHz, with more than 50 GHz instantaneous bandwidth using waveguide calibration. Detection with a 30 dB dynamic range is obtained at 320−360 GHz. Time domain measurements give spatial resolution down to 2 mm.
To appear in: Digest of the 20th Int. Conf. on Infrared and Millimeter Waves, Florida, USA, Dec. 1995.

Interferometric molecular line observations of the circumstellar envelope(s) around U Camelopardalis

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Abstract: We have observed the circumstellar envelope of the carbon star U Cam in the HCN ($J = 1 \rightarrow 0$) and CN ($N = 1 \rightarrow 0$) lines using the IRAM Plateau de Bure interferometer. There is evidence of a two-envelope structure: an outer extended envelope, possibly a shell, with a radius of $\approx 7 \times 10^{16}$ cm, that expands with a velocity of ≈ 25 km s^{-1}, surrounding an inner envelope with a radius of $\approx 6 \times 10^{15}$ cm and an expansion velocity of only ≈ 13 km s^{-1}. Mass loss rate estimates based on these data alone are uncertain, but they suggest that the mass loss rate during the formation of the outer envelope was higher than during the present mass loss epoch. Thus, we have evidence for a significant variation in the mass loss characteristics of U Cam within the last 10^3 years.

The filamentary structure of the interface between the atomic and the molecular phases in NGC7023

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Abstract: The combination of interferometric and single-dish data allow us, for the first time, to determine the intimate structure of the photodissociation region associated with the prototypical reflection nebula NGC 7023. We have mapped the J=1→0 HCO^+ line using the IRAM millimeter interferometer and the 30-m single dish telescope, and the 21cm HI line using the Very Large Array of NRAO. The interferometric HCO^+ data show the existence of four high density molecular filaments with different velocities (1.9 kms^{-1}, 2.4 kms^{-1}, 2.9 kms^{-1}, 4.0 kms^{-1}) located at the interface between the atomic and the molecular gas. An additional filament has been tentatively detected at 5.8 kms^{-1}. From the comparison between the single-dish and the interferometric HCO^+ data with HI emission, we derive that the filament at 4.0 kms^{-1} and, very likely, that at 5.8 kms^{-1} are located on the inner walls of the HI clump, immersed in an atomic medium, while those at 1.9 and 2.4 kms^{-1} are immersed in the molecular cloud. The filament at 2.9 kms^{-1} would be located in an intermediate zone. The thickness of the filaments are $\sim 6''$ and the derived densities vary between 10^5 and a few 10^6 cm^{-3}. The molecular filaments match perfectly the infrared filaments found at 2.1 μm, suggesting that infrared and millimeter data are probing regions of enhanced hydrogen density.

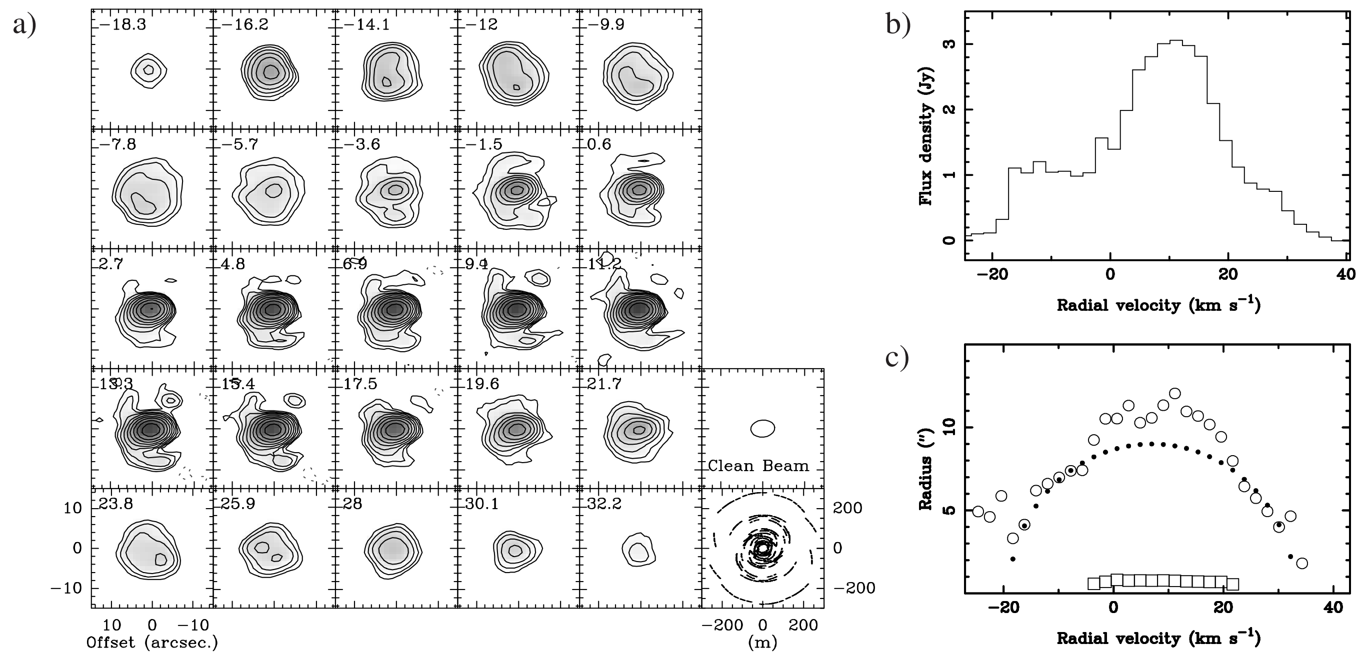

Figure 11: **a)** Velocity-channel maps of the HCN ($J = 1 \rightarrow 0$) emission towards U Cam. Contours levels are −0.18, −0.118, −0.077, −0.05, 0.05, 0.077, 0.118, 0.18, 0.276, 0.424, 0.649, 0.996, 1.526 and 2.34 Jy/beam, i.e., spacing is logarithmic. Negative contours are dashed. The synthesized CLEAN beam (shown at the half power contour) is $5.9 \times 4.2''$. The last panel shows the uv plane coverage. **b)** The HCN spectrum obtained from the map data. **c)** Size estimates for the inner (squares) and outer (circles) envelopes (see text for details). The small dots give the relation $\theta(v_z) = \theta(0)(1-(v_z/v_e)^2)^{1/2}$ with $v_e = 26$ km s^{-1} and $\theta(0) = 9''$

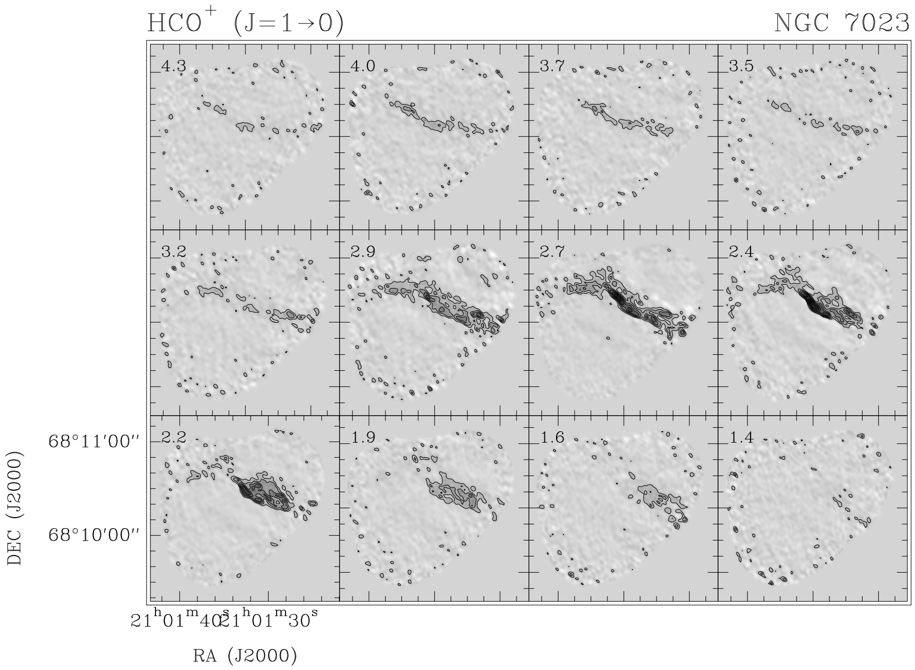

Figure 12: An HCO^+ J=1→0 mosaic of the line emission towards the reflection nebula NGC 7023. The filamentary structures are regions of enhanced hydrogen density located in a narrow ridge ($50'' \times 15''$) $\sim 46''$ North-West from HD 200775 at the interface between the molecular and the atomic regions. Contours are from 100 mJy to 700 mJy in steps of 100 mJy. The velocity is marked on the top-left corner of the panels.

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365. millimeter-wavelength observations of compact steep-spectrum sources
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366. The Plateau de Bure survey of galactic λ3mm HCO^+ absorption toward compact extragalactic continuum sources
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367. Millimeter-wave absorption studies of the onset of dark-cloud chemistry
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368. A precessing jet in the l1157 molecular outflow
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369. A search for CO emission in high redshift powerful radio galaxies
A.S. Evans, D.B. Sanders, J.M. Mazzarella, P.M. Solomon, D. Downes, C. Kramer, S.J.E. Radford
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371. Search for interstellar Glycine
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V. Despringre, D. Fraix-Burnet, E. Davoust
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373. CO in the barred galaxy NGC 1530
D. Downes, D. Reynaud, P.M. Solomon, S.J.E. Radford
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374. Dust and gas distribution around T Tauri stars in Taurus-Auriga: I. Interferometric 2.7 mm continuum and ^{13}CO J=1-0 observations
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376. Cold dust and molecular line emission in NGC 4565
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380. The filamentary structure of the interface between the atomic and the molecular phases in NGC 7023
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We also compile a list of e-mail addresses of IRAM users (e.g., in order to send warning messages when the Newsletter is available, but also to provide fast information, if needed). If you feel your address should be on this list, please send the one line message:

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to the following e-mail address:

`iramusers-request@iram.grenet.fr`

Both addresses are valid on Internet, EARN-Bitnet and EAN .... Please keep R. Lucas 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	(33) 76 82 49 00	(33) 76 51 59 38
Plateau de Bure	Institut de Radioastronomie Millimétrique, Observatoire du Plateau de Bure, 05250 St Etienne en Dévoluy, France	(33) 92 52 53 60	(33) 92 52 53 61
Granada	Instituto de Radioastronomía Milimétrica, Avenida Divina Pastora 7, Núcleo Central, 18012 Granada, España	(34) 58 22 88 99	(34) 58 22 23 63
Pico Veleta	Instituto de Radioastronomía Milimétrica, Estación Radioastronómica IRAM-IGN del Pico Veleta, Sierra Nevada, 18012 Granada, España	(34) 58 48 80 00	(34) 58 48 80 82

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.

If you are interested in attending the next IRAM User Meeting, please cut off this page, fill in the following questionnaire and return it before April 1st to:
Mrs G. Matoso, IRAM (300 rue de la Piscine, F-38406 Saint-Martin d'Hères, France - Fax (33) 76 51 59 38, e-mail: Matoso@iram.fr).

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USER MEETING
IRAM–Grenoble
May 6-7th, 1996

Registration Form

Name: ....
Surname: ....
Address: ....
....
....
....
Tel: ....
Fax: ....
E-mail: ....

Do you need hotel reservation ?
From .... May 1995 to .... May 1995
(Number of nights: ....)
Single Room ☐
Double Room ☐

I will attend:
Yes ☐
No ☐
Perhaps ☐
I will present a contribution:
Yes ☐
No ☐
I prefer:
An oral contribution ☐
A poster ☐
The titles(s) of my papers(s) is (are): ....
....
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