IRAM Newsletter

Number 33 October 31, 1997

Calendar

December 1st, 2nd 1997: User Meeting

December 3rd 1997: Scientific Advisory Committee Meeting

March 5th, 1998: Deadline for the submission of observing proposals for the period May 15, 1998 to Nov. 15, 1998.

Contents

Final Announcement of the IRAM User Meeting on December 1st and 2nd, 1997 in Grenoble

As described in the first announcement of this meeting, we will try a new structure for the User Meeting. Day 1 will mostly be devoted to presentations of the instrument status and the projects which are currently under development or planned. Day 2 will be devoted to scientific presentations on the topic of "Molecular Clouds and Star Formation". This theme has been chosen for two reasons: firstly, the majority of the contributions which have been announced to date deal with this topic, and secondly, this field is one of the two main scientific drivers for the 'Large Southern Array' project (LSA), which will also be presented.

If you have not yet done so, please register for the meeting as soon as possible by using the form attached at the end of this Newsletter or by sending an email to Mrs. G. Matoso (Fax: (33) 476 51 59 38, e-mail: matoso@iram.fr).

Preliminary Agenda: see next page.

Michael GREWING

Personnel Matters

Arrivals and Departures

Manfred MALZACHER has retired on July 31st, 1997 after having been Head of the IRAM Administration for more than 15 years. His successor, Michael LANGE has joined IRAM on July 1st, and since 1st he is the new Head of the IRAM Administration.

Mrs. Bernadette CROZET has retired on September 30th. She had been working in the IRAM Administration since 1986.

On October 31st Karl-Heinz GUNDLACH will retire. He joined IRAM in 1982 to build up the SIS laboratory.

The astronomers' group will have two new members: Dieter NUERNBERGER, a Ph.D. student at the University of Wuerburg will arrive on November 1st with a grant from the German Science Foundation. On December 1st, Michael DUMKE will join the group as a postdoc with a CNRS/MPG Stipendium.

As a temporary replacement for Mrs. Catherine BERJAUD, Mrs. Annelise JOST has been hired in the Administration Group as a new secretary.

Mr. Karim BOUYOUCEF will join the Computer Group on November 1st to work on scientific software.

Changed responsibilities

Bernard LAZAREFF has ended his appointment as Deputy Director of IRAM on August 31st, and has been

User Meeting: Preliminary Agenda

December 1st

10:30-10:40	Opening of the meeting	M.Grewing
10:40-11:20	Status report on the 30m-telescope	W.Wild
11:20-11:40	The surface accuracy of the 30m-telescope	B.Lazareff, D.Morris
11:40-12:00	Refurbishment plans for the receiver cabin and the next generation of receivers	B.Lazareff
12:00-12:30	Spectral-line on-the-fly observing: status, experience and results	H.Ungerechts
12:30-13:00	Discussion	
13:00-14:30	*Lunch Break*	
14:30-15:15	*Status report* on the PdB Interferometer	S.Guilloteau
15:15-15:35	Future extension plans (Antenna 6,next generation of receivers, further track extension)	M.Grewing, S.Guilloteau
15:35-15:55	*Status report* on the new multi-purpose backend for the 6-antennas array	M.Torres
15:55-16:30	Discussion	
16:30:16:45	*Coffee Break*	
16:45-17:30	Observing time allocation : new strategies needed ?	
	Discussion to be introduced by the Chairman of the SAC	J.Martin Pintado
17:30-18:30	Short scientific contributions	
18:30-???	Reception at IRAM	

December 2nd - Molecular Clouds and Star Formation

09:00-09:45	*Invited Review*: Small-scale structure in pre-star forming regions: results from the Key Project	E.Falgarone
09:45-10:00	CO On-the fly mapping of the S106 mol. cloud	N.Schneider
10:00-10:15	Small-scale dust continuum structure in the Rho Ophiuchi cloud cores	F.Motte, Ph.Andre
10:15-10:30	Vibrationally excited molecules in hot cores	P.Schilke
10:30-11:00	*Coffee Break*	
11:00-11:45	*Invited Review* on Molecular Clouds	N.N.
11:45-12:00	New results from Galactic hot cores	C.M.Walmsley
12:00-12:15	^{29}SiO and ^{28}SiO emission from Orion A	F.Herpin
12:15-12:30	A C^{17}O survey toward ultracompact HII regions	P.Hofner
12:30-14:00	*Lunch Break*	
14:00-14:45	*Invited Review*: Recent progress in the theory of star formation	H.Yorke
14:45-15:00	New views on low-mass star formation: confronting theory with observations	H.Wiesemeyer
15:00-15:15	L483: the birth of a cometary nebula	M.Tafalla
15:15-15:30	Molecular outflows from Class 0 objects	F.Gueth
15:30-15:45	High angular resolution images of protoplanetary disks associated with T Tauri stars	A.Dutrey
15:45-16:00	*Coffee Break*	
16:15-17:00	Status report on the LSA Project study	D.Downes, M.Grewing, S.Guilloteau
17:00-18:00	General Discussion	

appointed as the new Head of the Receiver Group as of September 1st.

On September 1st, Stéphane GUILLOTEAU took up his new duties as Deputy Director of IRAM.

On October 1st, 1997 Karl SCHUSTER started as the new Head of the SIS Group.

Michael GREWING

30m Telescope

Road news

When going up to the telescope on the road, some of the "Camel Trophy" or "Rallye Paris–Dakar" feeling has been lost since the previously very bad road to Borreguiles (the upper cable car station) has now been paved by the skiing company. We apologize to all of those who enjoyed the rough trip, all others (including the telescope staff) are certainly happy about this improvement.

Winter transport to the telescope

As every year, we are preparing for the winter at Pico Veleta. So far (as of September 25) no snow has fallen, but temperatures are dropping as a clear sign that the autumn has arrived. Below you find the schedule for the normal winter transport, i.e. when the cable car is operating (typically from December, possibly earlier if a lot of snow falls). During the transition period (i.e. with snow, but without cable car), the transport has to be organized in a very flexible way. We would like to ask visiting astronomers to the 30m telescope to plan their trips during this period with enough margin to account for delayed transport to and from the telescope.

Table 1: Transport to the 30m Telescope: Winter 1997/98 schedule
(subject to modification on short notice due to operational reasons)

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

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

Problems with the telephone lines at Pico Veleta

In two weeks in September it has happened twice that the (ISDN) telephone line to the 30m telescope was out of order after a thunderstorm. Since the telephone company TELEFONICA offers service for ISDN lines only from Monday to Friday, 8 am to 3 pm, it is well possible that the telescope cannot be reached at night or during weekends in case the line goes down. If you need to reach the telescope urgently, we suggest to use e-mail or fax (the fax line is independent from the telephone line), or even try calling the fax number (+34-58-48 11 48, we may disconnect the fax and connect a telephone to this line).

Scheduling

The week to week telescope schedules are now posted on the IRAM Web Pages at `http://iram.fr/PV/veleta.html`. Note however that observers will continue to be directly informed in due time of the scheduling updates concerning their own observing periods.

Wolfgang WILD

Interferometer

Observations

Good news! We are well on the way to complete all the A-rated projects before end of October. Moreover, thanks to the exceptional late summer conditions, we will even be able to carry out almost every B-rated project and, to some extent, a few requests for director's time. Although observations are currently carried out with the array in 4-antenna configurations, even the backlog from the previous observing period is now very small and will, if weather allows, be worked off in the month to come. Information on scheduled configurations for ongoing projects and on the current observational backlog can be retrieved through http://iram.fr/doc/ongoing.html. This page is updated every day.

Data reduction

Visitors who come to Grenoble for data reduction may now find their data prepared directly on disk for further processing with CLIC. IRAM will make an effort to take care of the data retrieval, provided the visitor announces his/her stay at least two weeks in advance. Note, however, that such a support is currently provided on a best effort basis only.

Maintenance

To start solving the long standing problem of "pinholes" in the conductive layer of the carbon fibre panels equipping antennas 1 to 4, we have completely re-equipped antenna 3 with aluminum panels identical to those of Antenna 5. Holography and surface adjustment will be performed as soon as weather conditions allow.

Although not all carbon fibre panels on this antenna required replacement, all were replaced to provide an homogeneous antenna surface. The valid carbon-fibre panels will be used next summer to replace the most severely affected panels on antenna 1,2 and 4. We then intend to repair all damaged carbon fibre panels by removing the Hostaflon layer and applying conductive (silver-based) and protective paints. This set of panels will eventually be used for Antenna 6.

The maintenance of all antennas is now complete. Surface adjustments have been performed for the inner 4 rings of antenna 1. Adjustment of rings 5 and 6 and holographic verifications are planned for antennas 1 and 2.

LSA tests

Some test observations have been carried out during September and October in view of the LSA project. These tests included a 3-mm survey for new phase calibrators, and investigations of the short term pointing behaviour of the Plateau de Bure antennas. The results will appear in the IRAM LSA Web page.

Stéphane GUILLOTEAUand Roberto NERI

The LSA Study

We have set up a new World-Wide-Web page dedicated to the studies on the Large Southern Array project. Its address is http://iram.fr/LSA/lsa.html

Data from Key Project available

Edith Falgarone, Principal Investigator of the Key Project on *Small–Scale Structure of Pre-Star Forming Regions*, has informed us that the data cubes are available (in FITS format) via anonymous ftp at `ftp.lra.ens.fr` in directory `/pub/users/panis/kp_release`. The file '`release.ps`' contains the description of the cubes.

Programme Committee News

The IRAM PC met on October 13th to discuss the observing proposals submitted for the winter period (November 15, 1997 to May 15, 1998). The recommendations are summarized below:

30m-Telescope

Project Status A: Accepted, B: Backup if available time, C: Rejected.

Project	Rate	Project	Rate	Project	Rate	Project	Rate	Project	Rate
101.97	C	102.97	C	103.97	C	104.97	C	105.97	A
106.97	A	107.97	C	109.97	A	110.97	C	111.97	C
112.97	C	113.97	C	114.97	C	115.97	A	116.97	C
117.97	B	118.97	B	119.97	B	120.97	C	121.97	C
122.97	A	123.97	B	124.97	C	125.97	A	126.97	C
127.97	C	128.97	A	129.97	A	130.97	B	132.97	A
133.97	A	134.97	A	135.97	C	136.97	A	137.97	A
138.97	C	139.97	B	140.97	C	141.97	B	142.97	A
143.97	B	144.97	B	145.97	B	146.97	A	147.97	A
148.97	B	149.97	A	150.97	A	151.97	C	152.97	C
153.97	C	154.97	A	155.97	B	156.97	C	157.97	A
158.97	B	159.97	A	160.97	B	161.97	A	162.97	A
163.97	C	164.97	C	165.97	C	166.97	C	167.97	A
168.97	A	169.97	B	170.97	B	171.97	B	172.97	A
174.97	C	175.97	A	176.97	C	177.97	C	178.97	A
179.97	B	180.97	B	181.97	A	182.97	A	183.97	A
184.97	A	185.97	A	186.97	A	187.97	A	188.97	A
189.97	C	190.97	A	191.97	C	192.97	A	193.97	A
194.97	C	195.97	A	196.97	B	197.97	B	198.97	B
199.97	A	200.97	C	201.97	C	202.97	C	203.97	A
204.97	B	205.97	C	206.97	C	207.97	C	208.97	A
209.97	A	210.97	C	211.97	C	212.97	B	213.97	A
214.97	B								

Notes:

- Proposals 108.97 and 131.97 were considered as purely technical.
- We expect all A programmes to be scheduled on the 30m telescope although some with less time than originally requested. Only part of the B programmes will be scheduled. This will take into account scientific merit, crowding in certain right ascension ranges and general aspects of balance.

Michel GUÉLIN

Interferometer

Project Status A: Accepted, B: Backup if available time, C: Rejected.

Project	Rate	Project	Rate	Project	Rate	Project	Rate	Project	Rate
H063	B	H064	A	H065	B	H066	A	H067	C
H068	C	H069	C	H070	C	H071	B	H072	A
H073	C	H074	A	H075	C	H076	A	H077	A
H078	B	H079	A	H080	A	H081	A	H082	C
H083	B	H084	A	H085	B	H086	B	H087	C
H088	A	H089	A	H090	C	H091	A/B	H092	C
H093	A	H094	A	H095	C	H096	C	H097	C
H098	B	H099	A	H100	A	H101	A	H102	C
H103	C	H104	C	H105	B	H106	A	H107	B
H108	B	H109	C	H110	A	H111	A	H112	A/B
H113	A	H114	C	H115	A	H116	C	H117	B
H118	A/B	H119	A	H120	A/B	H121	B	H122	C
H123	A	H124	B	H125	C	H126	A/B	H127	A/B
H128	B	H129	B	H130	B	H131	C	H132	A
H133	C	H134	A	H135	A	H136	A	H137	B
H138	A/B	H139	B	H140	B	H141	C	H142	A
H143	–	H144	–	H145	B	H146	B	H147	C
H148	C	H149	B	H150	C	H151	C	H152	C

Notes:

- The A programmes will be scheduled in priority. The A/B programmes will also be scheduled if feasible. Further time, if it becomes available, will go to the B programmes, taking into account scientific merit, crowding in certain right ascension ranges and general aspects of balance.
- B projects which cannot be started will not be automatically resubmitted: authors have to resubmit them explicitely.

Stéphane GUILLOTEAUand Roberto NERI

Scientific results

A thin molecular shell around the carbon star TT Cyg

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(2) Onsala Space Observatory, S-439 92 Onsala, Sweden
(3) Institut de RadioAstronomie Millimétrique, 300 rue de la Piscine, F-38406 Saint Martin d'Hères, France
(4) Uppsala Astronomical Observatory, Box 515, S-751 20 Uppsala, Sweden
(5) Steward Observatory, Univ. of Arizona, Tucson, AZ 85721, USA

Abstract: Interferometric CO($J = 1-0$ and $2-1$) observations reveal a remarkably thin shell of molecular gas around the carbon star TT Cyg, width/radius $\lesssim 1.3''/34'' \approx 0.04$ (Fig. 1). It expands at $\approx$13km s^{-1}, and contains ~ 0.02M$_\odot$ of gas provided the CO abundance with respect to H_2 is 10^{-3} and the distance is 1 kpc. The overall geometry is spherically symmetric, but clear deviations, at the per cent level, exist. The radial structure of the shell is barely resolved at the arc second level, but there exists weak emission extending a few arc seconds inwards from the peak. A drastic change in mass loss properties, possibly combined with the effects of interacting winds, provides the most likely explanation to the origin of the shell.

Pulsar detection at 87 GHz

D. Morris(1), M. Kramer(2), C. Thum(1), R. Wielebinski(2), M.Grewing(1), J.Peñalver(3), A.Jessner(2), G. Butin(3), W. Brunswig(3)
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(2) Max Planck Institut für Radioastronomie, Auf dem Hügel 69, D-53121,Bonn, Germany
(3) Instituto de Radioastronomía Millimétrica,Avenida Divina Pastora 7, E-18012,Granada,Spain

Abstract: Pulsed radio emission at 87 GHz has been detected from the pulsar PSR B0355+54 (Fig. 2. The observed flux density of 0.5 ± 0.2 mJy is, within the measurement errors, the same as measured previously at 43 GHz and is thus higher than expected. However the errors are such that all the measurements at frequencies higher than 1.2 GHz are just consistent with a single power law spectrum (Fig. 3.

A second pulsar, PSR B2021+51, with a reported excess of flux density at 43 GHz, has been observed but not detected. The resulting upper limit for the flux density provides little constraint on the form of its spectrum above 43 GHz.

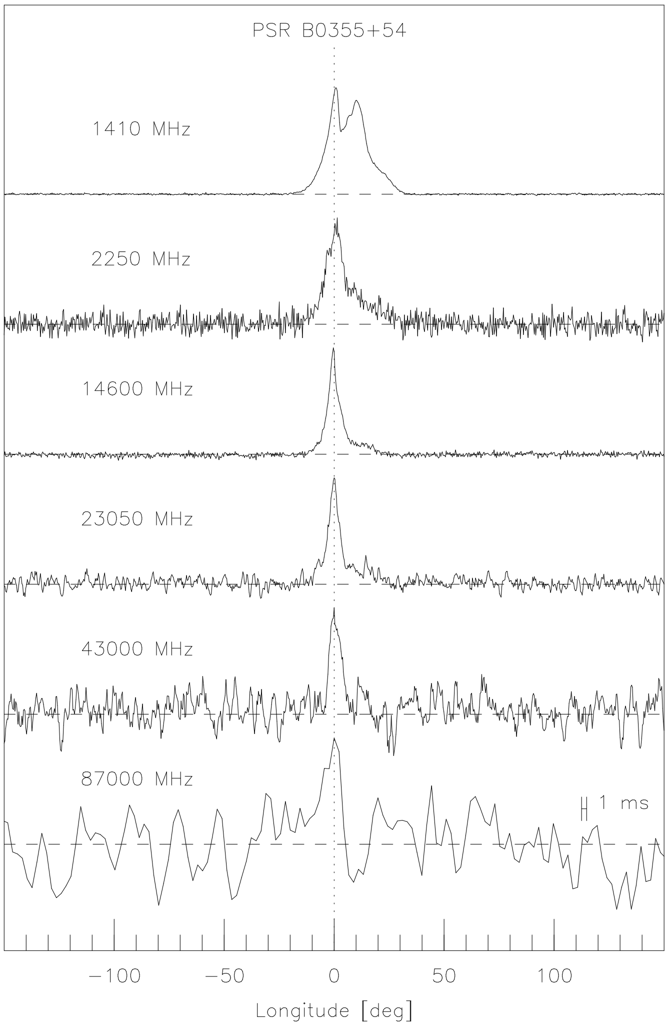

Figure 2: Observed pulse profiles of PSR B0355+54 at several radio frequencies between 1.4 GHz and 87 GHz. Flux density on an arbitrary scale, and different for each frequency,has been plotted vertically. The time resolution is 153μs for frequencies between 1.4 and 14.6 GHz, 458μs for 23.05 GHz and 763μs for the 43 GHz observations.The 87 GHz profile represents the Pico Veleta measurement smoothed to a time resolution of 4 ms.

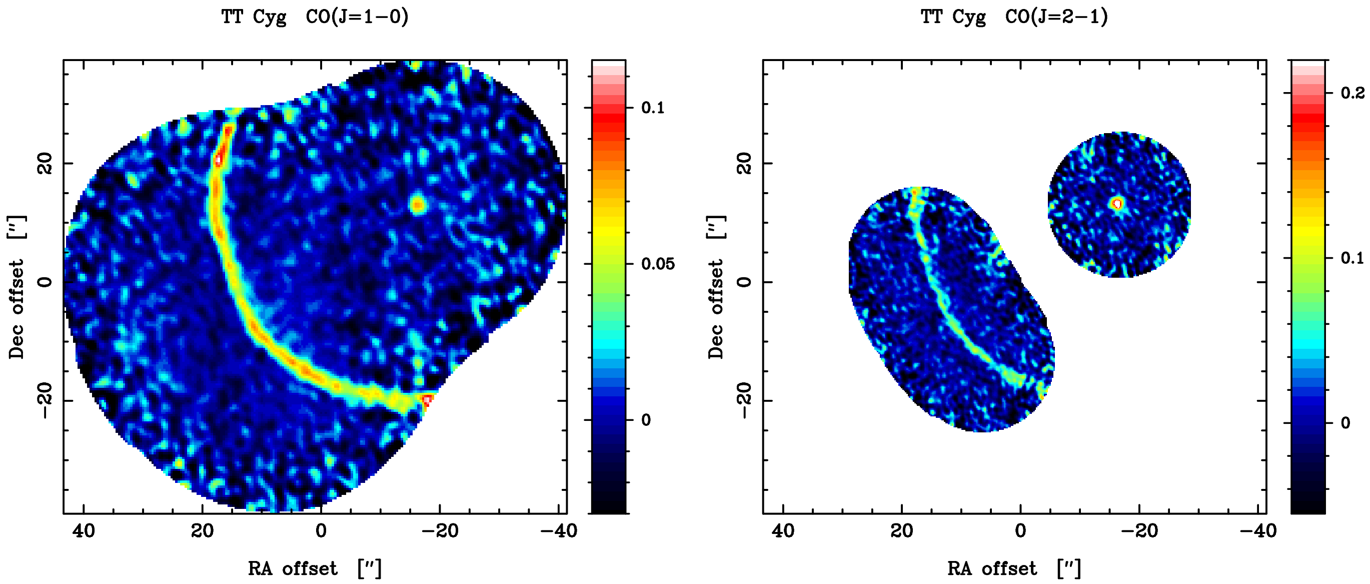

Figure 1: CO ($J = 1 - 0$ and $2 - 1$) maps of TT Cyg averaged over the interval $-27.5 \pm 2\mathrm{km\,s}^{-1}$. The star and about a quarter of the shell have been covered. The intensity unit is Jy beam^{-1}.

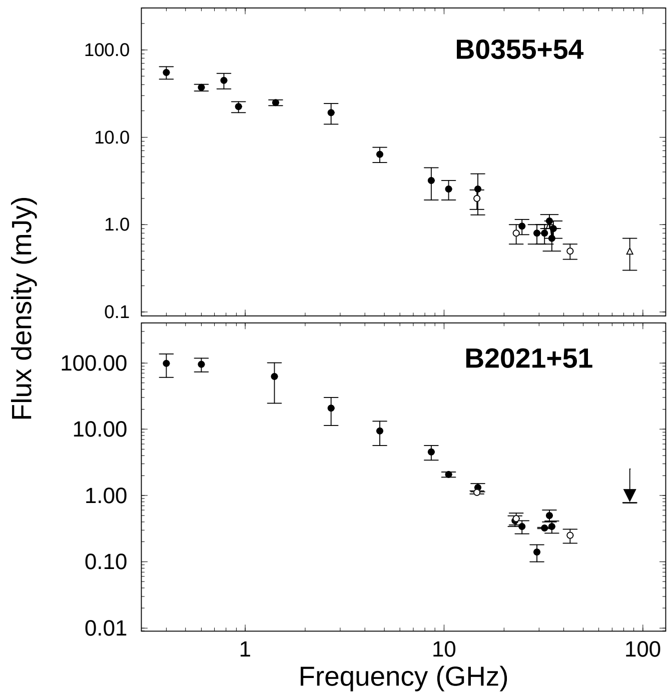

Figure 3: Pulse spectra for PSRs B0355+54. The measurements made at 87 GHz are presented as an open triangle and as an upper limit (at a 5σ level), respectively. For references of flux densities at lower frequencies see text.

A Search for Infall Motions Toward Nearby Young Stellar Objects

D. Mardones(1), P.C. Myers (1), M. Tafalla(1), D.J. Wilner(1), R. Bachiller(2), G. Garay(3)
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Abstract: We report observations of 47 candidate protostars in two optically thick lines (H_2CO $2_{12} - 1_{11}$ and CS $2-1$) and one optically thin line (N_2H^+ $1-0$) using the IRAM 30-m, SEST 15-m, and Haystack 37-m radio telescopes. The sources were selected from the redness of their spectra ($T_{\rm B} < 200$ K) and their near distance ($d < 400$ pc). Most of the sources have asymmetric optically thick lines. The observed distribution of velocity differences, $\delta V = (V_{thick} - V_{thin})/\Delta V_{thin}$, is skewed toward negative (blue-shifted) velocities for both the H_2CO and CS samples. This excess is much more significant for Class 0 than for Class I sources, suggesting that we detect infall motions toward Class 0 and not toward Class I sources. This indicates a difference in the physical conditions in the circumstellar envelopes around Class I and Class 0 sources, but does not rule out the presence of infall onto Class I sources by e.g. lower opacity gas. Bipolar outflows alone, or rotation alone, cannot reproduce these statistics if the sample of sources has randomly oriented symmetry axes. We identify 15 spectroscopic infall candidates, of which 6 are new. Most of these infall candidates have primarily turbulent rather than thermal motions, and are associated with clusters rather than being isolated.
Accepted by The Astrophysical Journal.

IRAS 06562−0337, the Iron-clad Nebula: a young star embedded in a molecular cloud

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Abstract: We present millimeter and sub-millimeter observations of IRAS 06562−0337, the so-called Iron-clad Nebula. It had been suggested previously that this object could be an evolved star in the transitional phase between the AGB and a planetary nebula. However, our observations show that this IRAS source lies at the center of a dense massive molecular cloud which exhibits strong lines of CO, ^{13}CO, CS, and CI. The close association of the source with this molecular cloud, the proximity to other molecular complexes, the infrared spectral energy distribution, and the main characteristics of the previously observed optical spectra, imply that IRAS 06562−0337 is a young stellar object (or a small cluster) still associated to its parent molecular cloud. IRAS 06562 is placed at 7 ± 3 kpc from the Sun, in the anti-center direction. Its location in the Galaxy, at about 15 kpc from the galactic center, makes the object particularly interesting for studies of galactic structure.
Accepted by Astronomy and Astrophysics.
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Shock chemistry in the young bipolar outflow L 1157

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([1]) Observatorio Astronómico Nacional, Apartado 1143, E-28800 Alcalá de Henares, Spain

Abstract: We present the first results from a recent survey of molecular lines in L 1157, a highly-collimated bipolar molecular outflow driven by a Class 0 protostar. These observations are used to study the chemical alterations produced by a violent highly-collimated outflow. Different molecular lines are observed to trace different components of the gas. Some molecules (C_3H_2, N_2H^+, $H^{13}CO^+$, DCO^+) are abundant in the quiescent medium but are not observed at high velocities. Lines from these molecules are the best tracers of the concentration of dense gas around the protostar. In addition, we find that some otherwise rare molecules (e.g. SiO, CH_3OH, H_2CO, HCN, CN, SO, SO_2) are enhanced by at least an order of magnitude at the shocked region. Our observations provide estimates of the enhancement factors for such species. Strong gradients in the chemical composition are observed along the outflow blue lobe which could be due to the evolution in time of the chemical processes. We briefly discuss the chemistry of the most important molecules, devoting special attention to the species which are thought to be abundant in interstellar ice mantles.
Accepted by Astrophysical Journal Letters.
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Clump mass spectra of molecular clouds

Carsten Kramer, Jürgen Stutzki, Ralf Röhrig, and Uwe Corneliussen
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Abstract: We present clump mass spectra of the seven molecular clouds L1457, MCLD 126.6 + 24.5, NGC 1499 SW, Orion B South, S140, M17 SW, and NGC 7538, which were derived by a Gaussian clump decomposition algorithm from large scale isotopomeric CO maps.

We discuss in detail the reliability of the mass spectra derived by studying their dependence on the control parameters of the decomposition algorithm.

All clump mass spectra found are consistent with a power law, $dN/dM \propto M^{-\alpha}$, with α between 1.6 and 1.8. Due to the different resolution of the observations and the different distances of the clouds, the clump masses range from several 10^4 $M_\odot$ in NGC 7538 down to 10^{-4} $M_\odot$, less than the mass of Jupiter, in the nearby cloud L1457. The large dynamic range covered by the observations is reflected by the high number of clumps found in each cloud, which lie between 100 and 1300. The spectral index of the clump mass distributions thus is independent of the wide range of physical properties of the clouds studied. In particular, there are no indications of a turnover of the clump mass power law index at a characteristic clump mass such as the Jeans mass, below which the clumps become gravitationally unbound. This is particularly emphasized by the clump properties in L1457 most of which are clearly sub stellar and which are far from being gravitationally bound objects (Fig 4).

Accepted by Astronomy & Astrophysics
Preprint available at:
http://www.ph1.uni-koeln.de/~kramer/publications.html

A CO atlas of circumstellar envelopes of AGB and post-AGB stars

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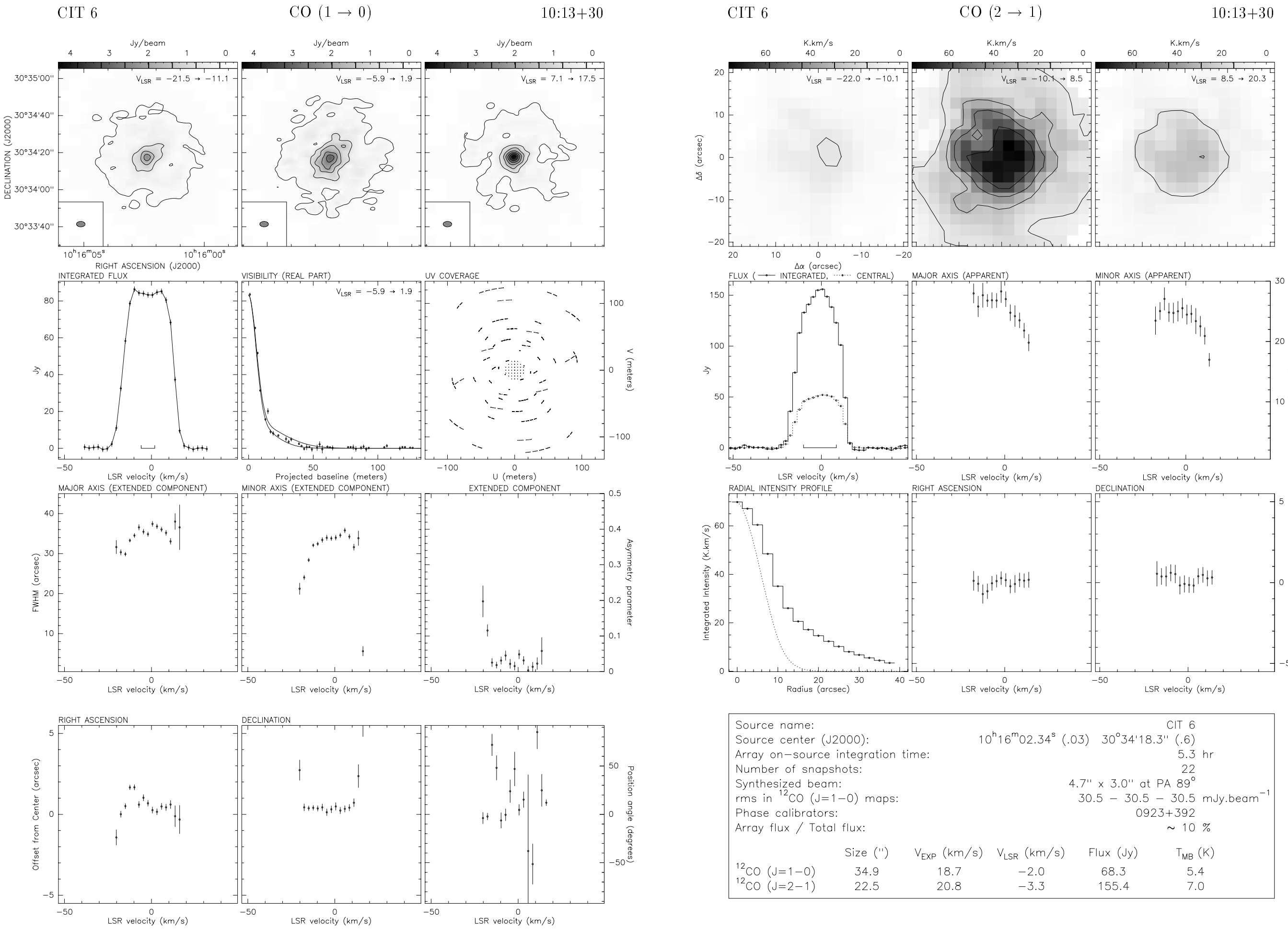

Figure 5: CIT 6 is a carbon-rich star, the most intense and one of the most extended sources in the atlas. The interferometric maps (lower panel) show the CO emission to be distributed in two components, in a compact one and in a weak and extended halo, both centred on the same position.

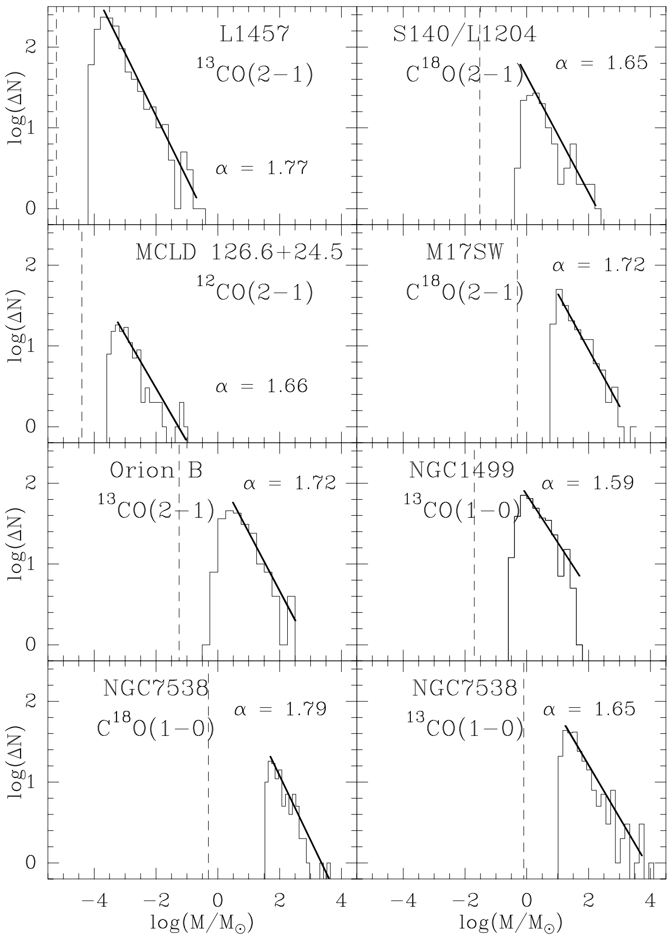

Figure 4: Clump mass spectra of the eight data sets analyzed. All spectra are fitted by a power law function $dN/dM \propto M^{-\alpha}$. The straight lines represent the best linear fit over the range of masses spanned by the line. The resulting indices α lie in the range 1.59 to 1.79. .

Cedex 9, France
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Abstract: We present the results of a CO ($J = 1-0$) and ($J = 2-1$) survey on a sample of 46 objects classified as AGB and post-AGB stars. We have obtained fully sampled high resolution maps of their CO ($J = 1-0$) emission by combining visibilities from the IRAM interferometer with short spacing observations from the IRAM 30m telescope. Properties of their circumstellar envelopes like fluxes, radii, and positions are derived from model fits to the visibilities and compared to the results obtained from CO ($J = 2-1$) maps observed at the IRAM 30m telescope (Fig. 5). From the CO ($J = 1-0$) observations we have derived mass loss rates for 38 stars and established an empirical relation between the CO photo dissociation radius of an envelope and the measured radius in the $J = 1-0$ emission. *Accepted by Astron.Astrophys. Preprints can be obtained from* neri@iram.fr

Small-scale dust continuum structure in the ρ Ophiuchi cloud cores

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Abstract: We summarize the results of an extensive 1.3mm continuum mapping study of the ρ Ophiuchi main cloud obtained with the IRAM 30m telescope equipped with the MPIfR 19-channel bolometer array. The mosaiced field covers about 1 pc^2 with enough sensitivity to probe, for the first time, cloud cores, star-less clumps, and circumstellar envelopes/disks simultaneously. A comparison with the ISOCAM 6.75 μm and 15 μm images of ρ Oph obtained as part of the ISO central programme survey by Nordh, Olofsson et al. is presented. There is a good correspondence between the cores/clumps detected in emission at 1.3mm and the dark absorption structures seen in the ISOCAM images.
To appear in "Star Formation with ISO", Proc.Lisbon Meeting, June 1997

The second detection of CO at redshift larger than 4

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Abstract: We report the detection with the IRAM interferometer at 3 mm of J=5-4 CO line in the radio quiet quasar BRI 1335-0415 at redshift of $z = 4.41$ (Fig. 7). After BR 1202-0725 at $z = 4.69$ (Ohta et al. 1996, Omont et al. 1996a), this is the second detection of CO at $z > 3$. The integrated line intensity is 2.8 ± 0.3 Jy km s^{-1} with a linewidth of 420±60 km s^{-1}. The dust continuum emission has also been mapped at 1.35 mm (Fig. 6). The 1.35 mm flux is found to be 5.6±1.1 mJy. The ratio of the CO to 1.35 mm continuum flux is slightly larger than for BR 1202-0725. Contrary to the case of BR 1202-0725, there is only marginal evidence of extension of the 1.35 mm continuum and 3mm CO emission. In the absence of gravitational lensing, for which there is no a priori evidence, and within the uncertainties of the CO to M(H_2) conversion factors, the mass of molecular gas M(H_2) could be $10^{11} M_\odot$.

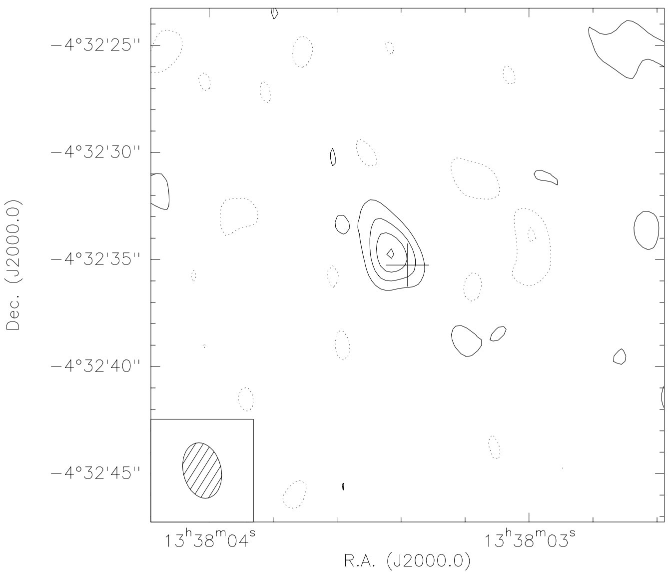

Figure 6: 1.35 mm continuum map of BRI 1335-0415. Contour step is 1 mJy/beam, and the rms noise 0.7 mJy/beam. The cross indicates the optical position.

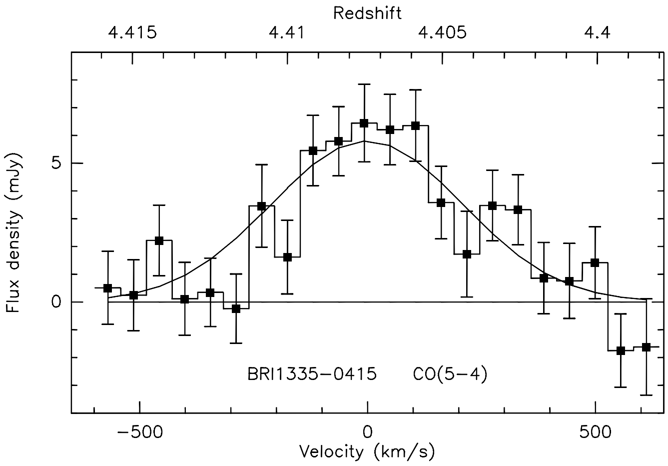

Figure 7: Spectrum of the CO J=5-4 line towards BRI 1335-0415, superimposed with the best Gaussian profile. Errorbars are $\pm 1\sigma$. The velocity scale corresponds to a frequency of 106.570 GHz corresponding to a redshift $z = 4.4074 \pm 0.0015$.

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