IRAM Newsletter

Number 31 April 11, 1997

Calendar

15-17 April 1997: "The Far InfraRed and Submillimetre Universe", An ESA/IRAM Symposium devoted to the Far InfraRed and Submillimetre Telescope (FIRST) cornerstone mission. IRAM will be responsible for the local organisation.

18-19 April 1997: Programme Committee Meeting

29-30 April 1997: Scientific Advisory Committee Meeting

16-17 June 1997: Executive Council Meeting

September 8th, 1997: Deadline for the submission of observing proposals for the period Nov. 15, 1997 to May 15, 1998.

Please Note

In order to reduce costs we are now sending paper copies of this Newsletter to astronomical libraries only. Individuals are invited to retrieve the IRAM Newsletter by anonymous ftp (`ftp://iram.fr/dist/newsletter`) or from our Web site (`http://iram.fr/newsletter`); please check last page for details.

Contents

Position open

A postdoctoral position in Astronomy is open at IRAM/Granada. *See Announcement on Page 2*

30m Telescope

New telephone and fax numbers for Pico Veleta

The Spanish telephone company *Telefónica* changed the telephone and fax numbers for the 30m telescope in the first week of March without prior notice. The numbers for the IRAM Granada office remain unchanged. The old numbers for the telescope worked on certain days in parallel with the new numbers, but from now on, only the new numbers can be used. In addition, there will be another change of the telephone number on April 15th.

These are the new fax and telephone numbers for Pico Veleta:
(the numbers for the Granada office remain unchanged)

New fax number:
Fax +34-58-481148

Telephone number until 30 April 1997:
Tel. +34-58-481211 and +34-58-481250

Telephone number from 15 April 1997:
Tel. +34-58-482002

From April 15 to 30, we should have three telephone numbers in parallel for the 30m telescope. If you cannot reach Pico Veleta by telephone or fax, please call the Granada office to inquire (*Telefónica* may have changed the numbers again ...).

One week of 350 GHz observations at the 30m telescope

The IRAM 350 GHz SIS receiver has been installed and used during the week from 4 to 11 of March, with exelent results. The receiver performance was very good, with

IRAM — Institut de Radioastronomie Millimétrique

Applications are invited for a

Postdoctoral Position in Astronomy

at IRAM Granada/Spain, starting as soon as possible, and not later than June/July 1997.

IRAM Granada operates the 30m millimeter telescope, located 50 km from Granada in the Sierra Nevada at an altitude of 3000 m, and offices (laboratories/library/administration) in the town of Granada. The total size of the group is approximately 30 persons.

The tasks of the post-doc astronomer include:

- to participate in projects to improve the telescope system in such areas as software, receivers, backends and optics, as well as to participate in the ongoing development and improvement of observing techniques (such as spectral line on-the-fly observing and frequency switching)
- to carry out part of the regular test observations (pointing, calibration, etc.) and participate in their analysis
- regular participation in the astronomer-on-duty service at the 30 m telescope to support guest observers.

These activities will occupy at least 50% of the post-doc's time. In addition he/she has the possibility to pursue his/her own scientific projects, also in collaboration with IRAM astronomers and/or outside groups.

The applicant should have a Ph.D. in astronomy or physics and preferably some experience in observational astronomy. Knowledge in some areas related to the hardware or software of a millimeter telescope is an advantage. The ability to work at high altitude (3000 m) is essential. Good knowledge of English is required.

The initial appointment will be for a period of two years with the possibility of renewal for a third year. Applications should be submitted before April 30th, 1997, to:

Prof. Dr. M. Grewing
Director
IRAM
300 rue de la Piscine
Domaine Universitaire
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e-mail: grewing@iram.fr

Further information can be obtained from Dr. W. Wild, Station Manager, e-mail: wild@iram.es receiver noise temperatures of 70 K to 100 K on the sky (including optics) and a sideband rejection of about 6 dB. The weather was excellent during a large fraction of the time. System noise temperatures of 400 K to 600 K at 350 GHz were not unusual, even during daytime ! These low temperatures correspond to about 0.5 mm of precipitable water vapour, clearly demonstrating the potential of the 30m telescope site for observations at 0.8 mm wavelength.

Interruption of the Internet link for one week

IRAM Granada is connected to the Internet via a digital (ISDN) telephone line to the University of Granada. This telephone line, operated by the Spanish telephone company *Telefónica*, was interrupted for approximately one week (March 6 to 12) due to a major failure in one of *Telefónica's* telephone exchanges. Unfortunately, *Telefónica* was not able to fix the failure quicker. In the future we will have a private link to the University of Granada and will then use the telephone link just as a backup. With this, we hope to be more independent and to be able to provide a more reliable Internet connection.

This incident – which caused some inconvenience for the visiting astronomers – emphasizes what has been mentioned here earlier:

> Do not rely on the Internet for your observations! Make sure to bring all necessary files (source lists, frequencies, previous data etc.) with you, or transfer them to Granada well before your observing run.

New Chart Recorder Software

A new software for the bolometer chart recorder is available now. It does not require special hardware as the previous version, and is more reliable and flexible. The new version displays its output (> 2 channels) on a window under X-Windows and, if required, two channels on the chart recorder. A hardcopy of the display window is possible as well. The current version works for bolometer observations, and we plan to offer it also for observations with heterodyne receivers.

Wolfgang WILD

Interferometer

Observations

Thanks to the very good weather conditions in the last 2 months, we have been able to recover most of the delay accumulated during the fall. Almost all "A" proposals are now complete, with few exceptions. Most "B" proposals are nevertheless unlikely to be started, because of unfavourable combinations of frequency and LST range: 1.3 mm observations are difficult in daytime at this epoch of the year.

A "blind" adjustment of the panels from the inner ring of antenna 5 had been done late November. This adjustment could only be checked when the interferometer was back to the compact D configuration late March. The holography of antenna 5 performed late March yields a surface accuracy of 50 μm. 3 out of 5 antennas now have a gain of 27 Jy/K at 245 GHz.

Data Reduction

Visitors coming for data reduction in Grenoble will find a number of hardware and software changes.

Concerning the hardware, 16 GBytes of disk space have been recently added to the workstation dedicated to Plateau de Bure data reduction. A second, more powerful, HP-J280 workstation with 24 GBytes of storage will be added soon. Real-time archiving is now done on CD-ROMs rather than DATs, significantly reducing the time required to load the original data set.

To fully benefit from the CD-ROM archiving, the CLIC program has been modified to handle the data and the calibration parameters in two separate files. The data file is never modified, and can reside in a read-only file system like a CD-ROM. Operation is transparent for the user. The original DAT archive is progressively converted to CD-ROMs.

A new calibration procedure has been written. The new procedure utilizes the SIC Window interface, and greatly simplifies and speeds up data reduction. "Automatic" calibration is even possible on good quality data. The procedure handles dual-frequency projects by phase-referencing the 1.3 mm data to the 3 mm ones.

Based on this procedure, and capitalizing on the experience gained with the interferometer, we are studying a method to pre-calibrate the data at the Plateau de Bure.

The "Calibration CookBook" is under revision to include a more comprehensive description of the new calibration facilities.

Stéphane GUILLOTEAU

Software

A number of small installation problems and/or bugs which appeared in the DEC96 release have been fixed in the APR97 release. The APR97 release also incorporates two internal changes: the merging of two libraries (libgag.a and library.a), and the "disparition" of the "old" CLASS program. The new CLASS program incorporates full support for the On-The-Fly mapping.

The APR97 release is complete for HPUX, AIX and Dec-OSF1 systems. The SIC Window facilities are still not available for SunOS, Solaris, Ultrix and Linux.

Finally, since PCs are now extremely widespread and powerful enough to handle the type of data processing required by the IRAM instruments, we have undertaken a porting of the GILDAS software to the Windows-95 operating system.

Stéphane GUILLOTEAU

Recent observations

Molecular observations of comet Hale-Bopp (C/1995 O1) with the IRAM Plateau de Bure interferometer.

Report by: D. Bockelée-Morvan, N. Biver, P. Colom, J. Crovisier, E. Gérard, H. Rauer (Observatoire de Paris-Meudon), D. Despois (Observatoire de Bordeaux) , J. Wink (IRAM, Grenoble), R. Moreno, G. Paubert (IRAM, Grenade), J.K Davies, W.R.F. Dent (JAC, Hilo)

The gaseous coma of Hale-Bopp was observed at the IRAM Plateau de Bure Interferometer in October and November 1996 and from March 10 to March 20 1997. The spatial resolution was 1.5″ at 1mm and 3.5″ at 3 mm, corresponding to about 1500 and 3500 km on the comet in March 1997. Emission lines of HCN, HNC, CO, H_2CO, CH_3OH, CS and H_2S were successfully detected in cross-correlation mode. High quality maps were obtained for these species. SO was not detected in interferometry. In addition SO_2 (Wink et al. Circ. 6591, 1997) and HCOOH (Wink et al. Circ. 6599, 1997) were successfully detected in auto-correlation mode, providing the first identification of these species in cometary atmospheres.

These interferometric observations have several goals. First, the spatial distribution of CO (fig. 1, H_2CO and HNC should put strong constraints on their origin. *In situ* observations aboard the Giotto spacecraft have shown that a large fraction of CO and H_2CO is released in the coma rather than from the sublimation of the nucleus. This distributed source could be organic grains or complex species, as polymers. The observations at Plateau de Bure should be able to distinguish the fraction of CO and H_2CO coming from the nucleus and constrain the size of the distributed sources. The abundance of the very unstable species HNC in cometary nuclei is another important issue, since it should be an important diagnostic on the conditions of formation of cometary material. The non-detection of SO in interferometric mode brought the proof that SO is mainly a daughter species, i.e. a photodissociation product (Wink et al. IAU Circ. 6591, 1997). Detailed modelling is needed to establish whether SO_2 (Wink et al. IAU Circ. 6591, 1997) is its main parent. The observations will also provide a 3-D reconstruction of the morphology of the gaseous coma, the high spectral resolution giving the informations along the line of sight. Several lines of CH_3OH, CO and CS were observed to study the evolution of the excitation temperature in the coma.

The abundance of SO_2 and HCOOH in the nucleus of comet Hale-Bopp will allow to better understand the links between cometary and interstellar material and the origin of comets.

See also the Comet page on IRAM's Web page at http://iram.fr/hale-bopp/comet.html .

Editor's Note: The continuum emission from the nucleus has also been detected with the Plateau de Bure Interferometer by Altenhof, Wink et al. (IAU telegram 6587), allowing an estimate of the size of the nucleus (diameter $\sim$ 45 km).

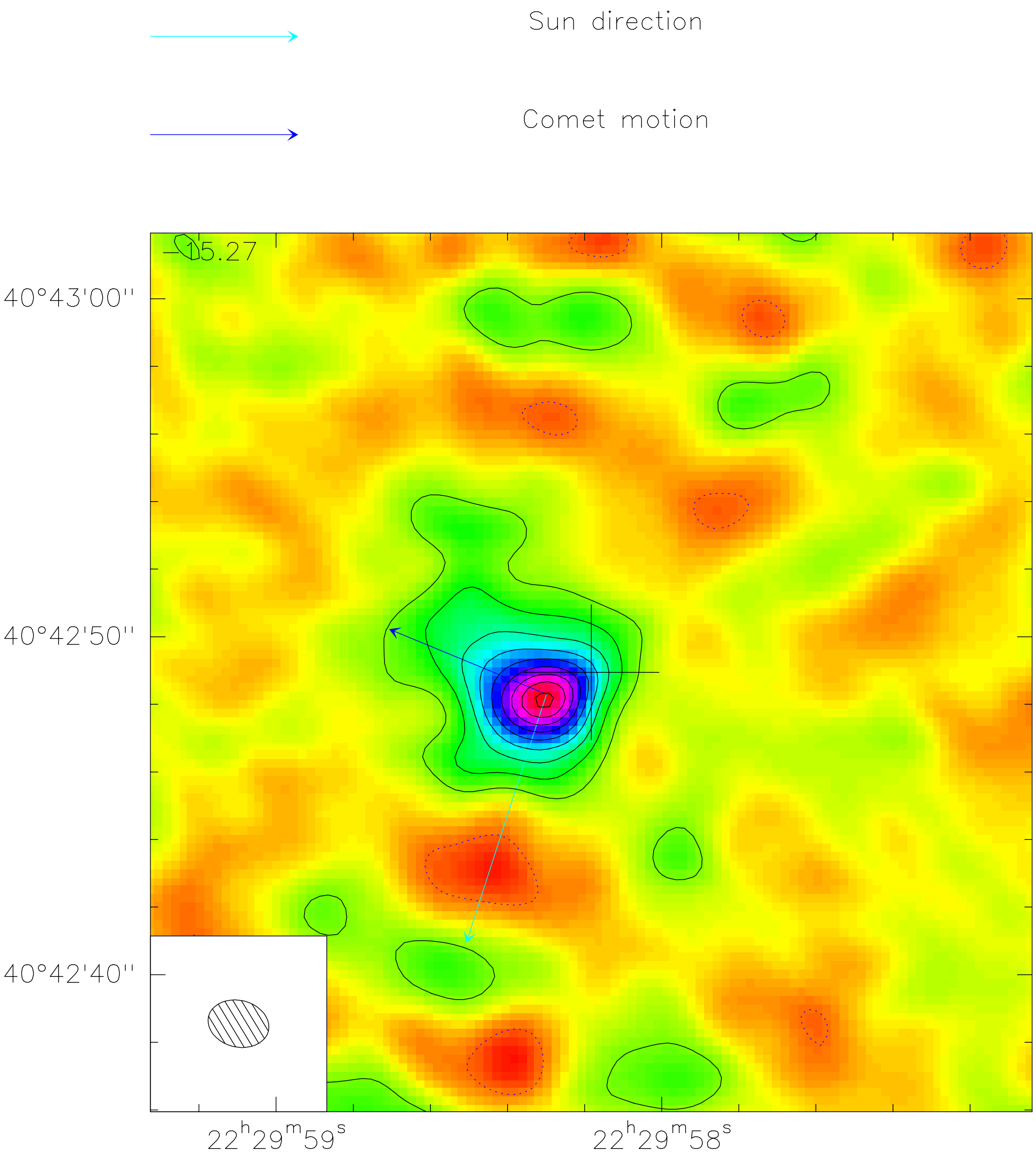

Figure 1: Map of the J(2-1) transition of CO at 230 GHz obtained on March 11, 1997. The spatial resolution is 1.5″.

Scientific results

MOLECULAR GAS IN THE BARRED SPIRAL M 100. I. THE IRAM 30M MAP

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Abstract: We present a study on the distribution, kinematics and evolution of the molecular gas disk in the barred SBbc spiral M100(NGC4321). The J=2–1 and J=1–0 lines of ^{12}CO have been mapped with the IRAM 30m telescope, with resolutions HPBW=12″ and HPBW=21″, within the inner 8 kpc of the disk (1″ = 82pc, assuming $D_{\rm M100}$ = 17.1Mpc). Complementary ^{13}CO(1–0) observations of the nucleus, spiral and interarm regions are used to study the nature of H_2 gas.

CO emission traces a markedly asymmetric two spiral-arm structure stretching out from a molecular gas bar. The CO bar has a diameter D$\sim$90″ and it is aligned with the stellar bar seen in I and K band images (PA=110°). Arm I (II) springs off the western (eastern) side of the bar at $r \sim 50''$. Arm II is split up in two armlets (at $r \sim 40-50''$), it disappears and finally shows up at a position angle close to the major axis northern crossing (PA=330°). The splitting starts near the inner 3::1 resonance identified by Elmegreen et al (1992) in the enhanced optical images of M100. Molecular gas in the bar is strongly concentrated in a nuclear disk of $r_{nucl} \sim 30''$ and $M({\rm H_2})_{\rm nucl} = 2.8\ 10^9 M_\odot$.

Arms I-II display different arm-interarm contrasts (on average, $R_{a/ia}$(CO) increases with radius from 2.5 (r$\sim$30″) up to 6.5 (r$\sim$110″), being higher for arm I than for arm II. Also arms I-II relate differently to other spiral arm tracers, underlying the asymmetry in the disk. Comparison between CO, H I and H_α maps show that there is no *coherent* sequence in the relative location of the star formation tracers along the spiral arms. Evidences of triggering of star formation along spiral arms are poor: $R_{a/ia}(H_\alpha)$ is only $\sim$ 2 $R_{a/ia}$(CO) and systematic offsets between H_α and CO ridges (expected to lie downstream and upstream the spiral potential minimum, respectively, assuming trailing arms inside corotation) are hard to find and at places they are absent or even inverted.

CO reveals as the best tracer of gas kinematics in the inner disk. The CO rotation curve (V_{rot}) is steeper than the curves derived from the HI and H_α data. $V_{\rm rot}$ reaches 200km s^{-1} in less than 1 kpc. The signature of the $m = 3$ instability has been also identified in the CO derived velocity field. The magnitude and the sign of streaming motions, associated with the spiral arms and the bar, are consistent with the CO disk to be inside corotation ($r_{\rm cor} = 110''$). A secondary wave compression develops in the eastern side where arm II is split.

Massive star formation (MSF) is inhibited along the gaseous bar, indicating that M100 is an *evolved* barred system (Friedli and Benz, 1995). Star formation rate (measured as the ratio SFR=$F(H_\alpha)/I_{\rm CO}$) is lower for the nuclear disk than for the disk itself. However we suspect the measurement of SFR to be subjected to major uncertainties: the $X = N({\rm H_2})/I_{\rm CO}$ conversion factor might be 3 times lower than implicitly assumed and to vary within the disk (lower for the interarm than for the arms and nuclear region) . Moreover extinction affects $F(H_\alpha)$ mostly in the nucleus where the classical Schmidt law breaks down paradoxically (SFR$_{\rm ND} \sim N^\alpha_{\rm gas}$, $\alpha \sim 1$). MSF is set on at a distance $r_{\rm c} \sim 12$ kpc where $N({\rm H_2})$ approaches the Toomre (1964) gravitational instability threshold ($N_{\rm c} \sim 7 M_\odot$). Also for $r < r_{\rm c}$, the neutral gas is mostly in the H_2 phase. HI is underabundant in the inner 6kpc and cannot be accounted for by photodissociation of H_2 by HII regions.

Asymmetry in the observed molecular gas distribution and kinematics of M100 seems related with the three–arm structure studied by Elmegreen and collaborators. Although the $m = 2$ spiral mode is still predominant in M100, other secondary modes seem at interplay reflecting the secular evolution of the disk. Compared to M51, M100 appears as an *evolved* barred spiral.

THE EXTENDED 1.3 MM CONTINUUM EMISSION AROUND CW LEO

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Abstract: We have obtained a 150 × 150″ map of the 1.3 mm emission around the carbon star CW Leo. Emission is detected at the 3σ level out to a distance of 50″ from the central star. From model calculations we find that the dust density distribution is described by an approximate r^{-2} law superposed on which are possible density enhancements at about 5 and 20″ distance from the star. This could imply phases of enhanced mass loss lasting up to several hundred years duration over the last few 1000 years. The major uncertainty in a quantitative analysis is in the contribution of molecular lines. The density enhancement at 5″ is consistent with a recent phase of increased mass loss as inferred from CO data.
Accepted by A&A Letters
For preprints, contact groen@mpa-garching.mpg.de, or http://www.mpa-garching.mpg.de/~groen/groen.html

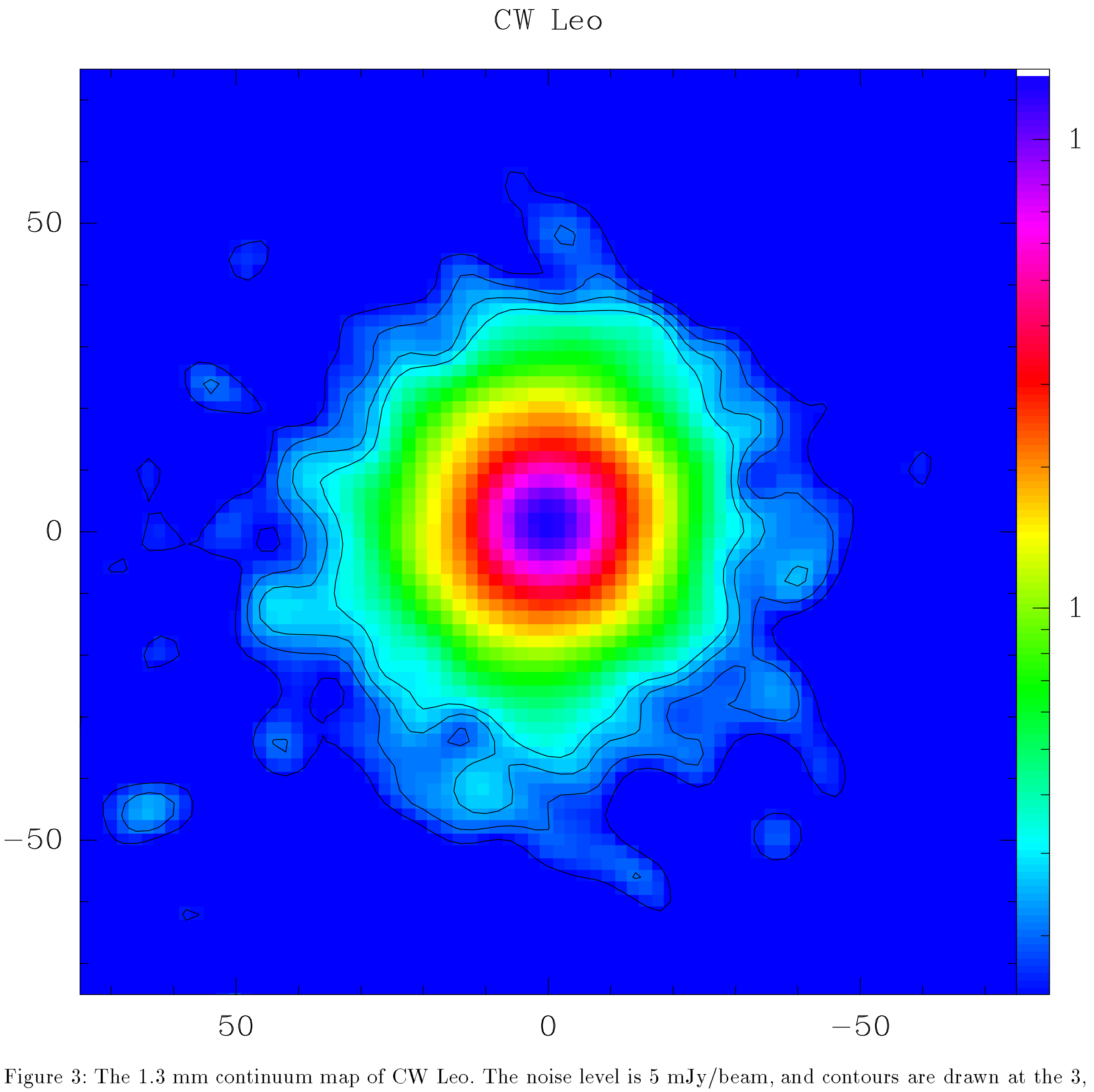
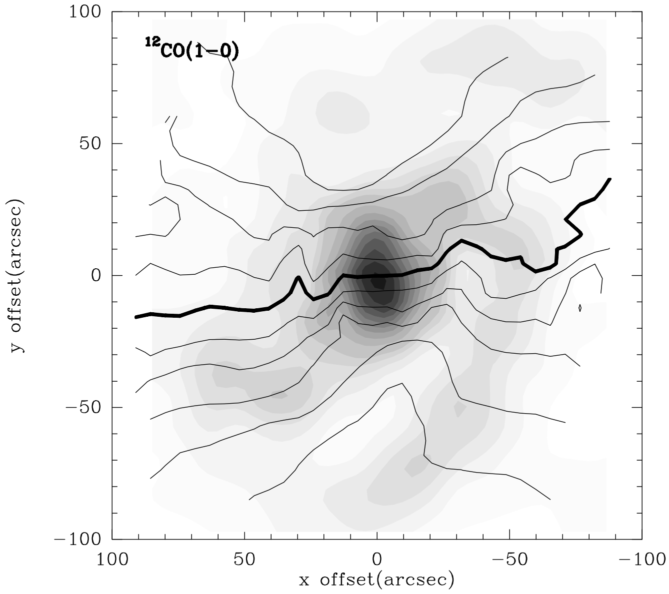


Figure 3: The 1.3 mm continuum map of CW Leo. The noise level is 5 mJy/beam, and contours are drawn at the 3, 4, 5 and 6 σ level. The map size is 150 $\times$ 150$''$, with north up and east to the left. Scale is in arcseconds.



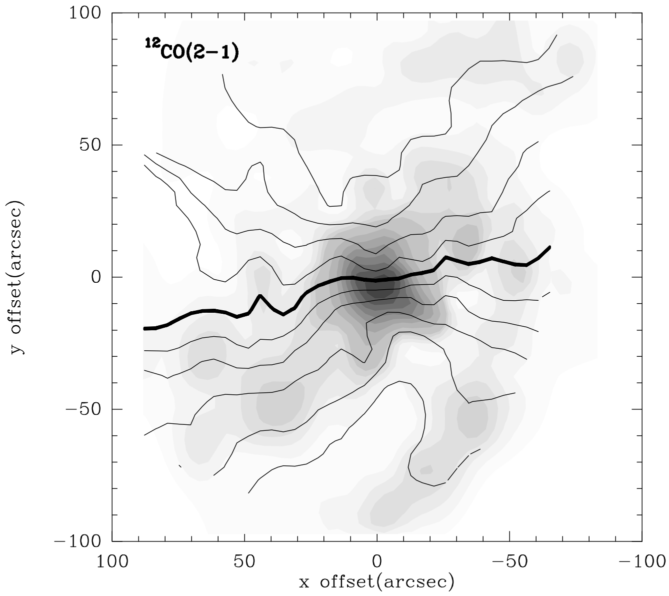


Figure 2: Overlaid on gray scale images of I_{10} and I_{21}. We plot the first-moment isovelocity contours derived from the 1–0 and 2–1 transitions of ^{12}CO (figures (a)(top) and (b)(bottom), respectively). Isovelocities go from 1450kms^{-1} to 1750kms^{-1} by steps of 25km s^{-1}. Thick contours stand for the systemic velocity $v_{\rm sys}$ = 1575km s^{-1}. A close view shows the different strength and degree of symmetry of the streaming motions in the southern (I) and northern (II) arms. Along arm I, streaming motions can be followed more continuously and their amplitude is stronger than in arm II. The velocity field along arm II reflects again the asymmetry of the gaseous spiral response in M100: a secondary wave compression appears in the eastern side, coinciding with the splitting of arm II. This kinematical feature, present in the 2–1 and the 1–0 maps, assesses our view that we are detecting the signature of the $m = 3$ mode.

The chemical evolution of planetary nebulae

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Abstract: We report millimeter line observations of CO, ^{13}CO, SiO, SiC_2, CN, HCN, HNC, HCO^+, CS, and HC_3N to study the chemistry in planetary nebulae (PNe) with massive envelopes of molecular gas. The sample observed consists of representative objects at different stages of development in order to investigate evolutionary effects: the proto-PNe CRL 2688 and CRL 618, the young PN NGC 7027, and the evolved PNe NGC 6720 (the Ring), M4-9, NGC 6781, and NGC 7293 (the Helix).

The observations confirm that the chemical composition of the molecular gas in PNe is radically different from that in interstellar clouds and the circumstellar envelopes of Asymptotic Giant Branch (AGB) stars. There are also clear trends in the chemical evolution of the envelopes. As a star evolves beyond the AGB, through the proto-PN and PN phases, the abundances of SiO, SiC_2, CS, and HC_3N decrease, and they are not detected in the PNe, while the abundances of CN, HNC, and HCO^+ increase dramatically. Once a PN has formed, the observed abundances in the molecular clumps of the envelope remain relatively constant, although HNC is anomalously underabundant in NGC 7027. In the evolved PNe, CN is about an order of magnitude more abundant than HCN, HNC, and HCO^+, and the average abundance ratios are CN/HCN = 9, HNC/HCN = 0.5, and HCO^+/HCN = 0.5. These ratios are, respectively, one, two, and three orders of magnitude higher than in the prototypical AGB envelope IRC+10216. The $^{12}C/^{13}C$ ratios are $\approx$ 10 − 25, within the large range found in AGB envelopes. The chemical evolution of the envelopes likely occurs through the development of photon-dominated regions produced by the ultraviolet radiation field of the central star.

The observations also provide important information on the physical conditions in the molecular gas. Multi-line observations of CN, CO, and HCO^+ show that the clumps which form the envelopes of the evolved PNe maintain remarkably high gas densities ($\sim$ few $\times 10^5$ cm^{-3}) and low temperatures ($\sim$ 25 K). These values are consistent with the idea that the clumps are in rough pressure equilibrium with the more diffuse, ionized gas and can last for a significant part of the nebular lifetime, providing the environment needed for the survival of the molecules. Thus the clumping of the gas in these PNe is an essential aspect

of both their physical and chemical evolution.
Accepted by Astron. Astrophys.
Preprints can be obtained by contacting bachiller@oan.es

The Gravitational Lensing Nature of the Cloverleaf Unveiled in CO (7-6) Line Emission

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Abstract: We report $0.5''$ resolution imaging of the Cloverleaf quasar in the CO(7-6) line and 1.3 mm continuum,, as well as $1''$ resolution imaging in the CO(3-2) line, performed with the IRAM interferometer. The CO(7-6) image is clearly resolved into 4 spots, demonstrating that the CO emission is also gravitationally lensed. We do not find any convincing evidence for a velocity gradient in the maps. As compared to the optical spots from a V band HST image, some of the CO spots are found to be stretched along the Einstein ring. Using the available lens model for the Cloverleaf, this suggests an intrinsic radius of $\sim$ 600 pc for the CO emitting region. No continuum emission is detected: the measured flux density is 5 ± 3 mJy, consistent with a spectral index larger than 3.

Structure and kinematics of a protostar: mm-interferometry of L 1157

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Abstract: We present high angular resolution ($2.5''$) interferometric images of ^{13}CO ($J = 1 \rightarrow 0$), C^{18}O ($J = 1 \rightarrow 0$), and λ 2.7 mm continuum emission around L1157-mm, a suspected protostar powering an energetic molecular outflow. The continuum emission consists in two distinct components. The Class 0 object L1157-mm is seen as a compact source of size $\leq 1''$ (440 AU) and mass $\simeq 0.2 M_\odot$, which is marginally resolved and elongated perpendicular to the outflow axis. In addition, spatially-extended low-level emission is observed and likely arises at the heated edges of the cavity excavated by the outflow in the surrounding envelope. Simple modelisation shows that such an interacting structure can explain the observed morphology and the spectral energy distribution of the source.

The line observations indicate that ^{13}CO mostly originates from the envelope and the limb-brightened edges of the outflow, whereas the C^{18}O emission is more directly associated with the compact continuum source. Weak evidence for rotation has been found. Comparison of the two line tracers shows proeminent redshifted self-absorption in the ^{13}CO spectrum which is very suggestive of infall motions. The infalling medium seems to be confined in a large (a few thousands AU) flattened structure.

These observations provide a quite detailed description of the structure of a Class 0 protostar, which appears to have a complex vicinity where the outflowing and accreting phenomena are closely linked together (Fig. 4)

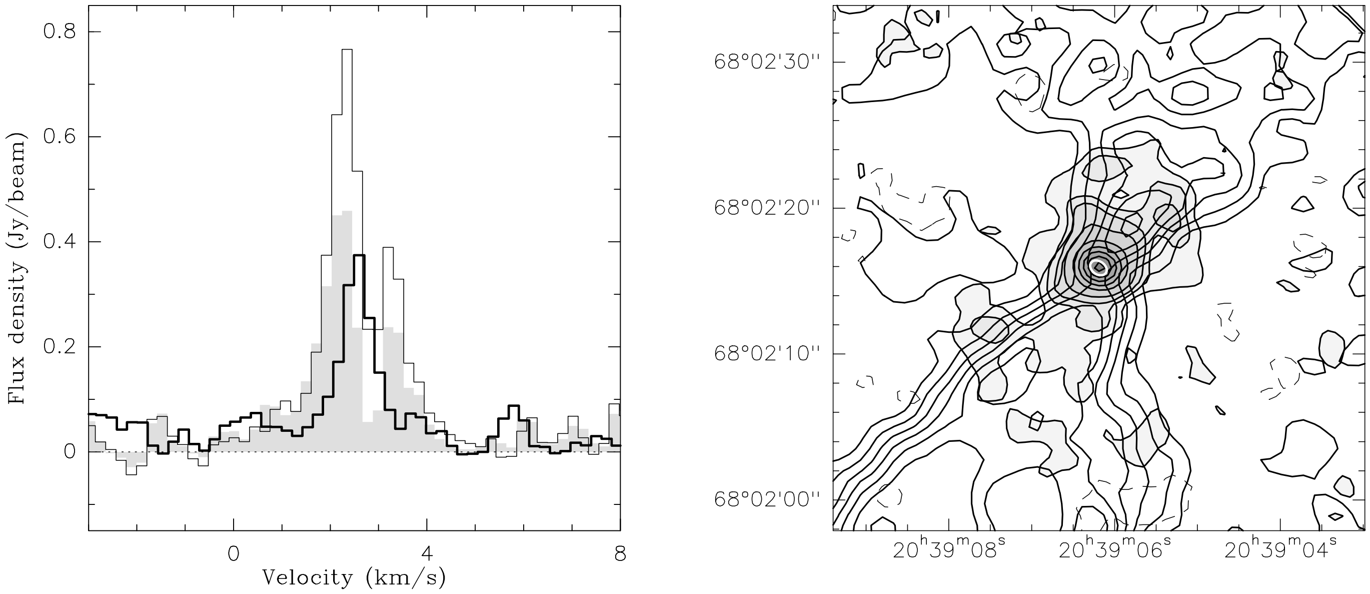

Figure 4: 2.5″ observations of the protostar L 1157-mm: *(Left)* $C^{18}O$ $J = 1 - 0$ (thick histogram), ^{13}CO $J = 1 - 0$ (filled) and ^{13}CO $J = 1 - 0$ interferometric + single-dish (thin) spectra observed towards the central position. *(Right)* λ2.7 mm continuum emission (greyscale) surimposed with the integrated CO emission: the extended component of the continuum emission is associated with the edges of the molecular outflow. The white ellipse is the formal result of a fit of the compact central source.

The interstellar medium in the edge-on galaxy NGC 5907: Cold dust and molecular line emission

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(2) Observatoire de Bordeaux, URA 352, CNRS/INSU, B.P. 89, F-33270 Floirac, France
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Abstract: We present new observations of the interstellar medium in the non-interacting edge-on galaxy NGC 5907. We have observed the $J = 2 - 1$ and $J = 1 - 0$ lines of the ^{12}CO molecule and radio continuum emission at λ 1.2 mm.

The distribution of the molecular gas (as traced by CO) shows a maximum in the central region and a ring or spiral arm at $r \sim 7$ kpc. Further analysis of the major axis distribution reveals evidence for an inner ring-like structure at $r \sim 3.5$ kpc. The kinematics can be described by rigid rotation in the inner part, a turnover at ~ 3 kpc, and differential rotation with a velocity of 230 km/s in the outer disk.

The observed continuum emission is mainly due to thermal radiation of cold dust with an average temperature of $T_{\rm d} = 18$ K, with a small gradient from 20 K to 16 K from the center to the outer disk. This cold dust component is necessary to explain our results.

The dust emission closely follows the molecular gas in the central region, but is also detected at large radii where no CO can be seen (Fig. 5). In these regions the dust absorption cross section per H atom at λ1.2 mm is estimated to be $\sigma_\lambda^{\rm HI} \sim 4.5\ 10^{-27}$ cm^2, a value similar to that in the outer parts of other galaxies.

From the λ1.2 mm emission we estimated a molecular mass of NGC 5907 of 0.9 10^9 $M_\odot$, about 50 % smaller than from the CO emission. By combining the CO and continuum data we found that the CO-H_2-conversion ratio increases with galactocentric radius, from $\sim 0.7\ 10^{20}$ at the centre to $\sim 1.6\ 10^{20}$ cm^{-2}/K km s^{-1} at $r = 7.5$ kpc.
Accepted for publication in A&A

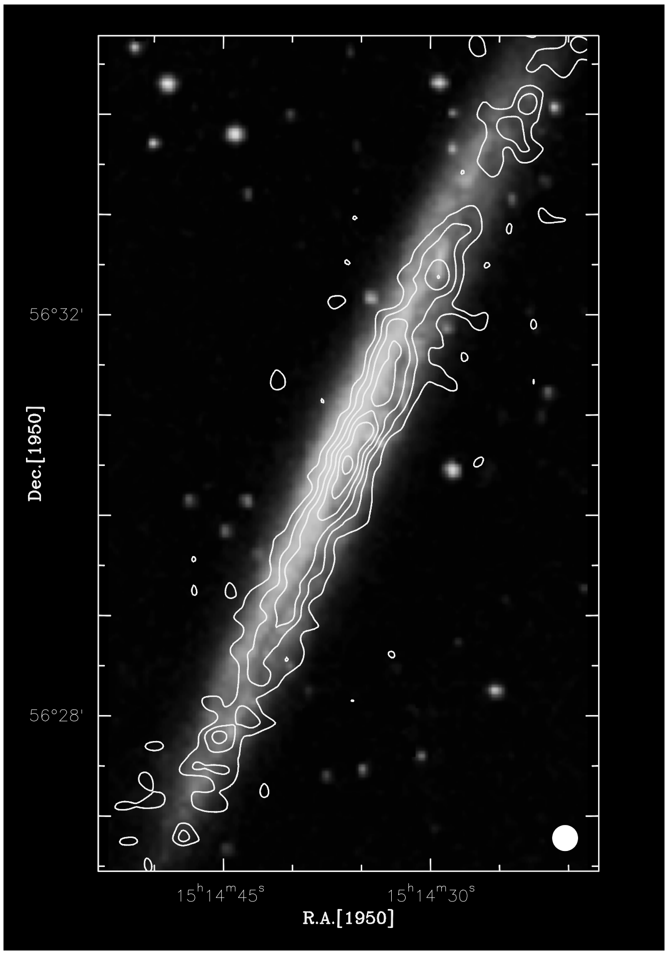

Figure 5: Contour map of the continuum emission of NGC 5907 at 245 GHz, overlaid onto an optical image extracted from the Digitized Sky Survey. The beam size of 15″ is indicated by the filled white circle in the lower right corner. The rms noise depends on the location in the map; on the galaxy it is about 1.5 mJy/beam area, contour levels are 4, 8, . . . , 24 mJy/beam area

Evolution of the outgassing of comet Hale-Bopp (C/1995 O1) from radio observations.

Nicolas Biver, Dominique Bockelée-Morvan, Pierre Colom, Jacques Crovisier, John K. Davies, William R.F. Dent, Didier Despois, Eric Gérard, Emmanuel Lellouch, Heike Rauer, Raphael Moreno, Gabriel Paubert

Abstract: Since soon after its discovery at 7 AU from the Sun, comet Hale-Bopp has been studied by radio spectroscopy to investigate the gas species associated with its activity. We present an extensive monitoring performed with the Nançay, IRAM-30m and JCMT radio telescopes, showing the progressive release of CO, CH_3OH, HCN, OH, H_2S, CS, H_2CO, CH_3CN and HNC as the comet approached the Sun from 6.9 to 1.4 AU. These data provide clues to the chemical and physical state of cometary ices and allow us to investigate the fractionation processes that accompany their sublimation upon solar heating. Simultaneous observations of the relative intensities and line shapes of several transitions are used to measure the expansion velocity and temperature of the cometary atmosphere and their evolution with heliocentric distance, as well as to study possible sublimation from icy grains. The more volatile species are relatively more abundant in the coma far from the Sun, but there is no direct correlation between overabundance and volatility. Evidences for H_2O sublimation from icy grains are seen beyond 3.5 AU from the Sun. The change from a CO-driven coma to a H_2O-driven coma occured at about 3 AU. The gas outflow velocity and temperature increased with decreasing heliocentric distance.

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Millimeter Interferometry towards the ultra–compact Hii region W3(OH)

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Abstract: We used the IRAM Interferometer to map the J=1–0 and J=2–1 lines of $C^{17}O$ as well as the continuum at 112 and 225 GHz of the W3(OH) region. Towards the cluster of water masers W3(H_2O) we observed compact continuum emission at both frequencies with spectral index of 3.6 from hot dust emission. The $C^{17}O$ maps show more extended gas with the most massive molecular clump towards W3(H_2O) and none towards W3(OH) itself. We derive a peak column density of 5×10^{23} cm^{-2} at the H_2O maser position. Dust and line fluxes are both consistent with a mass of 10 $M_\odot$. Peaks of molecular line channel maps of $C^{17}O$, CH_3OH, and C_2H_5CN show an E–W orientation similar to the cluster of H_2O masers.

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Programmes Scheduled on the 30-m Telescope in 1996

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Ident.	Title	Freq. (GHz)	Authors
1.96	Time-delay measurements in the gravitational lens PDS1830-211	94	Combes, Wiklind, Kramer
121.96	High density molecular clumps in the ionized cavity surrounding the galactic center	86, 130, 217, 244	Martin-Pintado, de Vicente, Fuente, Planesas
126.96	Is SiO emission in external galaxies associated to star formation ?	86, 130, 217	Martin-Pintado, Garcia-Burillo, de Vicente, Fuente
127.96	Does dense material confine HII regions ?	108, 113, 145, 226	Martin-Pintado, Gaume, Rodriguez, de Pree, Fey
46.96	On the Fly mapping of the Cepheus-B molecular cloud	109, 115, 219, 230	Ungerechts, Guélin, Kramer, Sievers, Wild, Cernicharo
44.96	IRAS 20468 : Confirming the collapse of a low-mass protostar	98, 147, 219, 241	Wiesemeyer, Guesten
57.96	A search for redshifted [NII] 205 micron emission from BR 1202-0725	256	Van der Werf, Yun
92.96	A thorough radio spectroscopic investigation of comet Hale-Bopp	88, 96, 115, 241	Crovisier, Bockelée-Morvan, Colom, Lellouch, Rauer, Despois, Moreno
14.96	CO(1-0) along the bar and CO(1-0) (2-1) isotopes in NGC 1530	114, 109, 108	Reynaud, Downes
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Ident.	Title	Freq. (GHz)	Authors
63.96	The magnetic field in the MWC349 disk (III)	86	Thum, Morris
94.96	A complete CO survey of the irregular galaxy IC 10	115,230	Wild, Kramer, Paubert, Sievers, Masset, Ungerechts, Greve
5.96	CO observations of 2 red carbon stars in the galactic halo	115, 230	Groenewegen, Oudmaijer
69.96	Does ethanol only form by evaporation from grains ?	91, 142, 234	de Vicente, Martin-Pintado
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113.96	CO mapping in isolated spiral galaxies	113, 115	Casoli, Sauty, Gerin

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123.96	Are optical jets associated to high velocity gas in molecular outflows ?	115, 230	Cernicharo, Neri, Reipurth
56.96	A conspicuous optical jet in the trifid nebula	97, 148, 230, 244	Cernicharo, Gonzalez, Cox, Lefloch, Garcia-Lopez
81.96	Probing the infrared field of the interior of hot cores	86, 87, 109, 110	Wyrowski, Schilke, Walmsley
δ20.96	Detection of C7H		Guelin, Cernicharo
114.96	Optical thickness of CO in Wolf-Rayet galaxies	113, 114, 226, 229	Davoust, Bridges, Wozniak, Contini, Considere
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76.96	Chemical signatures of the dissipative structures of mol. clouds turbulence	89, 174, 262, 267	Falgarone, Joulain, Puget, Panis, Pineau des Forets

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48.96	Molecular study of the energetic and young molecular outflow Cep E	86, 89, 96, 98, 115	Lefloch, Eisloeffel, Lazareff
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1.96	Time-delay measurements in the gravitational lens PDS1830-211	94	Combes, Wiklind, Kramer
84.96	The HCS+ to CS dabundance ratio in cirrus clouds	85, 170, 213, 147, 244	Grossmann, Heithausen
28.96	Search for S_2O and OCS in IO s atmosphere	222, 219, 218	Lellouch, Belton, Strobel, Paubert
94.96	A complete CO survey of the irregular galaxy IC 10	115, 230	Wild, Kramer, Paubert, Sievers, Masset, Ungerechts, Greve
δ18.96	NGC 5907		Wielebinski, Dumke

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Ident.	Title	Freq. (GHz)	Authors
67.96	On the Fly observations of the Trifid nebula	109, 110, 115, 230	Cernicharo, Ungerechts, Lefloch, Cox, Bachiller
36.96	Search for molecular tori around AGN		Combes, Wiklind, Drinkwater
60.96	Search for high redshift molecular absorption line systems	89, 98, 104, 147, 157	Combes, Wiklind
29.96	Molecular clouds in the dwarf elliptical galaxy NGC 205	115, 110, 230, 220	Lo, Young, lequeux
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8.96	Molecular gas in a distant, dust-rich radio galaxy	87, 131	Ivison, Dunlop, Archibald, Hughes
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1.96	Time delay measurements in the gravitational lens PDS1830-211	94	Combes, Wiklind, Kramer
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11.96	A search for interstellar van der Waal complexes	86, 90, 91, 131	Havenith, Mauersberger, Wilson
7.96	CO mapping of the magellanic irregular galaxy NGC4449	115, 230	Klein, Henkel
22.96	A map of the source 3' North of Orion KL and selected positions in OMC1 in C170	112, 224, 109, 218	Wilson, Gensheimer, Dickel, Mehriger

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Ident.	Title	Freq. (GHz)	Authors
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1.96	Time-delay measurements in the gravitational lens PDS1830-211	94	Combes, Wiklind, Kramer
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22.96	A map of the sources 3' North of Orion KL and selected positions in OMC1 in C170	112, 224, 109, 218	Wilson, Gensheimer, Dickel, Mehriger
24.96	A new molecular core in Sgr B2	112, 224, 109, 218	Wilson, de vicente, Martin-Pintado, Gensheimer, Henkel
32.96	CN Zeeman observations : Magnetic fields in molecular clouds	113	Crutcher, Troland, Lazareff, Kazes
18.96	The ^{12}C ^{13}C ratio in the envi. of extreme ^{13}C rich carbon stars	230	Kahane, Forestini
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45.96	A CO map of the double-barred galaxy NGC 5850	114	Friedli, Combes, Leon
64.96	The giant molecular cloud W58	109, 110, 115	Thum, Ungerechts, Wink
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108.96	Chemistry of GM Aur protoplanetary disk	86, 96, 113, 226	Dutrey, Guilloteau

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Ident.	Title	Freq. (GHz)	Authors
1.96	Time-delay measurements in the gravitational lens PDS1830-211	94	Combes, Wiklind, Kramer
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77.96	On the Fly mapping of M31 in CO	115, 230	Neininger, Guélin, Wielebinski, Hoernes, Berkhuijsen, Berk, Garcia-Burillo
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107.96	Chemistry of the protoplanetary disks DM Tau and GG Tau	86, 144	Dutrey, Guilloteau
108.96	Chemistry of GM Aur protoplanetary disk	86, 96, 113, 226	Dutrey, Guilloteau
55.96	The origin of broad line wing emission in the Rosette molecular cloud	109, 115	Schneider, Stutzki, Williams
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46.96	On the Fly mapping of the Cepheus-B molecular cloud	109, 115, 219, 230	Ungerechts, Guélin, Kramer, Sievers, Wild, Cernicharo
6.96	CO search in HII galaxies	114, 228, 229	Klein, Brinks, Mebold, Heithausen, Taylor

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δ19.96	Campaign to determine the simultaneous radio-mm-submm spectrum of SgrA*		Zylka, Falcke
6.96	CO search in HII galaxies	114, 228, 229	Klein, Brinks, Mebold, Heithausen, Taylor
96.96	Oxygen-rich chemistry in NGC 7027: An ISO/LWS follow-up study	110	Cox, Barlow, Clegg, Baluteau, Gry, Caux
1.96	Time-delay measurements in the gravitational lens PDS1830-211	94	Combes, Wiklind, Kramer
124.96	On the origin of high velocity SiO maser emission from late-type stars	86, 129, 230	Baudry, Alcolea, Cernicharo, Herpin
116.96	Compact flat-spectrum radio cores in nearby galaxies	86, 138	Reuter, Lesch
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17.96	Probing shocks and fast wind in the bipolar flow of V Hya.	88, 147, 244, 130	Kahane, M-Morris, Barnbaum
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47.96	^{12}C ^{13}C isotopic ratio in PNe with 3He abundance determination	109, 110, 115, 230	Palla, Galli, Bachiller

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Ident.	Title	Freq. (GHz)	Authors
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Ident.	Title	Freq. (GHz)	Authors
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190.96	Isotopic ratios of heavy elements in evolved stars	89, 145, 163, 176	Kahane, Forestini, Guelin, Cernicharo
141.96	Time delay measurements in the gravitational lens PKS1830-211		Combes, Wiklind, Kramer
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145.96	Anisotropy measurements of the cosmic microwave background with Diabolo at the arcmn scale	Bolometer	Desert, Bernard, Delabrouille et al.
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152.96	Emission mechanisms in quasars	Bolometer	Chini, Kreysa, Meisenheimer, Klaas
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Ident.	Title	Freq. (GHz)	Authors
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254.96	Systematic study of 1.25mm emission of radioquiet QSOs with z 4	Bolometer	Omont, McMahon, Cox, Bergeron, Kreysa
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