IRAM Newsletter

Number 17 October 6, 1994

Calendar

Observing proposals: Proposals for the period *May 15, 1995 to Nov. 15, 1995* should be submitted before *Monday, February 27th 1995*

Contents

30-m Telescope

New 3 mm SIS mixer

A new SIS mixer was installed in the 3mm receiver in July 1994. The sensitivity and stability are so good that the receiver is used on a standard basis for pointing. Receiver temperatures are between 80 and 120 K (SSB). The image sideband rejection is between 25 dB and 30dB. This basically solves the calibration problem at 115 GHz caused by the strong oxygen line at 118 GHz. Many positive reports from observers using the new 3mm SIS mixer were received.

Surface adjustment

A surface adjustment based on earlier holography maps was done in July 1994. No holography measurements were done yet (not meaningful in summer) to check the surface accuracy.

AOS

The AOS is currently out of operation due to a failure of the laser diode. A replacement has been ordered.

Telescope time statistics

Fig. 1 shows how the 30m telescope was used during the period from September 93 to August 94. Please note that this does not reflect the scheduled time but how the telescope was actually used. For example, if an observation could not be carried out because of high wind, the lost time is attributed to the segment “Stop Wind”. Please note also that the telescope status is recorded every 2 hours which means that e.g. technical problems of shorter duration may not be included in the statistics.

Wolfgang WILD

Interferometer

Baseline Extension

The bad weather period of early September may have some serious consequences on the availability of the new East-West baselines. 2 to 3 full weeks of good, not too cold weather are required to finish the ground work, but snow is already present on the Plateau.

Receivers

A new dual-frequency receiver has been installed on antenna 4 at the end of August. It covers the 80–115 GHz and 210–250 GHz bands, and both mixers can be used simultaneously. The 3mm mixer allows true LSB tuning at all frequencies with high image sideband rejection, and good USB tuning (although with low rejection) at 115 GHz. Measured system temperatures are indicated below:

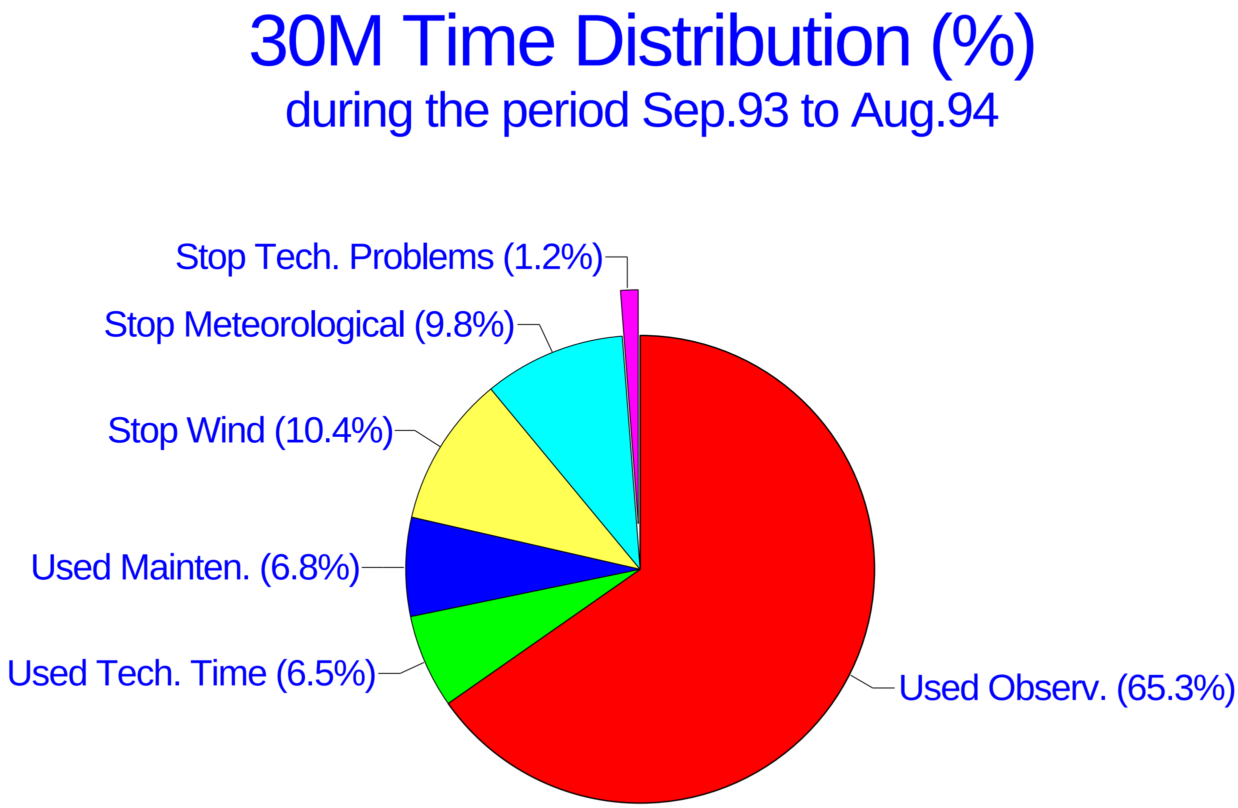

Figure 1: 30m telescope time statistics for the period September 1993 to August 1994.

Frequency GHz	T_{SYS} (K)	G(I/S)	$W(H_2O)$ (mm)	T_{SYS} (others)
86.2 LSB	130	0.004	$\simeq 10$	170
99.8 LSB	140	0.004	$\simeq 10$	220
109.97 LSB	170	0.008	$\simeq 8$	320
115.27 USB	390	0.25	$\simeq 12$	800

These measurements were obtained in rather poor weather conditions. Column 5 indicates typical T_{SYS} measured with the other antennas at the same time. Sensitivity has been improved by a factor 2 above 110 GHz. However, as expected, *pure DSB tuning* is not only less sensitive, but also very difficult to achieve above about 100 GHz. Observers are requested to consider seriously this problem in their applications.

Because of poor weather conditions, only a crude check of the pointing of the 230 GHz receiver has been made so far.

Unfortunately, problems with cryogenics have delayed the other 3 receivers, and no fixed schedule can be given yet.

Maintenance and Observations

We have replaced the receiver cabin protection during the summer maintenance. This took somewhat longer than expected, and had a negative impact on the observations. A potentially important backlog of observations has accumulated. For most projects accepted for the summer, only one configuration has been completed so far.

Stéphane GUILLOTEAU

Backends

Correlator news:

A compromise has been found with the manufacturer of the unreliable correlator chips to acquire a new batch of 1254 correlator chips. They have been installed in the Pico Veleta and Plateau de Bure correlator units in June. The failure rate has dropped from 1 per day to zero (over a 2 month period). This is likely to materialize an happy end of this problem.

Mark TORRES

Scientific Results

A Keplerian disk around DM Tau ?

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Abstract: Using the IRAM 30-m telescope, we have detected a rotating gas disk around the relatively old (5 10^6 yr) T Tauri star DM Tau. The kinematic pattern and line profiles obtained from ^{12}CO J=2–1 and ^{13}CO J=2–1 are consistent with a disk inclined about 30° from face-on, with a rotation axis at PA $\simeq$ 90°, and orbiting a 0.65$M_\odot$ central star with a systemic velocity of 6.1km s^{-1}. All detected lines can be well fitted by a simple Keplerian disk model with outer radius $\simeq$ 750 AU, mean temperature about 15 K, and standard isotopic ratios. If the CO abundance is normal, the total disk mass is 1.4 $10^{-3}M_\odot$.

Such a mass is small compared to that derived from mm and sub-mm continuum emission ($\simeq 0.03M_\odot$). This can be explained either by CO depletion, or by an anomalous gas-to-dust ratio, or by the existence of a dense, compact, optically thick core which dominates the mm continuum emission. The size derived for such a core is consistent with the size of the current solar system. In all cases, our results indicate that significant amount of gas still exists several Myr after star formation.

A Direct Image of Wind Interaction in the Post-AGB Evolution : CO Observations of M1-92

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Abstract: We present high-resolution CO J =1–0 maps of the protoplanetary nebula M1-92, Minkowski's Footprint, obtained with the IRAM interferometer at Plateau de Bure. The cartography is particularly revealing (see Fig. 2). Three components are distinguished in the maps: a bipolar outflow, with a (deprojected) velocity of about 65 km s^{-1}, a hollow prolate structure, with an axial velocity increasing with the distance to the star up to about 60 km s^{-1}, and a central condensation with velocities smaller than 10 km s^{-1}. A remarkable continuity in position and velocity is found between the hollow component and the bipolar flow. We argue that these properties indicate that an important dynamical interaction between both features is active at the present moment and affects most of the nebular material. Such an interaction would consist in a significant momentum transport from the bipolar fast flow to the rest of the nebula.

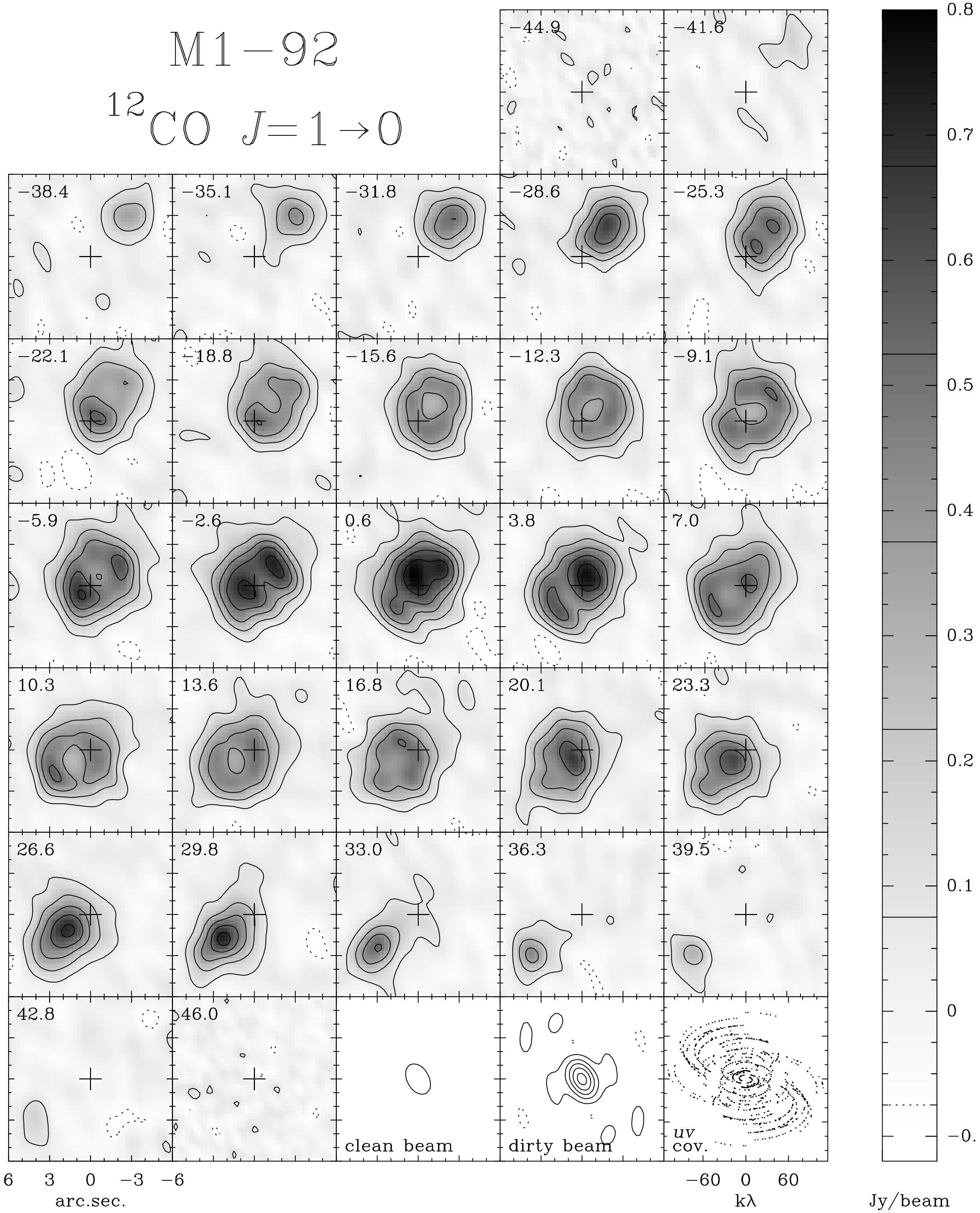

Figure 2: Channel maps of the ^{12}CO J =1–0 line from M1–92 taken with the PdB mm-interferometer. Spatial units are offsets in arc seconds with respect to the position of the central star (cross). North is top and East is left. LSR velocities are marked in the upper left corner.

New radio recombination maser features and CO observations in MWC349

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Abstract: We present observations of the $J = 1-0$ line of CO and of the millimeter recombination lines H30α, H35α, H38α and H39α toward the radio star MWC349. The profiles of the H35α and H39α lines show new narrow features (linewidths of 15-20 km s^{-1}) at radial velocities of -58 and 58 km s^{-1}, close to the terminal velocity of the ionized wind. These features are time variable and their intensities for different quantum numbers (strong emission in the H35α line and relatively weak in the H30α line) are inconsistent with LTE emission. Therefore these new high–velocity features are very likely radio recombination line masers (high–velocity masers). Contrary to the millimeter recombination line masers previously discovered in this source at radial velocities of 30 and -14 km s^{-1}(low–velocity masers) whose intensity increases by a factor $\sim$ 100 between the H39α and the H30α line, the high–velocity maser intensity increases by only a factor of $\lesssim 2$. We propose a two–component model which qualitatively explains the radial velocities and the line intensity characteristics of the two kind of masers observed in this source. In this model, the high–velocity masers arise from the ionized stellar wind and the low–velocity masers from the interface region of the ionized stellar wind and the neutral disk around MWC349. The radial velocity separation of the low–velocity maser spikes as a function quantum number deviates from that expected for a disk in keplerian rotation.

We have estimated the CO emission toward MWC349 by subtracting from the spectra of the blended CO and H38α line that of the H39α line. We detect a narrow ($\sim$ 5 km s^{-1}) absorption line plus a broad (linewidth of $\sim$ 50 km s^{-1}) emission. The broad emission is only tentatively detected because of the procedure used to derive it. We discuss the possible association of the CO features with neutral circumstellar material in MWC349.

Efficient mapping of faint sources with a multichannel bolometer: A "zero order" sky–noise suppression.

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Abstract: We have mapped the galaxy NGC2146 in 12CO(1–0, 2–1) and 1.2mm continuum emission with the 30–m Telescope (Greve et. al 1994, in preparation). Here we present preliminary maps of the 1.2mm continuum emission and show that a relatively simple correction for sky–noise can be very effective to improve maps made from data taken under average or even poor weather conditions.

Observations: We have observed NGC2146 using the 7–channel MPIfR bolometer on the 30m telescope in the ON-OFF mode. Since the individual beams (pixels) of the array have a spacing of about 21 arc sec, the array is displaced by 4 to 5 arc sec between individual ON-OFF measurements in such a way that we obtained a fully sampled map. With each map (coverage) consisting of 20 ON–OFF measurements an area on the sky of about 1 arc minute diameter is mapped. This observing procedure assumes that the 'OFF–position' is emission free, thus we took a fairly large separation (chopper throw) of 120 arc sec between the ON and the OFF beam. In order to obtain a better S/N, we mapped the galaxy 8 times, displacing individual coverages in order to map a slightly larger field.

Data Reduction: After calibrating the data, they are regridded into RA/DEC. A contour plot of the original data is shown in the upper part of Fig. 3. The data is heavily affected by sky–noise. As mentioned before, because of the size of the galaxy, we had to use a large chopper throw of 120 arc sec and this increases the sky–noise in particular under the average to poor weather conditions as occurred during our observations.

By inspection of the individual ON–OFF measurements we found that all seven channels often showed a large offset either positive or negative, suggesting that this might be a major component of the sky–noise. Hans–Peter Reuter developed a program to reduce the sky–noise by eliminating this "zero–order" component of the sky–noise, i. e. subtracting the average of simultaneous (here 7) observations from the data. The result of this is shown in the middle panel of Fig. 3, the map is much less noisy but part of the source emission has been subtracted from the map. This effect can be minimized by selecting a model distribution of the source and subtracting the model from the data before calculating the average. As model we took a two dimensional Gaussian fitted in an iterative process to the data. The result is shown on the bottom of Fig. 3. Contour levels are drawn at about 2.5 sigma RMS, there are no negative contours. The reason for including the intermediate step (subtracting the average without correcting by a model) is to show that the result is very little affected by the details of the model. In most cases it will be sufficient to approximate the source by a sum of Gaussians.

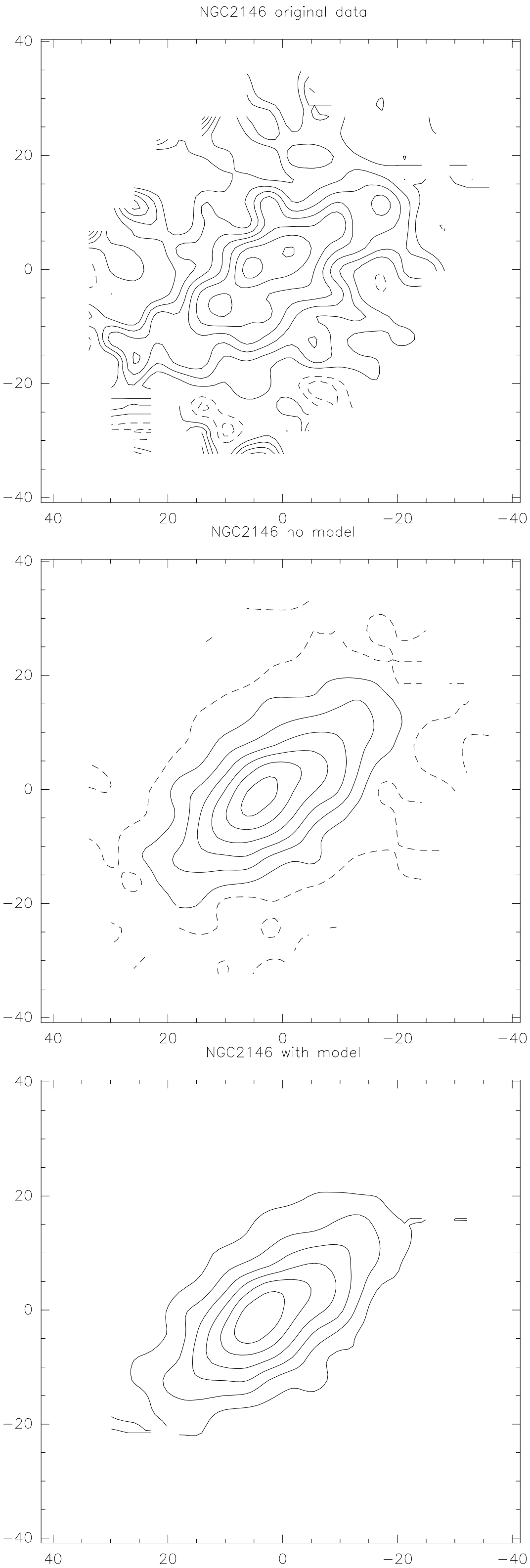

Figure 3: A map of NGC2146 taking the "raw", uncorrected data (top), correcting the data by subtracting the average of simultaneous observations (middle) and by subtracting the average relative to an Gaussian (bottom). The contour levels in all three plots are the same except that the zero level is drawn in the plot shown in the middle of the figure.

New Preprints

The following preprints are available from IRAM:

324. The molecular content of the Rosette's tear drops
E. Gonzalez-Alfonso, J. Cernicharo
1994, *Astrophys. Journal Letters*

325. Molecular gas in cometary globules : CG4 and CG6 in the Gum Nebula
E. Gonzalez-Alfonso, J. Cernicharo, S.J.E. Radford
1994, *Astron. and Astrophys.*

326. Widespread water vapor emission in Orion
J. Cernicharo, E. Gonzalez-Alfonso, J. Alcolea, R. Bachiller, D. John
1994, *Astrophys. Journal Letters*

327. Circumstellar CO emission in S stars: I. Mass-loss with little or no dust
R. Sahai, S. Liechti
1994, *Astron. and Astrophys.*

328. Dense clumps in the Mon R2 outflow
M. Tafalla, R. Bachiller, M.C.H. Wright
1994, *Astron. and Astrophys.*

329. Accurate radio positions of SiO masers
A. Baudry, R. Lucas, S. Guilloteau
1994, *Astron. and Astrophys.*

330. The outflow in the halo of M82
C.D. McKeith, A. Greve, D. Downes, F. Prada
1994, *Astron. and Astrophys.*