IRAM Newsletter

Contents

Number 46 December 13th, 2000

Cover Picture

Aligning the bolometer at the IRAM 30-m Telescope: A view from the receiver cabin through the vertex windows shows two engineers adjusting the beam of the MPI bolometer for the winter 1999/2000 campaign. The mechanism on the platform allows to move a chopper wheel (pointing at an ambient load and the sky) in horizontal and vertical direction. The optimum alignment is achieved when the bolometer looks toward the center of the subreflector. With this picture the IRAM staff send their Christmas greetings and best wishes for the year 2001.

Calendar

March 1st, 2001: Deadline for the submission of observing proposals for the period May 15, 2001 to Nov 15, 2001

April 2001: IRAM Program Committee meeting

April 2001: Scientific Advisory Committee

June 28/29 2001: IRAM Council

Extraordinary IRAM Council Meeting on October 17th, 2000 – Study of Future Means of Access to the Plateau de Bure

On October 17th, 2000 the IRAM Executive Council held its 3rd meeting this year, the second extraordinary meeting. The main purpose was to listen to a report on the results from a broad study of transport systems that could provide access to Plateau de Bure Observatory in the future. In addition, the Council got briefed on recent developments in the legal procedure related to the cable car accident of July 1st, 1999 , and took a final decision on financial matters which had already been discussed at the previous, regular meeting in June 2000.

Concerning the future access to the Plateau de Bure, the Technical Division of INSU, directed by François BAUDIN, had requested a consortium led by SCETAUROUTE, Lyon to prepare a study of all possible means of access to the Plateau de Bure (a similar survey had been conducted more than 20 years ago). The new study has been completed in October. It identified 10 different options which were characterized in terms of a large number of criteria, amongst which the safety and reliability (= 24 hours availability during 365 days per year) played key roles.

The multi-criterion analysis confirmed that a cable car solution in the area of the old Plateau de Bure cable car ranks very highly on technical grounds. It does, however, run against serious psychological barriers. This makes other solutions look more attractive, in particular if one adds as a criterion the interest of the local authorities who want to open any new transport system to the public, i.e. tourists.

This local interest is motivated by two ideas. On the one side there is an interest to develop further the already well developed skiing (and summer vacation) resort at Superdevoluy. On the other side there is a longer-term interest to develop a scientific outreach project in connection with the observatory installations.

This twofold interest led to the choice of a combination between a telecabin and a 'funiculaire' solution as the current baseline. The telecabin would have the capacity to bring a larger number of people up to about 2000m, where ski pistes are maintained, and the 'funiculaire' would go from there to the observatory at 2550m, and would at least initially only be used for IRAM purposes.

Such a combined solution requires a large effort. Discussions have started between the CNRS, the region (PACA), and the local Conseil Général to share the cost. In parallel, SCETAUROUTE is working out technical and other details of the baseline solution. Hope is that this will serve as basis for a final "go ahead" of the project within the next 6 months. If this goal can be met, a new means of access to the Plateau de Bure could be ready by the end of 2002 or in 2003 at the latest.

Until this date, we will continue to use helicopters and to organize ground transportation which includes climbing the "Fenêtre" area. Unfortunately, both modes of transport require good meteorological conditions. Given these restrictions, we will continue to limit the staff present on Bure at any one time, and as a consequence the activities that can be realized. For the observations with the interferometer this means that they will be carried out on a best effort basis but not at the previous level of efficiency. Full scale operations like in the past will have to await the arrival of the new transport system.

Michael GREWING

Restart of Astronomical Observations on the Plateau de Bure

On December 1st, 2000 regular astronomical observations have been restarted at the Plateau de Bure Observatory. Since the helicopter accident on December 15th, 1999 all regularly scheduled astronomical observations had been stopped. Following the maintenance work in the summer, only test observations were made to check the performance of each telescope and to verify the overall status of the instrument. This was necessary to prepare the arrival of the new correlator for 6 antennas which was installed in September and has been tested since.

Activities on the Plateau de Bure have focused throughout the last 6 months on the implementation of new safety measures. A new overall safety plan has been worked out and implemented. The conditions for the two accepted means of transport, i.e. helicopter flights and access on the ground, with a 4-wheel-drive vehicle during the summer and a ratrack during the winter season, and passing on foot the area near the "Fenêtre", have repeatedly been reviewed. Furthermore, the conditions for executing maintenance work and other tasks have been described in a series of documents.

The improvements mentioned in the previous paragraph have resulted from the technical safety audits by a team from CERN, and from the risk analyses carried out by the IRAM safety engineer, David THIEVENT, with the help of members of the Plateau de Bure team. An important role has also been played by the IRAM-CHSCT (committee for hygiene, safety and working conditions). This committee will regularly review all safety relevant issues. In particular, at the beginning of 2001 it will reconsider the impact of the restart of the observations on the overall safety at the observatory and give its advice.

The aim of all the safety measures is not only to reduce the risks associated with the activities on the Plateau de Bure to a minimum, but also to establish clear rules how to deal with a problem should it arise. This work will continue. New input is expected from a third auditing activity which will be finished soon: a team of experts in ergonomics from CIDECOS/ABILIS has been looking at organizational aspects and at the working conditions on the Plateau de Bure for each category of posts.

The large number of new safety measures already implemented, others which will be completed soon, and plans for further improvements under way, justified in our view the restart of regularly scheduled astronomical observations. It should, however, be clear that this is still on a best effort basis with other, safety related or technical activities taking precedence whenever needed. Full scale observations will be resumed as soon as a new transport system is in place. If all goes well, this could be at the end of 2002.

Michael GREWING

Personnel Changes

IRAM Grenoble

Jérôme PETY has joined the astronomer's group as a postdoc, and Melanie KRIPS has started a diploma thesis on gravitational lenses in collaboration with the University of Köln. Stephane CLAUDE has joined the receiver group for work on the ALMA project. Dave MORRIS and Dietmar PLATHNER have retired. Dave Morris has agreed to continue to work on frequency protection matters and on holography as needed. Anne DUTREY will leave IRAM at the end of the year to return to the Observatoire de Grenoble.

Michael GREWING

IRAM Granada

There are two new cooperants at IRAM Granada: Alexandre DUFLOS will be working in the computer group and also join the on-going project to understand the residual thermal and gravitational deformations of the antenna. Frédéric DAMOUR will be working as a friend of the telescope in the astronomy group.

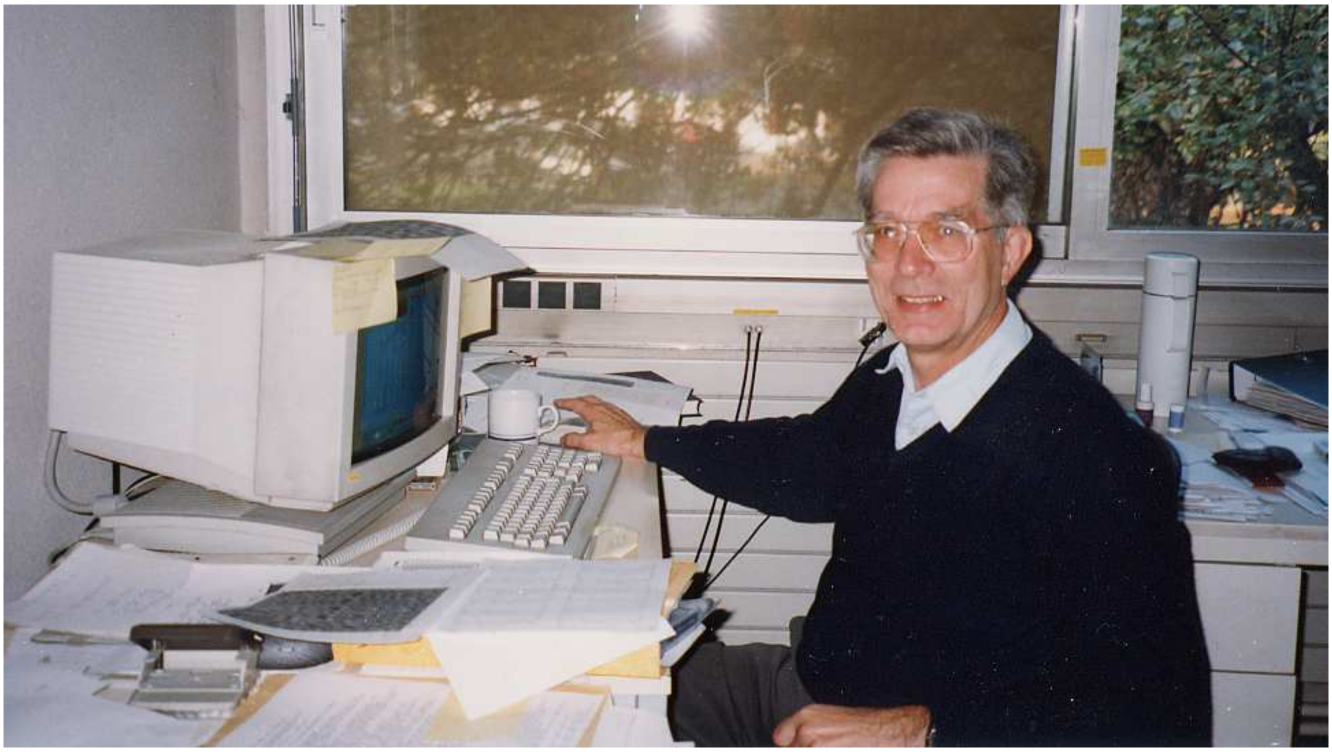
Rainer MAUERSBERGER

Jörn Erhard Wink (1942 – 2000)

Jörn Wink died on August 5, 2000, at age 58, of amyotrophic lateral sclerosis (ALS). An astronomer of the Max-Planck-Institut für Radioastronomie, delegated to IRAM, Grenoble, he is survived by his wife Adelheid and their two daughters, Jutta and Dagmar.

Jörn Wink was born in Berlin in 1942. As a consequence of the war, his family was obliged to move to different places several times in his childhood. Later on, he had the good fortune to attend the University of Münster, where he did a master's thesis in applied mathematics and was encouraged by Prof. Hans Strassl to work in radio astronomy. Dr. Peter Mezger arranged for a stipend from the Max-Planck-Gesellschaft so that Jörn Wink could do part of his doctoral thesis in 1969–70 at the U.S. National Radio Astronomy Observatory, with the three-element interferometer in Green Bank, West Virginia.

The results of these observations appeared in several publications and in Wink's doctoral thesis, "Radioastronomical Investigations of the Structures of Selected H II regions with the Aperture Synthesis Technique". In fact, this study included some of the earliest synthesis maps of giant H II regions, made with the aim of finding the centers of star formation. To reduce the data, Wink



had developed a precursor of the CLEAN algorithm for restoring interferometer images.

After his return from the USA, Jörn Wink worked from 1971 to 1987 at the Max-Planck-Institut für Radioastronomie in Bonn. His activity during this period was mainly centered on investigations with the Effelsberg 100 m telescope, most notably on continuum and radio recombination line studies of galactic H II regions, with a large number of his colleagues, and most frequently with Peter Mezger. During this time, he acquired his reputation as a highly valuable specialist in testing the performance of the 100 m telescope as new bands were opened up at ever higher frequencies. Due to his expertise at Effelsberg, he was a natural choice to participate in the commissioning of the IRAM 30 m telescope on Pico Veleta, near Granada, Spain, during 1984 – 85. In the period shortly thereafter, his aid was greatly appreciated in some of the first observations with the MPIfR bolometer on the 30 m telescope.

In 1987, because of Jörn Wink's previous experience in interferometry, he was delegated from the MPIfR to work at the Institut de Radio Astronomie Millimétrique (IRAM), in Grenoble, France, which was about to enter the commissioning and testing phase of the first two 15 m antennas of its interferometer on Plateau de Bure, France. During this commissioning period, Jörn Wink was a member of the team who found the first fringes with two antennas of the Plateau de Bure interferometer on the night of 14 December 1988.

The scientific interests of Jörn Wink were wide-ranging, and his very friendly personality attracted many other astronomers to include him as a highly valued partner in their observing groups. At Effelsberg, he collaborated on projects on radio recombination lines of hydrogen and helium in galactic H II regions and their implications for element and isotope gradients in the Galaxy. With the arrival of the 30 m telescope, he continued his studies of galactic H II regions and molecular clouds, and worked with Peter Mezger and Robert Zylka in an extended series of observations of the millimeter continuum emission from the galactic center region.

After the commissioning of the IRAM interferometer, Jörn Wink was fascinated by the application of the new instruments in the millimeter range to many different domains of astronomy. More than half of his 70 scientific publications were published in this period (the 1990's). He worked with I.F. Mirabel on the galactic micro-quasars 1740.7−2942 and GRS 1915+105, as well as on CO in interacting galaxies, he cooperated with several colleagues in observations of high-redshift objects, including a study of CO in the quasar 3C 48, and he participated in several VLBI experiments, including the first successful VLBI experiment between Pico Veleta and Plateau de Bure at 1.4 mm.

His main interest during the late 1990's, however, was the observation of comets, and in particular the detection of molecules and dust from comets at millimeter wavelengths. He was co-author on numerous papers dealing with detections of mm lines and continuum from comets Hyakutake and Hale-Bopp. Of these studies, he considered his main achievements in the last years of his scientific career to be the first interferometer detection of the radio continuum emission from any comet, namely Hale-Bopp, with the IRAM interferometer, and the first direct radio size measurement of any cometary nucleus.

Jörn Wink remained an enthusiastic scientist throughout his life, and even during his terrible illness, kept up an active interest in developments at both of the IRAM telescopes. He was a colleague who was highly valued and respected because of his high standards of professional correctness, his meticulous approach to observations and data reduction, and above all, because of his great generosity in helping other astronomers, young and old, in the best ways of observing, analysing data, and understanding their observations. He will be sorely missed in both IRAM and in the wider millimeter astronomy community.

Dennis DOWNES

News from the 30m Telescope

Remote Observing

The remote observing station at the MPI für Radioastronomie in Bonn has been used on various occasions. We have connected it via internet when the available bandwidth was high (e.g. on weekends). Otherwise it can be switched rapidly to a digital telephone line. Observers from the Bonn area who are interested to use this facility should contact Frank Bertoldi (bertoldi@mpifr-bonn.mpg.de) or Dirk Muders (muders@mpifr-bonn.mpg.de).

We are planning a fourth remote station (after Granada, Grenoble and Bonn) at the ENS in Paris. We hope to have it operational by the end of this year.

Remote observers might be interested in our web-camera which delivers online pictures of the Pico Veleta sky (accessible from our home page http://www.iram.es).

Rainer MAUERSBERGER

Winter Transport

Every frequent visitor to the Pico Veleta telescope knows that winter transport is often a challenge. If you as an observer plan to come with more colleagues than strictly necessary, please ask the station manager (mauers@iram.es) or the scheduler (thum@iram.fr) for authorisation, even if these observers are paying for their stay.

If transport conditions are difficult, we might ask those "extra" observers to stay in Granada and make use of our remote observing station.

Rainer MAUERSBERGER

Transport Schedule

In winter 2000 – 2001, transports between Granada and the observatory on Pico Veleta are organized according to the time table below. Maximum snow car capacity is 11 people.

	Departure Granada – Veleta	Departure Veleta – Granada
Mon	8:15	10:45
Tue	8:15	10:45 and 16:15
Wed	**no transport**	
Thu	7:00 (people & goods)	10:00 and 16:15
Fri	8:15	10:45 and 16:15

Javier LOBATO

Observer Comments

The comment sheets received from visiting astronomers are a valuable feedback for the IRAM 30m staff to further improve the hardware, software and service at the 30m telescope. We read them carefully and try to answer them individually.

Now the Observers' Comment Sheets can be filled out electronically, which makes it easier for us to distribute them to the staff involved. The corresponding web page can be accessed under the URL http://www.iram.es/forms/ocs/ocs.html ; alternatively any comment can be sent by conventional E-mail to ocs@iram.es . Just give it a try.

Rainer MAUERSBERGER

Secondary calibrators for bolometer observations

In order to calibrate bolometer observations one needs to compare them to the measurement of a source with a well known flux. The best calibrators are Mars and Uranus but since they are not always visible, it is desirable to have a group of "secondary" calibrators, i.e. objects which are calibrated with respect to the planets, and that can be observed at any LST.

For this purpose we have observed in spring 1999 and spring 2000 a group of secondary calibrators. The measurements included mapping of the objects in order to determine their shape and extent and On/Off measurements yielding their flux density per beam.

The summary of these observations, including tables of flux densities per beam for the secondary calibrators, is now available for observers under the following URL: (http://www.iram.es/Telescope/manuals/Report/-second_calib.ps)

Ute LISENFELD

A Fast-Mapping Method for Bolometer Arrays: Commissioning tests

Introduction

In the August 1999 IRAM Newsletter we presented a "fast-mapping method" for array receivers at the 30-m Telescope (see [1]). After initial successful tests, there were some open questions left, like: 'Do we observe any beam broadening due to fast mapping? How does the noise in a map decrease with increasing integration time?' Furthermore we want to demonstrate this method by doing a large map of more than an hour integration time. With this questions in mind we applied for test time. The results are summarized below.

The method

This method works best with closely packed hexagonal arrays. There is no need to de-rotate the array or to choose a particular scanning direction. Here we apply this method to the MPIfR 37-channel bolometer MAMBO II mounted in the Nasmyth focus of the IRAM 30-m. From Fig. 1 of our previous report [1], we may distinguish two different arrangements of pixels:

- At 30 and 90 degrees elevation we have 7 rows with a separation $D = 18''$. In order to obtain a map sampled $\delta = 4''$ in elevation we choose an increment in elevation of $\Delta E = D + \delta = 22''$. Consider a single scan-line (subscan). For simplicity let the first row of the array be at elevation offset 0, we can write down the following table of elevation offsets for three subscans:

sub-scan	row n	row n-1	row n-2	...	row n-7
1	0	$-D$	$-2D$	...	$-7D$
2	$D+\delta$	δ	$-D+\delta$	...	$-6D+\delta$
3	$2(D+\delta)$	$D+2\delta$	2δ	...	$-5D+2\delta$
			$\vdots$		

  and so on. We see that after 6 subscans we have sampled the elevation offset 5δ and thus the final map will be fully sampled in elevation. Thus the minimum map size in elevation is 6 subscans and the array should have more than 6 rows.
- At 0 and 60 degrees elevation we have 13 rows with a separation $0.56\,D \sim 10''$. An increment of $22''$ in elevation results in a map sampled better than $2''$ where the gaps are filled in with every other row of pixels. Here we also need 6 subscans or more and more than 11 rows of pixels.

Observations

On 12th February 2000 we had 7 hours of observing time. During the first hour the weather was too bad to observe, afterwards the opacity improved rapidly (tau 0.12 at the end of the session!) A rapid change in opacity often indicates that the atmosphere is not yet settled, indeed, we had some anomalous refraction that led to the large restoration residuals visible in the maps of the strong sources (see Fig. 2). All maps were done chopping the sub-reflector at a little less than 2 Hertz, scanning in Azimuth at $6''$ per second. For the normal maps we used $4''$ as increment in elevation and $22''$ for all fast maps.

Results

We have mapped a weak point-like source of about 80 mJy peak flux density several times, once using "normal mapping" and four times using "fast mapping" All four fast maps were averaged and the result shown in Fig. 1a. The normal map, shown in Fig. 1b, is equivalent to 11% more integration time compared to the average of 4 fast maps. On the right side we show the distribution of weights in the map, it is proportional to the number of points added per unit area, which in turn is proportional to the integration time. From this distribution we see that it is of advantage to map the same field at several hour angles, in particular for fast mapping as the distribution is not very uniform. In case of "deep" mapping the wider distribution of weights in a fast map may be of advantage and at the end may lead to a less centered distribution of weights. Mapping the same field in azimuth and elevation leads to a larger area mapped, say with weights > 90%. We computed the RMS noise in the maps over a small 'source free' region near the center of a map. The resulting RMS noise is shown for some combination of maps in Fig. 1c. From left to right the resulting noise for the average of 1, 2, 3 and 4 fast maps, the normal map and the average of all maps is plotted against $\sqrt{(integration\ time\ in\ minutes)}$. The flattening of the slope near the end may well indicate the confusion limit, which is probably quite high since some faint extended emission is visible in this field.

In Figure 2 we show a normal and a fast map of Saturn (Fig. 2a and b). The maps were interpolated onto a Azimuth/Elevation grid. The diagonal elongated structures are caused by the quadripod sub-reflector support legs,

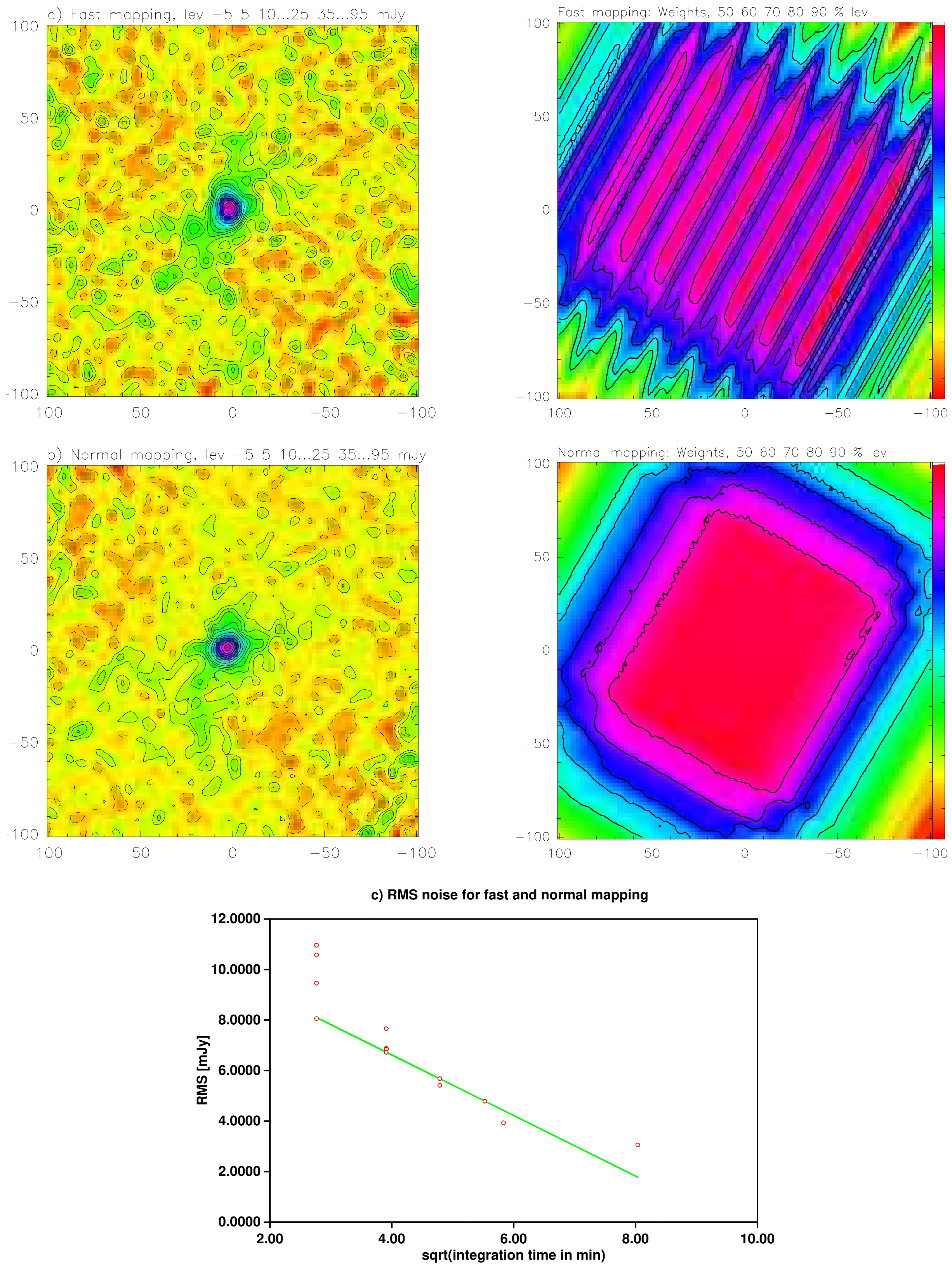
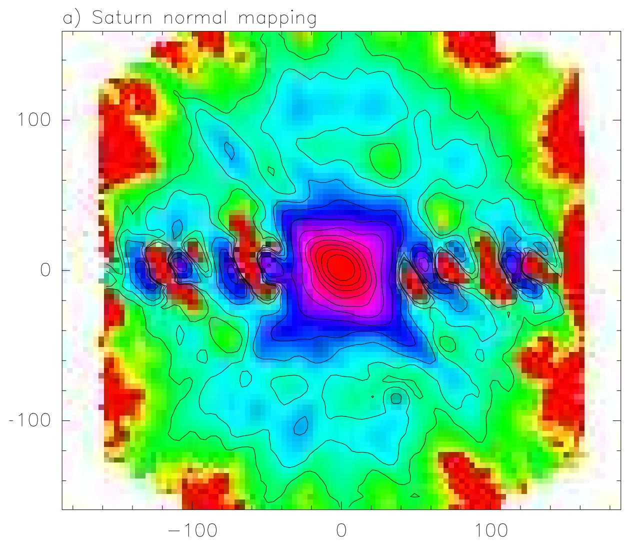
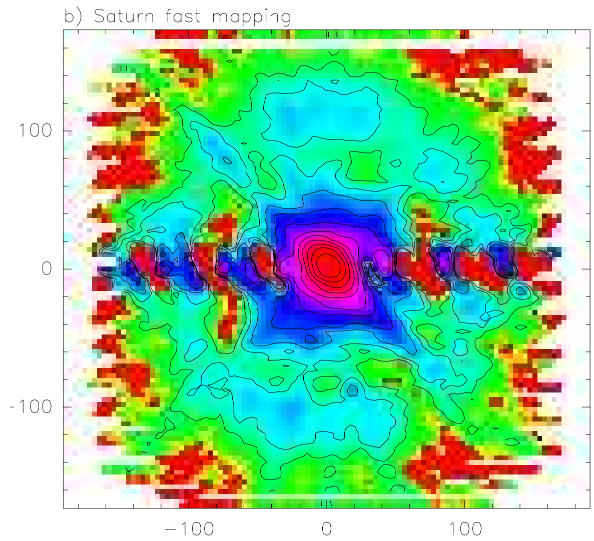


Figure 1: An example of mapping a faint source in two different ways. In Fig. **a** four fast coverages are averaged, in **b** a single 'normal' coverage is shown. In Fig. **c** the measured RMS noise is shown obtained in 1, 2, 3 and 4 'fast' maps as well as for the 'normal' map and the average of all 5 maps is shown. The line shown has a slope of -1, indicating that the RMS noise reaches the confusion limit for the longest integration.





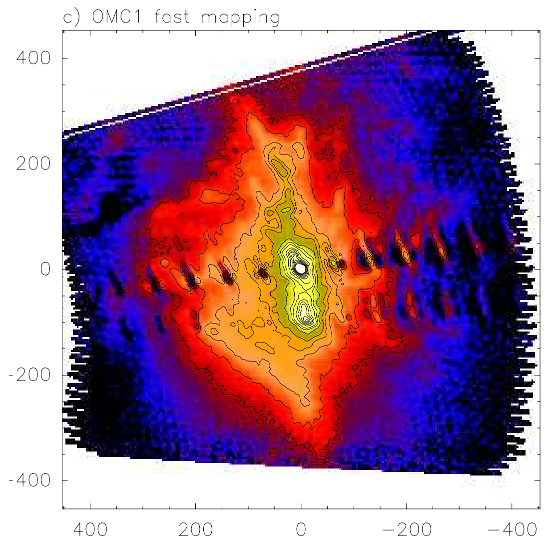


Figure 2: **a** shows a 'normal' map and **b** a fast map of Saturn. The contour levels are 0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8, 25.6 and 50% of the peak. Figure **c** shows a 13.5 by 10 arc minute map of Orion OMC1. The contour levels correspond to 0.5, 1, 2, 3, 4, 6, 8, 10, 15 ... 50 by 5% of the peak brightness.

these merge into a patchy ring of emission with diameter about 200″. These features agree well with those seen in holography maps, in spite of large disk of Saturn (18″ by 16″). The main beam is also well reproduced in the fast maps, comparing Gaussian fits to the main beam in our four Saturn maps showed a total variation of about 2%. This could easily be caused by changes in the opacity and we can only say that we did not detect any deterioration of the main beam due to fast mapping.

Finally in Fig. 2c we show a fast map of OMC1 in Orion. In Azimuth/Elevation we mapped a region of 800″ by 600″. At a scanning speed in azimuth of 6″/sec each subscan took about 133 seconds. With a spacing in elevation of 22″ the whole map consisted only of 29 subscans and took a little over 64 minutes to complete.

The Future

We successfully demonstrated a fast mapping method for closely packed hexagonal arrays with more than 19 pixels. This method will gain from more pixels, i.e. the weight distribution will be wider for fast maps and narrower for normal maps when comparing the upcoming 117 pixel bolometer array to the 37 pixel array.

One can improve the double beam restoration by combining the data of several fast maps done with different chopper throws by using a improved restoration method as described by Emerson and Payne 1995 [2].

Obviously this method can be used also with a fast scanning total power mode developed by the MPIfR in Bonn. In this case, a four-fold increased scanning speed of 24″ per second would allow to cover the region of the OMC1 map in Fig. 2 in 16 Minutes. You could map the full moon in about 1.5 hours!

Bibliography

[1] David Teyssier, Albrecht Sievers 1999, IRAM Newsletter Aug 1999 (http://www.iram.es/-Telescope/manuals/Report/Fast_bolo.ps)

[2] Emerson, D.T., Payne,J.M., 1995, Multi-Feed Systems for Radio-Telescopes, PASP, Vol. **75**, p. 332

Albrecht SIEVERS and David TEYSSIER

New Control System for the 30m Telescope: Status Report

Work on our plans for a New Control System (NCS) for the 30m telescope continues, and in many areas we have reached decisions about priorities, features, and solutions. Comments and input from all users and friends of the 30m are always very welcome and important.

Details and regular updates can be found on the WWW pages for this project which are situated at http://www.iram.es/FutureControl30M.

In the near future many older hardware components of the control system for the 30m telescope will be replaced by modern equipment. We take this as an occasion to consider very broadly the desired features of a new system including:

- observing modes,
- data acquisition, processing and archiving,
- well-documented modular system design to facilitate maintenance and further development,

while maintaining the many successful features of the current system. We expect that a core of high priority user features will form essential parts of the new system:

- observations with focal-plane arrays,
- continuous data taking, e.g., fast on-the-fly observations,
- remote observing, service observing, and flexibility of observing and scheduling.

Linked to these core features is a need to:

- foresee very large data rates,
- optimize the standard observing modes and make them easy to use,
- automate where possible.

Major tasks to be achieved for this project then are:

- replace the old hardware and operating systems, in particular:
  - CAMAC by VME,
  - Vax/VMS by solutions using Unix, in particular Linux,
- design and implement a new, modular control system,
- improve current observing modes in terms of flexibility, convenience, and data quality,
- design, test, and implement new observing modes,
- support all new and old features through a unified, flexible and easy user interface,
- support the new features of the control and data acquisition system by corresponding new developments in the data processing software,
- prepare the system for foreseeable new hardware, e.g., in the areas of antenna sub-components, receivers, and backends.

Observing modes and user commands for the New Control System are described in:

"New Control System for the 30m Telescope: Specifications: Observing Modes and User Commands"
http://www.iram.es/FutureControl30M/ Specifications/-Spec_ OM
Revision: Spec_Observing_Modes, V 1.0
Date: 2000-09-18

The current version still contains open questions, but in the meantime we have reached decisions on these and on priorities; they will be included in the next revision of this document (V 1.1).

Our discussions and decisions on several specific and technical issues important for the NCS are reported in documents by working groups (WG). They are posted at the same WWW site, in directories dedicated to each WG topic, and include:

"NCS 30m: WG Data"
http://www.iram.es/FutureControl30M/wg_data/

Of particular interest for users of the 30m is probably the document on raw data, "on-line" data processing, data format and archiving:

"DATA: Requirements, Specifications":
http://www.iram.es/FutureControl30M/wg_data/-ReqSpec/
Revision: ReqSpec.html , V 1.01
Date: 2000-11-07

"NCS 30m: WG Frontend and Backend Control"
http://www.iram.es/FutureControl30M/wg_fe_be/

"NCS 30m: WG Telescope (Antenna) Control"
http://www.iram.es/FutureControl30M/wg_telescope/

"NCS 30m: WG Synchronization"
http://www.iram.es/FutureControl30M/wg_synchron/

"NCS 30m: WG System Architecture"
http://www.iram.es/FutureControl30M/wg_sa/

"NCS 30m: WG VME Computer Systems"
http://www.iram.es/FutureControl30M/wg_vcs/

Hans UNGERECHTS

Plateau de Bure Interferometer Status

Since the helicopter accident on December 15th, 1999, no astronomical observations have been carried out with the Plateau de Bure Interferometer. Only observations aiming at testing thoroughly the instrumentation and the recently installed new cross-correlator have been made during these months. The antenna maintenance is now over and regular astronomical observations have restarted, as of December 1, 2000. Users of the Plateau de Bure Interferometer will independently be informed about the restart of the astronomical activities in the days to come.

Observations

As announced in the previous issue of the IRAM Newsletter, the CD (C2+D) set of configurations has been planned for the winter period: for practical reasons the interferometer has been moved recently to the C2 configuration and will be moved (depending on weather conditions) to the compact D configuration shortly after the middle of January, 2001. This means that projects aiming at deep integrations and mapping in the D-configuration can certainly not be completed before.

Though regular astronomical observations will be carried out all over the winter period, the safety of the personnel and of the instrumentation will take precedence over observations. For the time being and for the whole winter period, teams consisting of a mechanic, an electrician, a cook, two operators and an astronomer will operate on a weekly basis at the Plateau de Bure observatory to guarantee a regular astronomical activity. We are confident of scheduling all the A-rated projects, but even under best circumstances the number of B-rated projects that can be carried out will be small. We will do our best to keep investigators informed about the status of their projects all along the winter period.

Maintenance and Installation of the New Correlator

The interferometer was thoroughly maintained during the summer period. Time has essentially been invested to repair and replace equipment, to measure the surface of the antennas and to improve the alignment of the subreflectors. Noteworthy are the replacement of the aluminium subreflector of antenna 3 and, in connection with our plans to extend the capabilities of the Plateau de Bure interferometer, the replacement of the five antenna correlator. The new correlator was installed at the beginning of September and tested extensively during the months of October and November. The new facility was designed to serve on the long-term the six antenna array and the forthcoming generation of broadband receivers, and allows phased array operation for a future VLBI station. As it is largely improving on the old correlator, many of the winter programs will benefit of its extended performance. Noteworthy are the correlator capability to cover simultaneously and completely both receiver passbands (the correlator frequency coverage is 2.4 GHz in total), and the fact that any of the eight correlator units is now able to provide the 40 KHz spectral high resolution mode over a 20 MHz bandwidth.

Roberto NERI

Scientific Results in Press

Warm H_2 in the Galactic center region

N.J. Rodríguez-Fernández([1]), J. Martín-Pintado([1]), A. Fuente([1]), P. de Vicente([1]), T.L. Wilson([2]),([3]) and S. Hüttemeister([4])
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Abstract:
We present ISO observations of several H_2 pure-rotational lines (from S(0) to S(5)) towards a sample of 16 molecular clouds distributed along the central $\sim$ 500 pc of the Galaxy. We also present $C^{18}O$ and ^{13}CO $J = 1 \rightarrow 0$ and $J = 2 \rightarrow 1$ observations of these sources made with the IRAM-30m telescope. With the CO data we derive H_2 densities of $10^{3.5-4.0}$ cm^{-3} and H_2 column densities of a few 10^{22} cm^{-2}. We have corrected the H_2 data for $\sim$ 30 magnitudes of visual extinction using a self-consistent method. In every source, we find that the H_2 emission exhibits a large temperature gradient. The S(0) and S(1) lines trace temperatures (T) of $\sim$ 150 K while the S(4) and S(5) lines indicate temperatures of $\sim$ 600 K. The warm H_2 column density is typically $\sim 1 - 2 \times 10^{22}$ cm^{-2}, and is predominantly gas with T=150 K. This is the first direct estimate of the total column density of the warm molecular gas in the Galactic center region. These warm H_2 column densities represent a fraction of $\sim$ 30% of the gas traced by the CO isotopes emission. The cooling by H_2 in the warm component is comparable to that by CO. Comparing our H_2 and CO data with available ammonia (NH_3) observations from literature one obtains relatively high NH_3 abundances of a few 10^{-7} in both the warm and the cold gas. A single shock or Photo-Dissociation Region (PDR) cannot explain all the observed H_2 lines. Alternatives for the heating mechanisms are discussed.

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NbN_X Thin Film Resistors for Cryogenic Application

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Abstract:
We report on the deposition and characterization of highly resistive NbN_X films for cryogenic planar resistors. Radio frequency (RF) sputtering of Nb in a N_2/Ar mixture resulted in films with a temperature independent resistivity of 220 $\mu\Omega \cdot$ cm for temperatures down to at least 2.3 K. Sheet resistances of 25 $\Omega/\square$ were obtained for films of 90 nm thickness, which implies the application of even thicker films, advantageous for step-edge coverage, thickness tolerances, and interface effects. The films are thermally stable up to 200°C and exhibit only minor surface oxidation. Both the film deposition and trimming by reactive ion etching (RIE) will be described.
Keywords: Sputtering –Electronic devices – Niobium nitride – Resistors

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High-resolution observations at $\lambda = 3$ mm of the OH 231.8+4.2 molecular outflow

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Abstract:
We present high spatial resolution observations of HCO^+ (J= $1-0$), SO (J= $22-11$), $H^{13}CN$ (J=1-0), SiO (v= 1, J= $2-1$), and the continuum at 3 mm from OH 231.8+4.2, taken with the IRAM interferometer at Plateau de Bure. We also report the first detection of NS in circumstellar envelopes. The overall distribution of the emission of all molecules (except for HCO^+ and the SiO maser) is similar to that of CO. The most intense emission arises from a compact, slowly-expanding component around the central star. The rest of the emission comes from gas distributed in a narrow region along the symmetry axis, that flows outwards following a velocity gradient also similar to that found in CO. Our observations show with high accuracy the distribution of the HCO^+ intensity, that is found to be very clumpy and strongly enhanced in the

shock-accelerated lobes. We argue that such a distribution is due to the efficient formation of this molecule by shock-induced reactions. An expanding disk or ring around the central star is detected from the SO emission. The characteristic radius and expansion velocity of this structure are $2\,10^{16}$ cm and $6-7\,\mathrm{km\,s^{-1}}$, respectively. The SiO maser emission could arise from the innermost parts of such a disk. The 3 mm continuum emission seems to be due to cold dust (~ 20 K) distributed in the lobes of object OH 231.8+4.2 as well as from warmer (~ 55 K) dust located in a compact region surrounding the central star.

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A ridge of recent massive star formation between Sgr B2M and Sgr B2N

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Abstract:
We present single dish and interferometric maps of several rotational transitions of HC_3N vibrationally excited levels towards Sgr B2. HC_3N is a very suitable molecule to probe hot and dense regions (hot cores) affected by high extinction since its vibrational levels are mainly excited by mid-IR radiation. The single dish maps show, for the first time, that the HC_3N vibrationally excited emission ($HC_3N^\star$) is not restricted to Sgr B2M and N but extended over an area $40'' \times 20''$ in extent. We distinguish four bright clumps (Sgr B2R1 to B2R4) in the ridge connecting the main cores Sgr B2M and Sgr B2N, and a low brightness extended region to the west of the ridge (Sgr B2W). The physical properties and the kinematics of all hot cores have been derived from the $HC_3N^\star$ lines. Our high angular resolution images show that the Sgr B2N hot core breaks in two different hot cores, Sgr B2N1 and N2, with different radial velocities and separated by $\sim 2''$ in declination. We find that the excitation of the $HC_3N^\star$ emission in all hot cores can be represented by a single temperature and that the linewidth of the $HC_3N^\star$ rotational lines arising from different vibrational levels systematically decreases as the energy of the vibrational level increases. The systematic trend in the linewidth is likely related to the increase of the velocity as the distance to the exciting source increases. We have developed a simple model to study the excitation of the HC_3N vibrational levels by IR radiation. We find that the single excitation temperature can be explained by high luminosities of embedded stars ($\sim 10^7\,L_\odot$) and small source sizes ($\sim 2-3''$). The estimated clump masses are 500 $M_\odot$ for Sgr B2M, 800 $M_\odot$ for Sgr B2N and 10-30 $M_\odot$ for Sgr B2R1 to B2R4. Luminosities are $1-2\,10^6$ $L_\odot$ for Sgr B2R1-B2R4 and Sgr B2M and $10^7\,L_\odot$ for Sgr B2N. We estimate HC_3N abundances of $5\,10^{-9}$ for Sgr B2M and Sgr B2N2 and 10^{-7} for the rest of the hot cores. The different HC_3N abundances in the hot cores reflect different stages of evolution due to time dependent chemistry and/or photo-dissociation by UV radiation from nearby HII regions. According to the mass and the luminosity of the different hot cores, we propose that Sgr B2M and B2N contain a cluster of 20-30 hot cores, each like that in Orion A, a number similar to the UC HII regions already detected in the region. The Sgr B2R1-B2R4 hot cores represent isolated formation of massive stars.

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