Institut de Radioastronomie Millimétrique
Institut für Radioastronomie im Millimeterbereich
Instituto de Radioastronomía Milimétrica

Newsletter

Number 72 February 25, 2009

Contents

Calendar

March 12th, 2009 17:00h CET (UT+1 hour):
Deadline for the submission of IRAM observing proposals for the period from 01 June 2009 - 30 November 2009.

20-21 April, 2009
Program committee meeting

04-11 September, 2009
Fifth IRAM Summer School in Pradollano (Sierra Nevada, Spain)

28-30 September, 2009
International conference at IRAM Grenoble: To the Edge of the Universe: 30 years of IRAM

Introductory Remarks

As in the past years, 2008 has been a very productive and rewarding year for IRAM. At both the 30-meter telescope and the Plateau de Bure interferometer, numerous observations have led to a series of successful projects and exciting discoveries. Most notably, key results have been obtained on galaxies and quasars at high redshifts, studies around young stars have led to new detections of proto-planetary disks and a better understanding of their morphology, and kinematics and chemistry and maps of nearby galaxies have revealed the details of the distribution of the molecular gas to unprecedented sensitivity levels. Planned improvements on both facilities will increase their sensitivities and possibilities even further.

Next month, a major upgrade will take place at the 30-meter telescope with the installation and commissioning of a new series of dual polarization wide-bandwidth receivers operating at 3, 2, 1, and 0.9 mm. These new receivers, called EMIR (**E**ight **MI**xer **R**eceiver), will replace the current single pixel receivers and be made available for general use during the next semester. EMIR will provide a long-awaited boost in sensitivity and observing capabilities at the 30-meter. For the first time, EMIR will offer at the 30-meter a permanently available receiver that, under good weather, will operate in the 330 GHz atmospheric window. The 150 and 230 GHz receivers have SSB mixers with a single sideband available at a time, while the 90 and 330 GHz receivers operate in 2SB mode and both of their sidebands can be connected to the backend. The three upper frequency receivers have 4 GHz of instantaneous bandwidth; the 90 GHz receiver offers 8 GHz instantaneous bandwidth per sideband and polarization. Further technical details and characteristics of these new receivers are provided in the Call for Proposals, a short version of which is published in this Newsletter.

Later in the year, the Plateau de Bure interferometer will be equipped with a new broadband correlator (WIDEX) that will enable to fully take advantage of the 4 GHz bandwidth of the new receivers that were installed in 2007 and 2008. The sensitivity in the continuum will be increased accordingly and the large coverage in velocity will ease the search for emission lines in high-z objects as well as provide new possibilities for line detections in galactic sources.

As foreseen, the replacement of the carbon fiber panels of the Plateau de Bure antennas with aluminum panels has started last summer. Antenna 4 was successfully refurbished and today it is operating with a surface accuracy of better than 50 microns. The next three antennas, still equipped with carbon fibers panels, will be refurbished in the coming years during the summer maintenance periods.

Finally, a major event occurred at the end of last year with the selection of a company to rebuild the Plateau de Bure cable-car. The Austrian-Italian company LEITNER, a world leader in the transport by cable, was selected and the contract was signed early January 2009. The construction will start this spring with the goal to have a cable-car fully operational at the beginning of 2010. This major decision marks an important date for the institute and for its future. I would like to warmly thank all those who have contributed to this success as well as the IRAM Partners and the Executive Council who have, by their support, made this decision possible.

Pierre COX

To the Edge of the Universe: 30 Years of IRAM

An international Conference to be held in Grenoble on September 28-30th, 2009

The year 2009 marks the 30th anniversary of the creation of IRAM. The institute was founded in 1979 by the French CNRS, the German MPG and the Spanish IGN - initially an associate member, becoming a full member in 1990. The story of IRAM represents a trailblazing European scientific and technical partnership that has set standards in millimeter radio astronomy.

Both of IRAM's observatories, the 30-meter telescope and the interferometer on the Plateau de Bure, are prime facilities for radio astronomy and the most powerful observatories today operating at millimeter wavelengths. The institute is also a worldwide leader in technical expertise related to high frequency technology, from ultra-sensitive super-conducting detectors to complex receiver systems, high-speed digital electronics and advanced data reduction software. Providing manufacture and supply devices to other radio astronomy centers, IRAM has highly valued partnerships with space agencies and is a major partner in the ALMA project.

Over the last 30 years, the IRAM telescopes have been at the origin of a large number of spectacular results. The goal of the conference 'To the Edge of the Universe: 30 years of IRAM' is to review the main results, obtained with the IRAM telescopes, from cosmology to the solar system and to present the technical developments that enabled these observations. The impact of these advances on millimeter and sub-millimeter astronomy will be discussed and future plans for upgrading the IRAM telescopes will be outlined.

Figure 1: Participants of the sixth IRAM millimeter interferometry school.

The celebration of IRAM's 30 years will be an opportunity to discuss new scientific horizons that will be opened by the next generation of radio telescopes and to explore the role that IRAM will continue to play in this new and fast evolving landscape.

Further information about the conference will soon be available on IRAM's web page.

Pierre COX

Pre-Announcement: 5th Millimeter Observing School in Pradollano

IRAM is currently preparing the 5th Millimeter Observing School which will take place in September 4-11, 2009 in Pradollano (Sierra Nevada, Spain).

This fifth school in IRAM Spain is aimed at attracting new astrophysicists to current and future single-dish mm-, submm-, and far-infrared telescopes. Applications will be accepted from young scientists with little previous experience in mm-astronomy. The course is limited to about 40 students, who will be selected on the basis of their interests, CV, and references.

Details will be announced as soon as possible on the 30m homepage at http://www.iram.es/IRAMES and in future issues of the IRAM Newsletter.

Carsten KRAMER

Sixth IRAM millimeter interferometry school

The sixth IRAM millimeter interferometry school took place in Grenoble, October 6–10 2008. This event marked the 10th anniversary of the first millimeter interferometry school that was organized in June 1998. Since then, a school has been held every two years.

This year, about 70 particpants attended the school (Fig. 1) - but 108 applications were received, from astronomers of 23 different countries (+ ESO). These large numbers show that this school series is now well established in the community, and that the performances of the Plateau de Bure interferometer and the construction of ALMA increase the number of astronomers interested in millimeter interferometry. This school was supported by RadioNet.

The lectures presented the millimeter interferometry techniques, the data calibration and imaging procedures, the Plateau de Bure interferometer, and ALMA (and the ALMA Regional Center). Tutorials were also organized to allow participants to calibrate Plateau de Bure data. The presentations shown during the week are now available on-line at: http://www.iram.fr/IRAMFR/IS/school.htm

The next IRAM millimeter interferometry school will be organized in 2010.

Frédéric GUETH

Proposals for IRAM Telescopes

The deadline for submission of observing proposals on IRAM telescopes, both the interferometer and the 30m, is

March 12th, 2009 17:00h CET (UT+1 hour)

The scheduling period extends from 01 June 2009 - 30 November 2009. Proposals should be submitted through our web–based submission facility. Instructions can be found on our web page at URL:

http://www.iram.fr/GENERAL/
submission/submission.html

Detailed information on time estimates, special observing modes, technical information and references for both the IRAM interferometer and the IRAM 30m telescope can be found on the above mentioned web page. The submission facility will be opened about three weeks before the proposal deadline. Proposal form pages and the 30m time estimator are available now.

Please avoid last minute submissions when the network could be congested. As an insurance against network congestion or failure, we still accept, in well justified cases, proposals submitted by:

– fax to number: (+33) 476 42 54 69 or by
– ordinary mail addressed to:
IRAM Scientific Secretariat,
300, rue de la Piscine,
F-38406 St. Martin d'Hères, France

Proposals sent by e–mail are not accepted. Color plots will be printed/copied in grey scale. If color is considered essential for the understanding of a specific figure, a respective remark should be added in the figure caption. The color version may then be consulted in the electronic proposal by the referees.

Soon after the deadline the IRAM Scientific Secretariat sends an acknowledgement of receipt to the Principal Investigator of each proposal correctly received, together with the proposal registration number. Note that the web facility allows cancellation and modification of proposals before the deadline. The facility also allows to view the proposal in its final form as it appears after re–compilation at IRAM. We urge proposers to make use of this feature as we always receive a number of corrupted proposals (figures missing, blank pages, etc.).

Valid proposals contain the official cover page, one or more pages of technical information, up to two pages of text describing the scientific aims, and up to two more pages of figures, tables, and references. Normal proposals should *not exceed 6 pages*, except for additional technical pages. Longer proposals will be cut. We continue to call for **Large Observing Programmes** as described by P. Cox below. The Large Programmes may have up to 4 pages for the scientific justification, plus cover page, the technical pages, and 2 pages for supporting material.

Both proposal forms, for the 30m telescope and for the interferometer, have been changed considerably for the current deadline. In fact, we now have different template files for the two telescopes, `prop-pdb.tex` and `prop-30m.tex`. Please, **make absolutely sure to use the current version** of these files and the common LaTeX style file `proposal.sty`. All three files may be downloaded from the IRAM web pages[1] at URL http://www.iram.fr/GENERAL/submission/proposal.html. Do not change the font type or size, and do not manipulate the style file. In case of problems, contact the IRAM secretary. (e–mail: `berjaud@iram.fr`).

In all cases, indicate on the proposal cover page whether your proposal is (or is not) a *resubmission* of a previously rejected proposal or a *continuation* of a previously accepted interferometer or 30m proposal. We request that the proposers describe very briefly in the introductory paragraph (automatically generated header "Proposal history: ") why the proposal is being resubmitted (e.g. improved scientific justification) or is proposed to be continued (e.g. last observations suffered from bad weather).

Short spacing observations on the 30m telescope can now be requested directly on the interferometer proposal form. A separate proposal for the 30m telescope is not required. The interferometer proposal form contains a bullet, labelled "short spacings" which should then be checked. The user will be prompted to fill in an additional paragraph in which the scientific need for the short spacings should be described. It is essential to give here all observational details, including size of map, sampling density and rms noise, spectral resolution, receiver configuration and time requested.

A mailing list has been set up for astronomers interested in being notified about the availability of a new Call for Proposals. A link to this mailing list is on the IRAM web page. The list presently contains all users of IRAM telescopes during the last 2 years.

J.M. WINTERS & C. THUM

Large observing programs

IRAM offers the possibility to apply for observing time in the framework of a *Large Program* for the 30-meter telescope and the Plateau de Bure interferometer.

A Large Program should require a minimum of 100 hours of observing time, spread over a maximum of two years, i.e. 4 contiguous semesters. In the next two years, IRAM will accept a limited number of Large Programs to be carried out per semester and instrument (30-meter and

[1] Please note that we have stopped mirroring between the two IRAM web sites in February 2009. It was felt that the reliability and speed of the Internet has evolved to a point where the mirroring is not necessary any more.

Plateau de Bure interferometer), allocating a maximum of 30% of observing time to such projects.

The Large Program should address strategic scientific issues leading to a breakthrough in the field. Large Programs should be coherent science projects, not reproducible by a combination of smaller normal proposals.

The Large Program proposals should contain a solid management plan ensuring an efficient turnover, including data reduction, analysis, and organization of the efforts.

Because of the large investment in observing time, but also of the inherent support from IRAM, it is advised that Large Programs involve one or more IRAM internal collaborators.

During the execution period of the Large Programs (ideally before mid-term), the team leading the Large Program should report to IRAM about the preliminary results and possible technical difficulties, so that IRAM could assess the progress made, assist with any problems encountered in the course of the observations, and, if needed, adjust the program scheduling.

The proprietary period ends 18 months after the end of the last scheduling semester in which the Large Program was observed. The raw data and processed data then enter the public domain. An extension of this proprietary period may be granted in exceptional cases only. A corresponding request will have to be submitted to the IRAM director.

Because of the scope of the Large Programs and the need to explain the organization of the project, Large Program proposals will have a maximum length of 4 pages (not including figures, tables, or references), instead of the 2 pages for normal proposals. Large observing program proposals should be submitted using the standard proposal templates; just check the "Large Program" bullet on the cover page. The following sections should be included: i) Scientific Rationale, ii) Immediate Objective, iii) Feasibility and Technical Justification, and iv) Organizational Issues. For the Plateau de Bure interferometer, the latter section must include a consideration of sun avoidance constraints and configuration scheduling.

The scientific evaluation of the Large Program proposals will be done by the Program Committee at large (all 12 members, except if there is a direct implication of one the members in the proposal). External reviewers will be asked to evaluate Large Programs, if needed. In addition to the scientific evaluation, there will be an assessment of the technical feasibility by IRAM staff.

Note that a Large Program will either be accepted in its entirety or rejected, there will be no B–rating ("backup status") nor a partial acceptance/rejection of the proposal.

For the summer semester 2009, the call for Large Programs will be open for the 30m telescope and the Plateau de Bure interferometer. For the 30m telescope, Large Programs may consider using HERA and MAMBO, as well as EMIR with the exception of its 0.9 mm band.

Pierre COX

Travel funds for European astronomers

The European Framework Programme 6 (FP 6) which includes the RadioNet initiative has come to an end in 2008. In FP 7, a new RadioNet initiative has been accepted in which IRAM is involved with its two Observatories. A budget similar to the 2004 – 2008 period will be available for supporting travel by European astronomers through the Trans National Access (TNA) Programme.

As before, travel may be supported to the 30m telescope and to Grenoble for reduction of interferometer data. Detailed information about the eligibility, TNA contacts, policies, and travel claims can be found on the RadioNet home page at `http://www.radionet-eu.org`. The Principal Investigators of IRAM proposals eligible for TNA funding will be contacted as soon as the new Radionet programme has officially started and the corresponding funds are available.

Roberto NERI & Clemens THUM

Call for Observing Proposals on the 30m Telescope

Summary

Proposals for three types of receivers will be considered for this summer semester (01 June 2009 - 30 November 2009):

1. the new four band receiver EMIR consisting of dual–polarization mixers operating at 3, 2, 1.3, and 0.9 mm.
2. the 9 pixel dual–polarization heterodyne receiver array, HERA, operating at 1.3 mm wavelength.
3. The MAMBO-2 bolometer array with 117 pixels operating at 1.2 mm.

About 2000 hours of observing time are expected to be available. The emphasis will be put on observations at the longer wavelengths. The bulk of the 1.3 mm observations will be scheduled in October/November. Proposals for the 0.9 mm band of EMIR will not be considered for this deadline. A **separate Call** for 0.9 mm Proposals may be issued in May when the commissioning results for this highly weather dependent band will be available.

We continue to call for Large Programmes which may consider using HERA and MAMBO as well as the new receiver EMIR with the exception of its 0.9 mm band (see contribution by P. Cox earlier in this Newsletter).

What is new?

EMIR

The new generation single pixel heterodyne receiver for Pico Veleta, EMIR (**E**ight **MI**xer **R**eceiver), consisting of dual-polarization 4 GHz bandwidth mixers operating at 3, 2, 1.3, and 0.9mm, will be installed and commissioned during March/April 2009. During a large part of the five weeks installation and commissioning period, pooled observations will be made during night time.

EMIR not only provides large improvements in receiver noise temperature and bandwidth, it is also more complex than the old receivers. We therefore urge interested users to carefully study the detailed description below.

Observation time estimator

We have prepared a new 30m time estimator for EMIR. Starting with the feb02b release, it is part of the GILDAS software and accessible only via ASTRO. For downloading of the GILDAS package please go to the GILDAS web site and follow the instructions. Note that a *web based* estimator for EMIR will be made available only for the next deadline in September '09. As for HERA and MAMBO, the old web based time estimator is still available from the 30m web site.

Proposal form.

Motivated by the arrival of EMIR, the proposal form for the 30m telescope has been modified. It now collects the technical parameters of the requested observations in more detail on a separate *technical sheet* which is printed as the second page of the proposal. Note that the 30m telescope and the interferometer now have separate proposal templates.

In the following, we present the new receiver EMIR. The bolometer and HERA which continue to be operational as before are described in the full version of the Call for Porposals available on the IRAM web site.

EMIR

Overview

The new receiver **EMIR** (Fig. 2) is scheduled for installation and commissioning at the 30m telescope in March through April 2009. EMIR will replace the current single pixel heterodyne receivers A/B100, C/D150, A/B230, and C/D270. HERA, the bolometers, and the backends are unchanged. EMIR will provide a minimum instantaneous bandwidth of 4 GHz in each of the two orthogonal linear polarizations for the 3, 2, 1.3 and 0.9 mm atmospheric windows (Fig. 3). In addition to the vast increase in bandwidth compared to the old single pixel receivers, EMIR is expected to offer significantly improved noise performance, a stable alignment between bands, and other practical advantages.

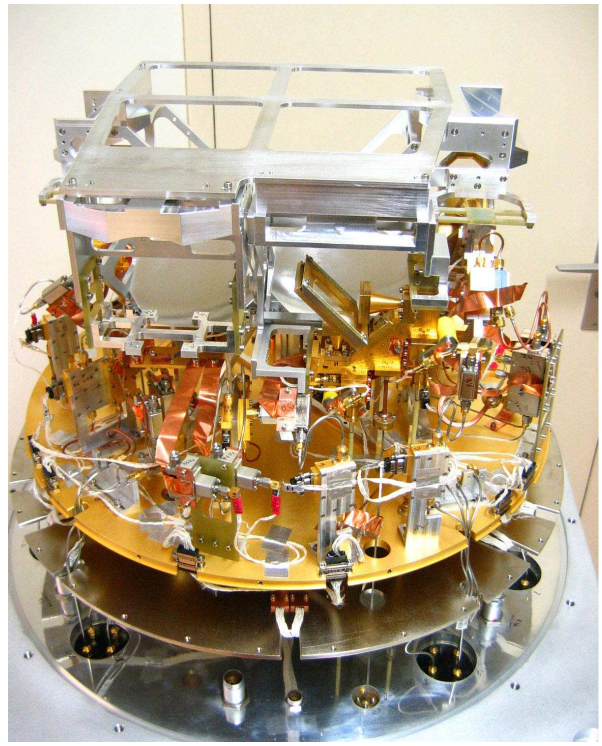

Figure 2: EMIR during final integration in the Grenoble receiver laboratory. One of the four dual–polarization mixer pairs is visible near the center of the photograph. The beams of the 4 mixer pairs leave the dewar through 4 separate windows towards the top of the figure. Warm optics (not shown) can combine some of the 4 beams for observation of the same position on the sky (see Tab. 1).

The four EMIR bands are designated as E 090, E 150, E 230, and E 330 according to their approximate center frequencies in GHz. While the E 150 and E 230 bands have SSB mixers with a single sideband available at a time, the E 090 and E 330 bands are operated in 2SB mode where both sidebands are available for connection to backends. Furthermore, the E 090 band uses a technology that offers 8 GHz instantaneous bandwidth per sideband and polarization. Both polarizations of a given band will always be tuned to the same frequency as they share a single common local oscillator. The tuning ranges of the 4 bands, the typical receiver noise temperatures, and other parameters as measured in the lab are listed in Tab. 1.

For the first time in the history of the 30m telescope, EMIR will provide a permanently available high sensitivity E 330 band, opening this atmospheric window for regular use under good weather conditions. However, as commissioning of this band will be difficult and time consuming during the summer semester, we do not offer the 0.9 mm band right now. A separate Call for 0.9 mm observations may be issued in May in case that commissioning of this band came to a positive conclusion.

Table 1: EMIR Frontend. Sky frequencies, F_{sky}, refer to the center of the IF band. 2SB – dual sideband mixers, SSB – single side band mixers, H/V – horizontal and vertical polarizations, T_{sb} is the SSB receiver temperature in single band observations (*left*). For dual–band observations, T_{db} includes a 15 K noise contribution from the dichroics (*right*).

EMIR band	F_{sky} GHz	mixer type	polari- zation	IF width GHz	T_{sb} K	G_{im} dB	combinations E 0/2	E 1/3	E 0/1	T_{db} K
E 090	83 – 117	2SB	H/V	8	50	> 13	X		X	65
E 150	129 – 174	SSB	H/V	4	50	> 10		X	X	65
E 230	200 – 267	SSB	H/V	4	50	> 13	X			65
E 330	260 – 360	2SB	H/V	4	70	> 10		X		85

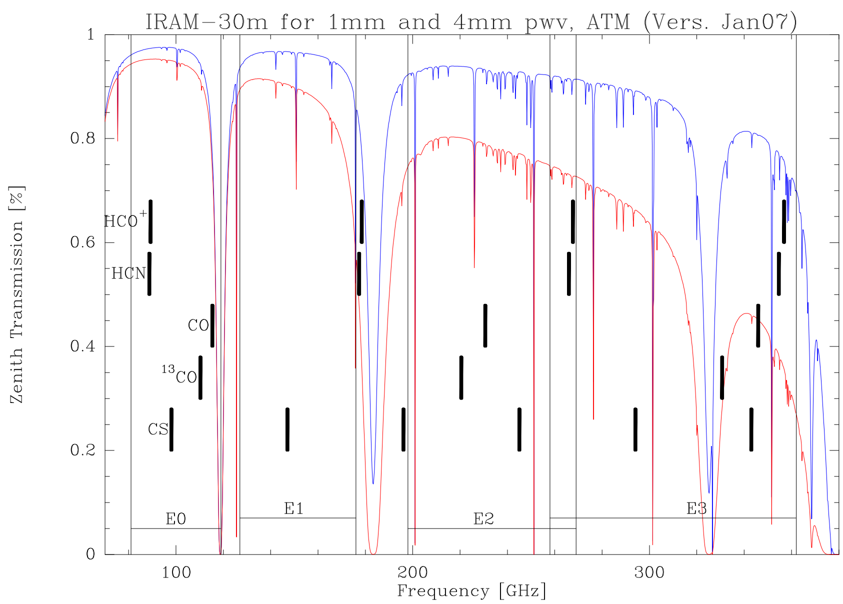

Figure 3: Atmospheric transmission at the 30m site between 60 and 400 GHz for 1 and 4mm of precipitable water vapor, derived from the ATM model. The EMIR bands are indicated and the frequencies of a few important molecular transitions are marked.

At the time of writing, EMIR is undergoing final tests in the receiver laboratory. Precise figures of EMIR's performance at the telescope will not be known before the proposal deadline. The Observatory will make the results of the commissioning available as soon as possible on the 30m web site. The interested astronomer may also find more detailed technical information on EMIR under this URL. IRAM staff is also be available to help astronomers with the preparation of EMIR (and other) proposals.

Selection of EMIR bands

Before reaching the Nasmyth mirrors, the four beams of the EMIR bands pass through warm optics that contain switchable mirrors and dichroic elements for redirection of the beams towards calibration loads and for combining beams. In its simplest mode, the warm optics unit selects one single EMIR band for observation. This mode avoids the use of the slightly lossy dichroic elements and therefore offers the best receiver noise temperatures.

Three dichroic mirrors are available for combining either the E 090 and E 150 beams, or the E 090 and E 230 beams, or the E 150 and E 330 beams (Tab. 1). The combination of bands is not polarization selective, i.e. the combined bands will stay dual polarization. The loss of these dichroics which is small over most of the accessible frequency range, increases however the receiver temperatures by 10 – 15 K. The observer is therefore adviced to carefully evaluate whether an observation involving two different bands is more efficiently made in parallel or in series.

Connection to backends

The remarkable bandwidth of EMIR of altogether 64 GHz faces 2 limitations of the existing 30m hardware: (1) the four IF cables can transport only 4 GHz each (the 4 × 4 GHz bottleneck) and (2) only at low spectral resolution are there enough backends to cover the 16 GHz which pass through the bottleneck.

A new **IF switch box** in the receiver cabin allows to select 4 EMIR channels of 4 GHz bandwidth each from 16 inputs.[2] The box can handle all plausible single band observations as well as the band combinations indicated in Tab. 1. A full list of possible switch settings is available on the 30m web site.

The selected 4 output channels are sent via the IF cables to a new **backend distribution unit** which provides copies of these 4 channels to a range of backends processors which then prepare the IF signals for distribution to the spectrometers. Three new backend processors have been build to feed the new 4 GHz wide IF channels to the existing backends:

- ▷ The **WILMA processor** rearranges the four incoming 4 GHz wide IF channels into 16 channels of 1 GHz width which can be processed by 16 WILMA autocorrelator units. Since each unit provides 512 spectral channels of 2 MHz, sufficient backend power is available at this low spectral resolution for full coverage of the 4×4 GHz bottleneck.
- ▷ The **4 MHz processor** rearranges any two incoming 4 GHz wide IF channels into 8 slices of 1 GHz width for processing in 8 units of the 4 MHz filter bank. 2×4 GHz of EMIR bandwidth are thus covered at 4 MHz resolution.
- ▷ The **"narrow band backends" processor** prepares the 4 incoming IF channels for input into the 1 MHz filterbank and VESPA. Only the central part of the 4 GHz IF channels is accessible to these backends. Inside this central part (1 GHz for the filterbank and 640 MHz for VESPA), these backends can be configured as before. The VLBI terminal is also fed from this processor.

Calibration Issues

EMIR comes with a new calibration system. The external warm optics provides ambient temperature loads and mirrors reflecting the beams back onto the 15 K stage of the cryostat. This system is expected to be very reliable and constant over time. Absolute calibration accuracy will be better than 10% with EMIR when all details are well settled.

Bands E 150 and E 230 have backshort tuned single–sideband mixers; DSB tuning is not possible, but sidebands (USB or LSB) may be selectable within limitations. The image rejection is better than 10 dB for all frequencies. On–site measurements of the rejection is not longer straightforward for these mixers, since the Martin–Puplett interferometers are not available anymore. As the optimum way of calibrating the image rejection is still under study, users who propose observations which rely on an enhanced accuracy of calibration of image gains should mention this request in the proposal.

Bands E 090 and E 330 have tunerless sideband separation mixers, allowing simultaneous observations of both sidebands in separate IF bands. These mixers have been characterized in the laboratory for their image rejection and are expected to have the same performance on site (> 13 dB).

Velocity scales

It is common practice at radio observatories to correct the frequency of an observation for the strongly time variable velocity of the Observatory with respect to the solar system barycenter. This guarantees that lines observed near the Doppler–tracked frequency, usually the band center, always have the correct barycentric velocity, independent of the time of observation. However, the effect of the Observatory's motion on the velocity *scale* which affects most the velocity channels farthest away from the Doppler–tracked frequency, is usually ignored.

This effect which is of the order of 10^{-4} cannot be neglected anymore if large bandwidths are used, as with EMIR. The worst case occurs with band E 090 where channels as far away as 20 GHz need to be considered if a velocity channel in one of the sidebands is Doppler–tracked. In unfavorable but nevertheless frequent cases (target source not too far from the ecliptic, like the Galactic center), errors of up to ± 2 MHz occur. Since the magnitude of the error changes with time, narrow spectral lines may be broadened after a few hours of observation.

Observers concerned by this complication may consult the 30m web site for further details and solutions.

Update of PaKo

The observer interface program PaKo has been adapted for EMIR. In particular, the receiver and backend commands have been updated. The updated documentation will be available from the 30m web site in time for the preparation of observations with EMIR.

Observation time estimator

The GILDAS group has prepared a new 30m time estimator for EMIR. It is now part of the GILDAS software package and accessible via ASTRO. For downloading the GILDAS package please connect to the GILDAS home page and follow the instructions. A description of the new time estimator is also available on the Gildas web site.
For HERA and MAMBO2, the old web based time estimator is still available from the 30m web site. Note that a web based version of the estimator for EMIR will be made available for the next deadline. As commissioning of EMIR has not yet started at the time of writing, the new time estimator is based on the laboratory performance of EMIR and the *expected* losses at the telescope.

[2] The 4 channels of 8 GHz width available from E 090 are rearranged by the IF switch box into 4 pairs of inner and outer 4 GHz wide channels.

News from the Plateau de Bure Interferometer

Aluminum panels for antenna 4

By the end of last summers' antenna maintenance period the reflector of antenna 4 was equipped with new aluminum panels, replacing the previous carbon fiber panels. The antenna was moved out of the maintenance hall on October 17 and the surface was subsequently adjusted to an accuracy of better than 50 μm rms in a series of holographic measurements and panel adjustments.

Weather conditions and observing

The current winter semester was affected by quite variable weather conditions so far with periods of excellent atmospheric stability and transparency in particular at the end of November and the beginning of January but with very poor weather during most of December and the second half of January. Bure entered into the winter observing period with the array in its C-configuration and we switched to the B configuration already on December 28. The most extended A configuration was available from January 30 and it is now planned to move back to the C configuration by beginning of March. Compared with the original planning, scheduling of the B and A configuration has been interchanged due to the already acceptable though not exceptional atmospheric conditions in late December. The switch back to the compact D configuration is foreseen before the end of April. Global VLBI observations, which include the array in the 3 mm phased-array mode, are planned from May 7 to 12, 2009. According to these plans, it will not be possible to complete projects requesting deep integrations using the compact configurations before the end of the current observing period.

As far as A-rated projects are concerned, we expect to bring most of these to completion before the end of the current winter semester. B-rated projects are likely to be observed only if they fall in a favorable LST range. We remind users of the Plateau de Bure interferometer that B-rated proposals which are not started before the end of the winter period have to be resubmitted.

Investigators who wish to check the status of their project may consult the interferometer schedule on the Web at http://www.iram.fr/IRAM/PDBI/ongoing.html. This page is updated daily.

Jan Martin WINTERS

Call for Observing Proposals on the Plateau de Bure Interferometer

Conditions for the next summer period

As every year, we plan to carry out extensive technical work during the summer semester, including the regular maintenance of the antennas. In particular, yet another antenna will be fully equipped with new aluminum panels replacing its current carbon fiber panels. During this period, regular scientific observations will therefore mostly be carried out with the five element array. We plan to start the maintenance at the latest by the end of May and to schedule the D configuration between June and October.

We strongly encourage observers to submit proposals that can be executed during summer operating conditions. To keep the procedure as simple as possible, we ask to focus on:

- observations requesting the use of the 2 mm and 3 mm receivers
- circumpolar sources or sources transiting at night between June and September,
- observations that qualify for the 5D, 6D, and 6C configurations

Proposal category

Proposals should be submitted for one of the five categories:

1.3MM: Proposals that ask for 1.3 mm data. 2 mm or 3 mm receivers can be used for pointing and calibration purposes, but cannot provide any imaging. During the summer semester, proposals requesting the extended tuning range (256-267 GHz) will be carried out on a "best effort" basis only.

2MM: Proposals that ask for 2 mm data. 3 mm receivers can be used for pointing and calibration purposes, but cannot provide any imaging.

3MM: Proposals that ask for 3 mm data.

TIME FILLER: Proposals that have to be considered as background projects to fill in periods where the atmospheric conditions do not allow mapping, to fill in gaps in the scheduling, or even to fill in periods when only a subset of the standard 5-antenna configurations will be available. These proposals will be carried out on a "best effort" basis only.

SPECIAL: Exploratory proposals: proposals whose scientific interest justifies the attempt to use the PdB array beyond its guaranteed capabilities. This category includes for example non-standard frequencies for which the tuning cannot be guaranteed, non-standard configurations and more generally all non-standard observations. These proposals will be carried out on a "best effort" basis only.

LARGE PROGRAM: This category is offered on both IRAM instruments since the winter 2008/2009 observing period. See Section *Large Observing Programs* for a detailed explanation.

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

Configurations

Configurations planned for the summer period are:

Name	Stations
5Dq	W08 E03 N07 N11 W05
6Dq	W08 E03 N07 N11 N02 W05
6Cq	W12 E10 N17 N11 E04 W09

Part of the projects will be scheduled at the end of the summer period when the six-element array (likely in C-configuration) is expected to be back to operation. Projects that should be observed with a subset of the five-element array will be adjusted in uv-coverage and observing time.

The following configuration sets are available:

- `D` is best suited for deep integration and coarse mapping experiments (resolution $\sim 5''$ at 100 GHz). This configuration provides both the highest sensitivity and the lowest atmospheric phase noise.
- `CD` is well adapted for low angular resolution studies ($\sim 3''\!.5$ at 100 GHz, $\sim 1''\!.5$ at 230 GHz.
- `C` is appropriate for mapping, snapshot, and size measurements and for detection experiments at low declination. It provides a spatial resolution of $\sim 2''\!.8$ at 100 GHz.

Finally, enter ANY in the proposal form if your project doesn't need any particular configuration.

Please consult the documentation *An Introduction to the IRAM interferometer* (http://www.iram.fr/-IRAMFR/PDB/docu.html) for further details.

Receivers

All antennas are equipped with dual polarization receivers for the 3 mm, 2 mm, and 1.3 mm atmospheric windows. The frequency range is 80 GHz to 116 GHz for the 3 mm band, 129 GHz to 174 GHz for the 2 mm band, and 201 to 267 GHz for the 1.3 mm band.

	Band 1	Band 2	Band 3
RF range*/[GHz]	80–116	129–174	201–267
T_{rec}/[K] LSB	40–55	30–50	40–60
T_{rec}/[K] USB	40–55	40–80	50–70
G_{im}/[dB]	-10	-12 ... -10	-12 ... -8
RF LSB/[GHz]	80–104	129–168	201–267
RF USB/[GHz]	104–116	147–174	

* center of the 4-8 GHz IF band

Each band of the receivers is dual-polarization with the two RF channels of one band observing at the same frequency. The three different bands are not co-aligned in the focal plane (and therefore on the sky). Due to the pointing offsets between the different frequency bands, only one band can be observed at any time. One of the two other bands is in stand-by mode (power on and local oscillator phase-locked) and is available, e.g., for pointing. Time-shared observations between different RF bands are presently being tested. Please contact the Interferometer Science Operations Group (sog@iram.fr) to discuss the feasibility in case you are interested to use this mode.

The mixers are single-sideband, backshort-tuned; they will usually be tuned LSB, except for the upper part of the frequency range in all three bands where the mixers will be tuned USB.

The typical image rejection is 10 dB. Each IF channel is 4 GHz wide (4-8 GHz). The two 4 GHz wide IF-channels (one per polarization) can be processed only partially by the existing correlator. A dedicated IF processor converts selected 1 GHz wide slices of the 4-8 GHz first IFs down to 0.1-1.1 GHz, the input range of the existing correlator. Further details are given in the section describing the correlator setup and the IF processor.

Signal to Noise

The rms noise can be computed from

$$\sigma = \frac{J_{\rm pK} T_{\rm sys}}{\eta \sqrt{N_{\rm a}(N_{\rm a}-1) N_{\rm c} T_{\rm ON} B}} \frac{1}{\sqrt{N_{\rm pol}}} \qquad (1)$$

where

- $J_{\rm pK}$ is the conversion factor from Kelvin to Jansky (22 Jy/K at 3 mm, 29 Jy/K at 2 mm, and 35 Jy/K at 1.3 mm)
- $T_{\rm sys}$ is the system temperature ($T_{\rm sys} = 100$ K below 110 GHz, 180 K at 115 GHz, 180 K at 150 GHz, and 250 K at 230 GHz for sources at $\delta \geq 20°$ and for typical summer conditions).
- η is an efficiency factor due to atmospheric phase noise and instrumental phase jitter (0.9 at 3 mm, 0.8 at 2 mm, and 0.6 at 1.3 mm) in typical summer conditions.
- $N_{\rm a}$ is the number of antennas (5), and $N_{\rm c}$ is the number of configurations: 1 for D, 2 for CD, 1 for C.
- $T_{\rm ON}$ is the on-source integration time per configuration in seconds (2 to 8 hours, depending on source

declination). Because of various calibration observations the total observing time is typically 1.6 T_{ON}.

- B is the spectral bandwidth in Hz (up to 2 GHz for continuum, 40 kHz to 2.5 MHz for spectral line, according to the spectral correlator setup)
- N_{pol} is the number of polarizations: 1 for single polarization and 2 for dual polarization (see section *Correlator* for details).

Investigators have to specify in the "technical justification" **and on the Technical Sheet** the one sigma noise level which is necessary to achieve each individual goal of a proposal, and particularly for projects aiming at deep integrations.

Coordinates and Velocities

For best position accuracy, source coordinates must be in the J2000.0 system.

Please do not forget to specify LSR velocities for the sources. For pure continuum projects, the "special" velocity `NULL` (no Doppler tracking) can be used.

Correlator

IF processor

At any given time, only one frequency band can be observed, but with the two polarizations available. Each polarization delivers a 4 GHz bandwidth (from IF=4 to 8 GHz). The two 4-GHz bandwidths coincide in the sky frequency scale. The current correlator accepts as input two signals of 1 GHz bandwidth, that must be selected within the 4 GHz delivered by the receiver. In practice, the IF processor splits the two input 4–8 GHz bands in four 1 GHz "quarters", labeled *Q1...Q4*. Two of these quarters must be selected as correlator inputs. The system allows the following choices:

- first correlator entry can only be Q1 HOR, or Q2 HOR, or Q3 VER, or Q4 VER
- second correlator entry can only be Q1 VER, or Q2 VER, or Q3 HOR, or Q4 HOR

where HOR and VER refer to the two polarizations:

Quarter IF1 [GHz]	Q1 4.2-5.2	Q2 5-6	Q3 6-7	Q4 6.8-7.8
input 1	HOR	HOR	VER	VER
input 2	VER	VER	HOR	HOR

How to observe two polarizations? To observe simultaneously two polarizations at the same sky frequency, one must select the same quarter (Q1 or Q2 or Q3 or Q4) for the two correlator entries. This will necessarily result in each entry seeing a different polarization. The system thus give access to 1 GHz × 2 polarizations.

How to use the full 2 GHz bandwidth? If two different quarters are selected (any combination is possible), a bandwidth of 2 GHz can be analyzed by the correlator. But only one polarization per quarter is available in that case; this may or may not be the same polarization for the two chunks of 1 GHz.

Is there any overlap between the four quarters? In fact, the four available quarters are 1 GHz wide each, but with a small overlap between some of them: Q1 is 4.2 to 5.2 GHz, Q2 is 5 to 6 GHz, Q3 is 6 to 7 GHz, and Q4 is 6.8 to 7.8 GHz. This results from the combination of filters and LOs used in the IF processor.

Is the 2 GHz bandwidth necessarily continuous? No: any combination of two quarters can be selected. Adjacent quarters will result in a continuous 2 GHz band. Non-adjacent quarters will result in two independent 1 GHz bands.

Where is the selected sky frequency in the IF band? It would be natural to tune the receivers such that the selected sky frequency corresponds to the middle of the IF bandwidth, i.e. 6.0 GHz. However, this corresponds to the limit between Q2 and Q3. It is therefore highly recommended to center a line at the center of a quarter (see Section "ASTRO" below). In all three bands, 3 mm, 2 mm, and 1.3 mm the receivers offer best performance in terms of receiver noise and sideband rejection in Q3 (i.e. the line should be centered at an IF1 frequency of 6500 MHz).

Spectral units of the correlator

The correlator has 8 independent units, which can be placed anywhere in the 100–1100 MHz band (1 GHz bandwidth). 7 different modes of configuration are available, characterized in the following by couples of total bandwidth/number of channels. In the 3 DSB modes (320MHz/128, 160MHz/256, 80MHz/512 – see Table) the two central channels may be perturbed by the Gibbs phenomenon if the observed source has a strong continuum. When using these modes, it is recommended to avoid centering the most important part of the lines in the middle of the band of the correlator unit. In the remaining SSB modes (160MHz/128, 80MHz/256, 40MHz/512, 20MHz/512) the two central channels are not affected by the Gibbs phenomenon and, therefore, these modes may be preferable for some spectroscopic studies.

Spacing (MHz)	Channels	Bandwidth (MHz)	Mode
0.039	1 × 512	20	SSB
0.078	1 × 512	40	SSB
0.156	2 × 256	80	DSB
0.312	1 × 256	80	SSB
0.625	2 × 128	160	DSB
1.250	1 × 128	160	SSB
2.500	2 × 64	320	DSB

Note that 5% of the passband is lost at the end of each subband. The 8 units can be independently connected to the first or the second correlator entry, as selected by the IF processor (see above). Please note that the center frequency is expressed in the frequency range seen by the correlator, i.e. 100 to 1100 MHz. The correspondence to the sky frequency depends on the parts of the 4 GHz bandwidth which have been selected as correlator inputs and on the selected side band (LSB or USB).

ASTRO

The software ASTRO can be used to simulate the receiver/correlator configuration. Astronomers are urged to download the most recent version of GILDAS at `http://www.iram.fr/IRAMFR/GILDAS/` to prepare their proposals.

The previous `LINE` command has been replaced by several new commands (see internal help; the following description applies to the current receiver system). The behavior of the `LINE` command can be changed by the `SET PDBI 1995|2000|2006` command, that selects the PdBI frontend/backend status corresponding to years 1995 (old receivers, 500 MHz bandwidth), 2000 (580 MHz bandwidth), 2006 (new receivers and new IF processor, 1 GHz bandwidth). Default is 2006:

– `LINE`: receiver tuning
– `NARROW`: selection of the narrow-band correlator inputs
– `SPECTRAL`: spectral correlator unit tuning
– `PLOT`: control of the plot parameters.

A typical session would be:

```
! choice of receiver tuning
line xyz 93.2 lsb low 6500

! choice of the correlator windows
narrow Q3 Q3

! correlator unit #1, on entry 1
spectral 1  20 600 /narrow 1

! correlator unit #2, on entry 1
spectral 2  20 735 /narrow 1

! correlator unit #3, on entry 1
spectral 4 320 300 /narrow 1

! correlator unit #4, on entry 2
spectral 4 320 666 /narrow 2
...
```

Sun Avoidance

For safety reasons, a sun avoidance limit is enforced at 45 degrees from the sun. We are presently testing a reduced sun avoidance circle at 35 degrees and expect that projects observed in the summer semester may already profit from this reduction. This can however not be guaranteed yet and we therefore ask proposers to still take into account the 45 degrees limit for the target sources.

Mosaics

The PdBI has mosaicing capabilities, but the pointing accuracy may be a limiting factor at the highest frequencies. Please contact the Science Operations Group (sog@iram.fr) in case of doubts.

Local Contact

A local contact will be assigned to every A or B rated proposal which does not involve an in-house collaborator. He/she will assist you in the preparation of the observing procedures and provide help to reduce the data. Assistance is also provided before a deadline to help newcomers in the preparation of a proposal. Depending upon the program complexity, IRAM may require an in-house collaborator instead of the normal local contact.

Data reduction

Proposers should be aware of constraints for data reduction:

- We recommend that proposers reduce their data in Grenoble. For the time being, remote data reduction will only be offered in exceptional cases. Please contact your local contact if you're interested in this possibility.
- We keep the data reduction schedule very flexible, but wish to avoid the presence of more than 2 groups at the same time in Grenoble. Data reduction will be carried out on dedicated computers at IRAM. Please contact us in advance.
- In certain cases, proposers may have a look at the uv-tables as the observations progress. If necessary, and upon request, more information can be provided. Please contact your local contact or PdBI's Science Operations Group (sog@iram.fr) if you are interested in this.

- Observers who wish to finish data reduction at their home institute should obtain the most recent version of CLIC. Because differences between CLIC versions may potentially result in imaging errors if new data are reduced with an old package, we advise observers having a copy of CLIC to take special care in maintaining it up-to-date. The newer versions are in general downward compatible with the previous releases. The recent upgrades of CLIC implied however many modifications for which backward compatibility with old PdBI receiver data has not yet been fully checked. To calibrate data obtained with the "old" receiver system (up to September 2006), we urge you to use the January 2007 version of CLIC.

Technical pre-screening

All proposals will be reviewed for technical feasibility in parallel to being sent to the members of the program committee. Please help in this task by submitting technically precise proposals. Note that your proposal must be complete and exact: the source position and velocity, as well as the requested frequency setup must be correctly given.

Non-standard observations

If you plan to execute a non-standard program, please contact the Interferometer Science Operations Group (sog@iram.fr) to discuss the feasibility.

Documentation

The documentation for the IRAM Plateau de Bure Interferometer includes documents of general interest to potential users, and more specialized documents intended for observers on the site (IRAM on-duty astronomers, operators, or observers with non-standard programs). All documents can be retrieved on the Internet at `http://www.iram.fr/IRAMFR/PDB/docu.html`. Note however, that not all the documentation on the web has already been updated with respect to the current receivers. All information presently available on the current receiver system is given in the *Introduction to the IRAM Plateau de Bure Interferometer* at `http://www.iram.fr/IRAMFR/GILDAS/doc/html/pdbi-intro-html` and in this call for proposals.

Finally, we would like to stress again the importance of the quality of the observing proposal. The IRAM interferometer is a powerful, but complex instrument, and proposal preparation requires special care. Information is available in this call and at `http://www.iram.fr/IRAMFR/PDB/docu.html`. The IRAM staff can help in case of doubts if contacted well before the deadline. Note that the proposal should not only justify the scientific interest, but also the need for the Plateau de Bure Interferometer.

Jan Martin WINTERS

IRAM mailing lists

IRAM provides an e-mail based news service for its Call for Proposals and the Newsletter; many of our readers may have been informed on the availability of the present Call and the Newsletter by the respective mailing lists. In this context, we would like to encourage the readers to use the web-based subscription facility on http://www.iram.fr/mailman/listinfo to keep their e-mail addresses up-to-date, as mails sometimes bounce because the subscribers have moved. The interface of the facility provides guiding information on each level.

Cathy BERJAUD & Michael BREMER

News from the 30m

GISMO - The Goddard-IRAM Superconducting 2 Millimeter Observer tested at the IRAM 30m observatory

In October 2008, the GISMO team Johannes Staguhn, Stephen Maher, Elmer Sharp, Dale Fixsen, and Dominic Benford spent two weeks at the 30m observatory to first install their GISMO bolometer camera in the lab and then in the receiver cabin to test its performance on the sky. GISMO consists of 8×16 pixels with 2mm pitch transition edge sensors (TES). The super conducting TES are read out by time domain SQUID multiplexers built at the National Institute for Standards (NIST), in Boulder, Colorado. The nominal bandwidth of the camera is 125–175 GHz, pixels are spaced by $14''$, the telescope HPBW is $16''$ at 2mm. Data are taken while the telescope is performing Lissajous scan patterns, without switching the secondary, to increase the mapping efficiency. An automated pipeline merges the GISMO data with the telescope data streams to create FITS files, being triggered by the IRAM messaging system. Data are then further reduced using the Goddard data reduction package.

The 2mm spectral range provides a unique terrestrial window enabling ground-based observations of the earliest active dusty galaxies in the universe and thereby allowing to derive better constraints on the star formation rate in these objects. Preliminary results from this second observing run at the 30m telescope look very promising. More detailed information will be given in the next Newsletter. Figure 4 shows a quicklook result from Cygnus A observations.

Carsten KRAMER

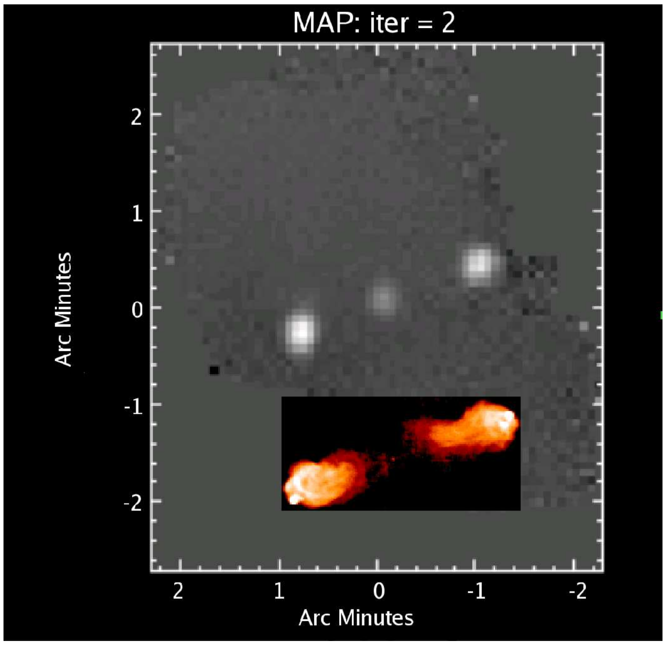

Figure 4: Composite picture showing Cygnus A at 2mm (grey) and at 21cm.

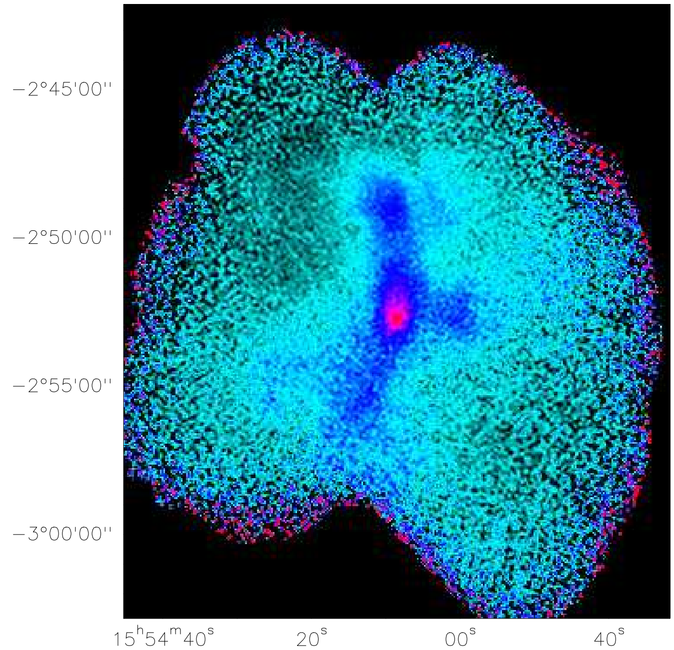

Figure 5: MAMBO2 1.2mm dust continuum map of the starless cloud L183 by Pagani et al

MAMBO2 - Science highlights from November 2008

After a first visit earlier this year, MAMBO2 was recommissioned in early November by the Bonn bolometer group Ernst Kreysa, Giorgio Siringo, Walter Esch and IRAM staff, in preparation of two weeks of pooled observations. In the weeks before, it was notably Axel Weiss who contributed his expertise of the internals of the pool data base.

During recommissioning, mirrors M5 to M8 had to be realigned and the vibration damping of the optical table had to be optimized again for MAMBO2. Temperature readouts were installed, which now allow to continuously monitor the temperatures of the different stages. The heat pulse needed to recycle He-3 is now set automatically allowing for a well controlled and reproducible recycling. Various problems previously encountered with the ABBA2 backend-PC were addressed and most of them solved.

The following first week of pooled observations enjoyed good to excellent weather conditions reaching below 1mm of water vapor, and some exciting new results were obtained, despite some remaining problems with the hard- and software. During the second week, weather was less favourable. In total 14 MAMBO2 projects were finished, leaving only 3 unfinished. In addition, several of the heterodyne backup projects were observed in this period.

Among the science highlights of these two weeks are: the detection of a quasar at $z = 6$, and the detections of four new disks around brown dwarfs. Another highlight is a new MAMBO2 map of the starless cloud L183, conducted by the PI, Laurent Pagani (Fig. 5). L183 is high above the galactic plane and close to us (110 pc). It hosts two prestellar cores inside an elongated ridge, and several secondary cores, some of them having a molecular counterpart ($C^{18}O$ peak to the east, SO peak to the west, C_3H_2 peak to the north, etc...). The main prestellar core with an estimated column density of 1.5 $\times 10^{23}$ cm^{-2} is devoid of most molecular species, and only the H_2D^+ peak is coincidental with it. It has also revealed itself as being one of the coldest prestellar cores known today with both gas and dust estimated at 7 K.

Carsten KRAMER

WideX correlator board: first fringes

On November 25th 2008, an important milestone of the WideX development has been reached. A complete signal chain including two samplers boards, one correlator board and one readout/clock board have been successfully operated together. The sampler board includes a 4 GHz sampling head, a demultiplexer and a format/delay system. The correlator board includes 28 correlator ASIC's of 2048 channels each. The readout board provides clock and timing signals for the whole system and manages data

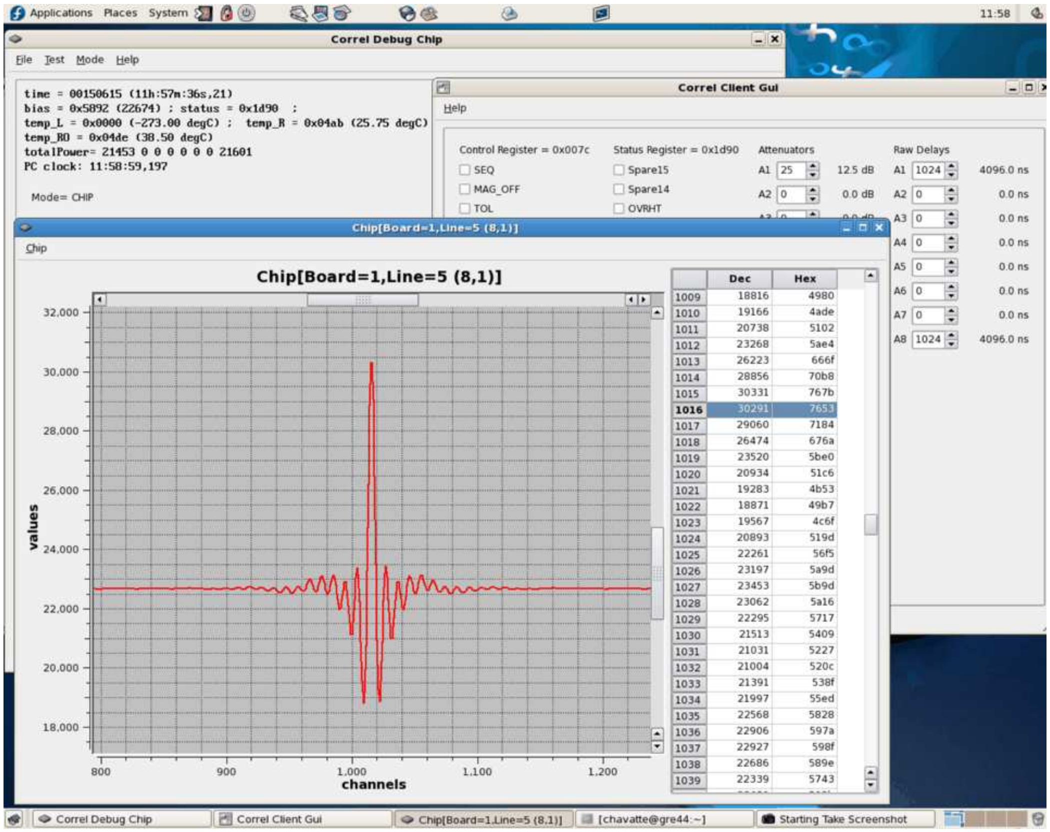

Figure 6: First fringes of the WideX correlator board

transmission to and from the computer, which runs a user friendly test software interface. The screen snapshot in Fig. 6 shows the cross-correlation function of two analog copies of a 2-4 GHz noise source, which was deliberately filtered to a 350 MHz width in order to spread the $\sin x/x$ pattern over several channels. The peak appears on channel 1015 instead of 1023, (250 picosecond per channel) due to deliberately using non-equal analog cables. The total delay range is 16.384 microseconds, which corresponds to ±2.4km from the array phase center.

Marc TORRES

VLBI News

October 2008 session

The October 9-15 Global Millimeter VLBI session did not work well for both IRAM instruments. The 30-m lost 66% of the observing time due to bad weather conditions (winds beyond the operation limits and snow), while Plateau de Bure had good weather conditions, but encountered a phase stability problem in the VLBI system. This problem was diagnosed in a fringe test at the beginning of the session; as it became clear that it could not be resolved within the duration of the session, Bure went back to local observing mode (100% VLBI session loss).

Since then, the origin of the problem has been tracked back to the Bure Racal Dana frequency generator; this unit had been specially adapted for VLBI to allow an excellent phase stability, and was only connected during VLBI sessions. Unfortunately, absolute phase stability is not a design feature that is well established on the frequency generator market: The Racal Dana unit that failed was already more than 20 years old, but still better than many high-level modern units. As second-hand Racal Danas of the model in question become increasingly rare and fragile, the IRAM backend group started a test series to search for a suitable modern replacement while the MPIfR Bonn kindly agreed to loan us a frequency generator to restore the Bure VLBI capabilities independently of the result of this quest.

Fortunately, a likely candidate was found in the Rohde & Schwarz SMA100 B22 that passed the rigorous phase stability tests of the IRAM backend group, although its sensitivity to ambient temperature variations is a bit higher than we would have prefered. IRAM has bought a unit, and we plan to install it in a temperature controlled rack on Plateau de Bure. A small VLBI test with this new generator is foreseen between Plateau

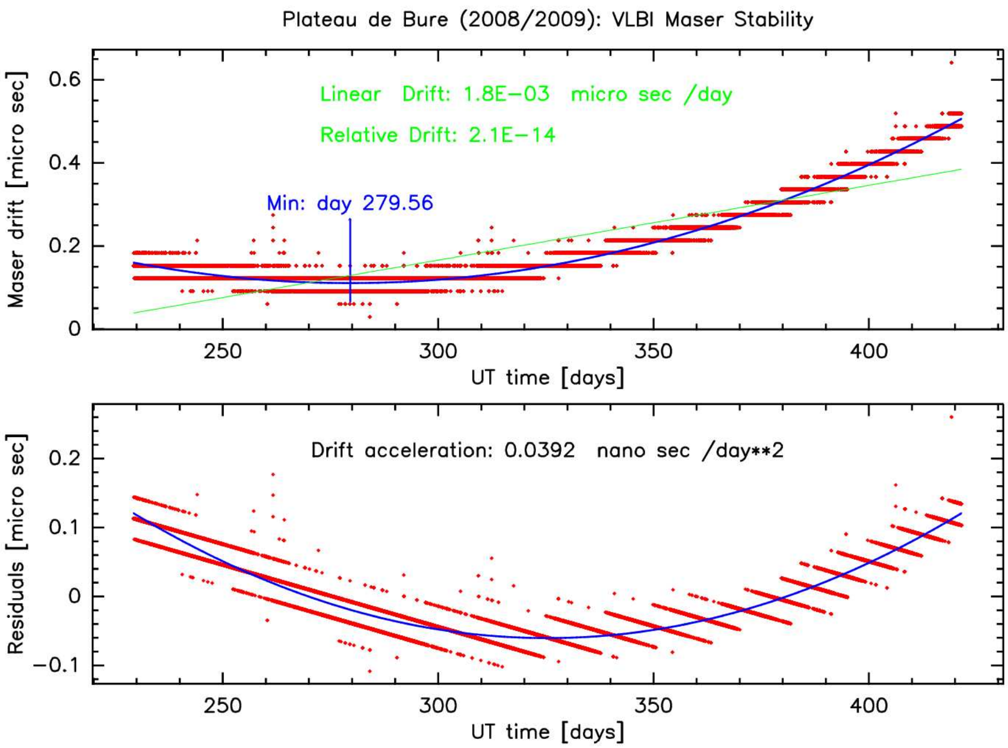

Figure 7: Maser-GPS drift monitoring over 192 days in 2008/2009. The steps indicate the resolution of the GPS

de Bure and Pico Veleta before the installation of EMIR begins.

Michael BREMER

Result of the EFOS-38 ballistic tuning

In the IRAM Newsletter No. 71, we announced a tuning of the Plateau de Bure EFOS-38 maser that anticipated the very slight drift acceleration of the instrument. The monitoring of the maser against GPS since then (Fig. 7) indicates that this ballistic tuning was successful. The residual drift during the October VLBI session was below 0.4 nanosec/day, i.e. the relative stability over that week was better than $5 \cdot 10^{-15}$. Our second-order estimate based on the monitoring since the last maser retuning is about 39 picosec/day^2, which is comparable to the previous value of 42 picosec/day^2.

Michael BREMER

Winter 2008/2009 proposal ratings

The IRAM program committee convened in Madrid on October 20 and 21 to discuss the proposals submitted for the winter 2008/2009 scheduling period. The committee was chaired by Axel Weiss (MPIfR, Bonn) and Asuncion Fuente (OAN, Madrid).The principal investigators of each proposal were informed by letter which included comments issued by the committee, if there were any. As usual, the proposals were classified A (accepted), B (backup), and C (rejected).

Plateau de Bure Interferometer Proposals

A total of 131 proposals were received for the interferometer, including 3 proposals that were submitted in the new "Large Program" category. Proposals rated A (among those is one Large Program) will be scheduled in priority. Further time, if it becomes available, will go to the B programs, taking into account scientific merit, crowding in certain right ascension ranges and general aspects of balance.

For proposals rated A or B which do not have an IRAM internal collaborator, please consult the list of local contacts.

30m telescope

We received 128 proposals for the 30m telescope (see alphabetic list), four of which were in the new category of Large Programs. A total of 4490 hours of telescope time

Table 2: IRAM PdBI proposal ratings for winter 2008/2009. A: Accepted, B: Backup, C: Rejected.

Project	Rate	Project	Rate	Project	Rate	Project	Rate	Project	Rate	Project	Rate
S055	B	S056	BΥ	S057	C	S058	C	S059	C	S05A	A
S05B	A	S05C	C	S05D	B†	S05E	C	S05F	C	S060	C
S061	C	S062	C	S063	B	S064	C	S065	B†	S066	B
S067	C	S068	C	S069	B†	S06A	A	S06B	A	S06C	C
S06D	C	S06E	C	S06F	B†	S070	B	S071	B†	S072	B
S073	B	S074	C	S075	C	S076	A	S077	C	S078	A
S079	B	S07A	C	S07B	A	S07C	B†	S07D	B	S07E	B†
S07F	C	S080	B	S081	A	S082	C	S083	C	S084	C
S085	B	S086	C	S087	B	S088	C	S089	C	S08A	C
S08B	B	S08C	C	S08D	A†	S08E	B†	S08F	C	S090	C
S091	B	S092	C	S093	C	S094	C	S095	B	S096	C
S097	A	S098	A†	S099	C	S09A	C	S09B	C	S09C	C
S09D	B	S09E	C	S09F	C	S0A0	C	S0A1	B	S0A2	B†
S0A3	A	S0A4	C	S0A5	C	S0A6	C	S0A7	B	S0A8	B†
S0A9	C	S0AA	C	S0AB	A	S0AC	B	S0AD	C	S0AE	C
S0AF	B†	S0B0	C	S0B1	A†	S0B2	C	S0B3	A	S0B4	B
S0B5	B	S0B6	C	S0B7	B	S0B8	B	S0B9	C	S0BA	B
S0BB	C	S0BC	B†	S0BD	C	S0BE	C	S0BF	B	S0C0	A
S0C1	B	S0C2	A	S0C3	B†	S0C4	C	S0C5	B†	S0C6	C
S0C7	B†	S0C8	A	S0C9	B	S0CA	B‡Υ	S0CB	B†	S0CC	C
S0CD	B	S0CE	C	S0CF	C	S0D0	B	S0D1	C	S0D2	B‡
S0D3	C	S0D4	B	S0D5	C	S0D6	C	S0D7	A		

† : some parts of the program - others rated B or C. ‡ : with time restrictions. Υ : time filler.

Table 3: IRAM 30-m proposal ratings for winter 2008/2009

A		B					C	
140-08 [2]	141-08	124-08	125-08	126-08	129-08 [1]	130-08	127-08	128-08
145-08	149-08	131-08	132-08	133-08	135-08 [1]	136-08	134-08	138-08
151-08	155-08 [1]	137-08	142-08	144-08	147-08	150-08	139-08	143-08
157-08	164-08 [1]	152-08	153-08 [1]	154-08	156-08 [1]	159-08	146-08	148-08
177-08	178-08	160-08	163-08	165-08 [1]	166-08	170-08 [1]	158-08	161-08
184-08	187-08	171-08	173-08 [1]	174-08 [1]	175-08	176-08 [1]	162-08	167-08
188-08	192-08 [1]	179-08	180-08	181-08	182-08	183-08	168-08	169-08
198-08	200-08	185-08	186-08 [1]	189-08	190-08	191-08	172-08	199-08
212-08	215-08	193-08	194-08 [1]	195-08	196-08 [1]	197-08	203-08	204-08
216-08	226-08	201-08	202-08	206-08	207-08	209-08	205-08	208-08
229-08	230-08	211-08 [1]	213-08 [1]	218-08	219-08 [1]	220-08	210-08	214-08
233-08	237-08	221-08	222-08	223-08 [1]	225-08	227-08	217-08	224-08
240-08	241-08	228-08	232-08	234-08	235-08 [1]	236-08	231-08	250-08
248-08	249-08	238-08 [1]	239-08	242-08 [1]	243-08 [1]	244-08		
251-08		245-08 [1]	246-08	247-08 [1]				

[1] time reduced [2] part of time rated B

were requested. Another 42 hours were requested by 8 interferometer proposals for short spacing observations. The highest rating "A" was given to 29 proposals, among which there is one Large Program. 73 proposals were rated "B", i.e. were given backup status. The remaining proposals, although scientifically valuable in most cases, were rated "C". The individual ratings are listed in the table below. All A-rated proposals will be scheduled on the telescope, although some with less time than requested. We expect that about half of the B-rated programs will actually be scheduled. The selection will take into account scientific merit, crowding in certain right ascension ranges, and general aspects of balance. Proposals rated "C" will not get telescope time.

The committee accepted more time in "B" than usual in order to facilitate the telescope scheduling during the extensive technical work expected this spring when EMIR, a completely new set of 8 single pixel heterodyne receivers, is planned to be installed and commissioned.

The short spacing proposals are not listed here. They will be scheduled on the 30m if they get observed at Bure.

Jan Martin WINTERS and Clemens THUM

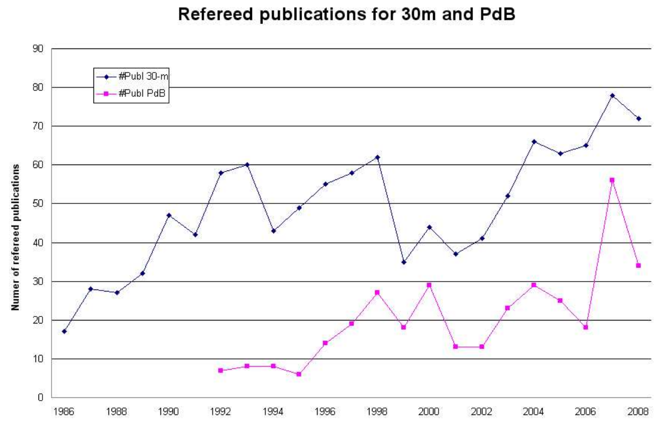

Figure 8: Time series of IRAM PdB and 30m publications.

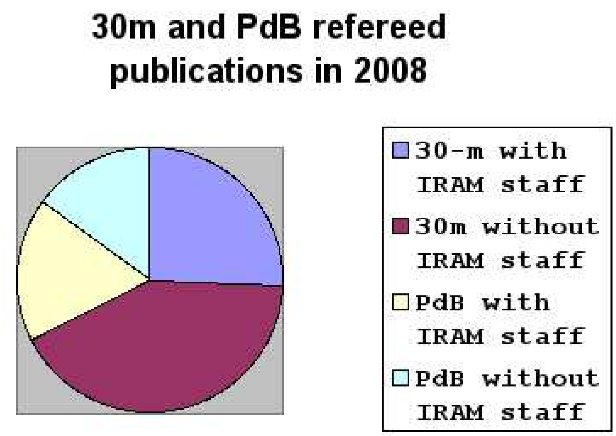

Figure 9: Staff member participation in IRAM PdB and 30m publications, year 2007.

On the Publications and Citation Statistics of the IRAM telescopes

I have used the publication lists of the IRAM Annual Reports and identified the refereed publications based on observations with the IRAM 30-m and PdB Plateau de Bure (PdB) antennas. Fig. 8 shows the annual number of PdB and 30m based refereed publications. During the last 10 years, the outcome of the PdB has been oscillating between 13 and 56 publications per year (average: 25.8). In the same time span, the 30m telescope has been producing 35-78 publications per year (average: 55.3). In the case of the interferometer, one can see the effects of the cable car accident, which resulted in a drop in the scientific output, which could be noticed in 2001 and 2002. On the other hand the availability of new receivers in 2006 resulted in an increase of publications in 2007 and 2008. The pronounced peak in 2007 may be in part due to a special edition on PdB results of Astronomy and Astrophysics. In the case of the 30m telescope the productivity has been increasing since the introduction new single pixel receivers in 1999/2000 with better tuning ranges, sensitivities and bandwidths and the introduction of VESPA, HERA and MAMBO2. Also the introduction of the MAMBO and HERA pool has certainly played an important role in the increase of productivity witnessed after 2000.

When looking at the refereed publications published in 2008, 28 of the 72 papers obtained with the 30-m telescope had IRAM staff members as coauthors; this corresponds to 39% of the 30-m papers. For the IRAM PdB interferometer, 19 of the 34 papers have IRAM staff members as coauthors, corresponding to 56% of the PdB data (Fig. 9). It is not clear whether this reflects a major scientific interest of IRAM staff in science with the interferometer, whether observation and data reduction with the 30m telescope can be done without substantial help from the staff for most observers, or whether it is just statistical noise.

Since its beginnings (i.e. since 1992) until 2009, the PdB interferometer has produced 346 publications, which were cited 10690 times. The average citation rate per paper was 30.9 and the h- and m-indices[3] are 51 and

[3] An h-index with value h indicates that there are h publications with at least h citations, the m- index is the h-index divided by the number of years since the first paper was published

3.0. The 30m telescope has produced since its first publications (in 1986) 1131 refereed publications with 37460 citations. The average citation rate per paper is 33.1, and the h and m-indices are 84 and 3.7. Links ADS of the to the PdB and 30m publications can be found at http://www.iram.es/IRAMES/dataarchive/init.html.

Rainer MAUERSBERGER

Staff changes

IRAM Granada

After more than 20 years as a telescope operator at the Pico Veleta, Mariano ESPINOSA BURILLO has left IRAM end of September 2008 to take up new challenges in his hometown Murcia. We thank him for all the high altitude work, and wish him all the best for the future.

In October 2008, Victor PEULA started training as telescope operator.

Stephane LEON has left IRAM end of 2008. We wish him all the best for his future career.

On January 7, Guillermo QUINTANA-LACACI has joined the science support group in Granada. He will become one of our experts on pooled observations. In addition, he is working on evolved stars and will enter extragalactic science by joining the Herschel key project HERMES on M33. We wish him many interesting photons.

Carster KRAMER

IRAM Grenoble

The IRAM workshop and construction group changes its head: Jean-Louis POLLET, who directed the group successfully for many years, will take his well-deserved retirement. Jean-Louis has been a key person in the design and construction of the PdB antennas and will stay involved in the NOMEA project as a councelor. His successor Bastien LEFRANC has started work on November 24.

Fabienne SCHICKE, who replaced Cathie BERJAUD in her function as scientific secretary, has left IRAM on August 8th. Cathie, who was on leave to complete her masters's degree, has returned to IRAM on September 1st.

The Backend group welcomes Roberto GARCIA GARCIA, who works since September 1st on numerical simulations.

In the SIS group, Markus Rösch has started on a thesis on November 1st.

The astronomer's group welcomes two new members: Sebastien BARDEAU has started work as a postdoc on December 15, and Sascha TRIPPE has arrived on February 1st.

In our "general services" group, Nicolas MOURAT who had replaced Dimitri MOCELLIN left IRAM at the end of January. Stefan MARCOUX (who was on special leave since February 2008) has returned to IRAM on February 4th. Patrice PASTUREL has left the institute on February 16. Patrice was with IRAM for 16 years, first as SIS technician and in recent years as responsible for our general services section. We wish him all the best for his future career.

On Plateau de Bure, Alain CAYOL has started work as a technician on February 5th.

Michael BREMER

Matt Carter in memoriam

It is with deep sadness that we report on the passing of our friend and colleague Matthew Carter on Friday, November 28th 2008 following a long illness.

Matt joined IRAM in 1984 as an engineer in the frontend group. Since then, Matt played a key role in the IRAM's receiver program. He was closely involved in the development and building of three generations of receivers for both the 30-meter telescope and the Plateau de Bure interferometer. In particular, Matt contributed in an essential way to the design of optics for sophisticated multichannel receivers for the IRAM's observatories. In recent years, Matt became very active in the ALMA project, designing the optics for ALMA's multi-band front-end and the calibration system.

We will remember Matt as a creative and imaginative engineer, as well as a beloved and appreciated friend and colleague. Matt was always cheerful at work and courageous in difficult times.

Pierre COX, Karl SCHUSTER & Bernard LAZAREFF

Scientific Results in Press

Self-Regulated Fueling of Galaxy Centers: Evidence for Star Formation Feedback in IC 342's Nucleus

Eva Schinnerer([1]), Torsten Böker([2]), David S. Meier([4,5]) and Daniela Calzetti([6])
([1])Max-Planck-Institut für Astronomie, Königstuhl 17, D-69117 Heidelberg, Germany, ([2])European Space Agency, Department RSSD, Keplerlaan 1, 2200 AG Noordwijk, Netherlands, ([3])David S. Meier is a Jansky Fellow of the NRAO, ([4])National Radio Astronomy Observatory, P.O. Box O, Socorro, NM 87801, USA, ([5])Department of Astronomy, University of Massachusetts, Amherst, MA 01003, USA

Abstract:
Using new, high-resolution interferometric observations of the CO and HCN molecules, we directly compare the molecular and ionized components of the interstellar medium in the center of the nearby spiral galaxy IC 342, on spatial scales of ~ 10 pc. The morphology of the tracers suggests that the molecular gas flow caused by a large-scale stellar bar has been strongly affected by the mechanical feedback from recent star formation activity within the central 100 pc in the nucleus of the galaxy. Possibly, stellar winds and/or supernova shocks originating in the nuclear star cluster have compressed, and likely pushed outward, the infalling molecular gas, thus significantly reducing the gas supply to the central 10 pc. Although our analysis currently lacks kinematic confirmation due to the face-on orientation of IC 342, the described scenario is supported by the generally observed repetitive nature of star formation in the nuclear star clusters of late-type spiral galaxies.

Appeared in ApJ 684, L21

H I and CO in the circumstellar environment of the oxygen-rich AGB star RX Lep

Y. Libert([1]), T. Le Bertre([1]), E. Gérard([2]) and J.M. Winters([3])
([1])LERMA, UMR 8112, Observatoire de Paris, 61 Av. de l'Observatoire, 75014 Paris, France, ([2])GEPI, UMR 8111, Observatoire de Paris, 5 Place J. Janssen, 92195 Meudon Cedex, France, ([3])IRAM, 300 rue de la Piscine, 38406 St. Martin d'Hères, France

Abstract:
Context. Circumstellar shells around AGB stars are built over long periods of time that may reach several million years. They may therefore be extended over large sizes ($\sim$ 1 pc, possibly more), and different complementary tracers are needed to describe their global properties.
Aims. We set up a program to explore the properties of matter in the external parts of circumstellar shells around AGB stars and to relate them to those of the central sources (inner shells and stellar atmospheres).
Methods. In the present work, we combined 21-cm H I and CO rotational line data obtained on an oxygen-rich semi-regular variable, RX Lep, to describe the global properties of its circumstellar environment.
Results. With the SEST, we detected the CO$(2-1)$ rotational line from RX Lep. The line profile is parabolic and implies an expansion velocity of ~ 4.2 kms^{-1} and a mass-loss rate $\sim 1.7 \times 10^{-7}$M$_\odot$ yr^{-1} ($d = 137$ pc). The H I line at 21 cm was detected with the Nançay Radiotelescope on the star position and at several offset positions. The linear shell size is relatively small, ~ 0.1 pc, but we detect a trail extending southward to ~ 0.5 pc. The line profiles are approximately Gaussian with an FWHM ~ 3.8 km^{-1} and interpreted with a model developed for the detached shell around the carbon-rich AGB star Y CVn. Our H I spectra are well-reproduced by assuming a constant outflow ($\dot{\rm M} = 1.65 \times 10^{-7}M_\odot$ yr^{-1}) of $\sim 4 \times 10^4$ years duration, which has been slowed down by the external medium. The spatial offset of the H I source is consistent with the northward direction of the proper motion measured by Hipparcos, lending support to the presence of a trail resulting from the motion of the source through the ISM, as already suggested for Mira, RS Cnc, and other sources detected in H I. The source was also observed in SiO (3 mm) and OH (18 cm), but not detected.
Conclusions. A detached shell, similar to the one around Y CVn, was discovered in H I around RX Lep. We also found evidence of an extension in the direction opposite to the star proper motion. The properties of the external parts of circumstellar shells around AGB stars should be dominated by the interaction between stellar outflows and external matter for oxygen-rich, as well as for carbon-rich, sources, and the 21-cm H I line provides a very useful tracer of these regions.

Appeared in A&A 491, 789

Coordinated multi-wavelength observations of Sgr A*

Eckart A.([1,9]), Schödel R.([2]), Baganoff F.K.([3]), Morris M.([4]), Bertram T.([1]), Dovciak M.([5]), Downes D.([6]), Duschl W.J.([7,8]), Karas V.([5]), König S.([1,9]), Krichbaum T.([9]), Krips M.([10]), Kunneriath D.([1,9]), Lu R.-S.([9,1]), Markoff S.([11]), Mauerhan J.([4]), Meyer L.([4]), Moultaka J.([12]), Muzic K.([1,9]), Najarro F.([13]), Schuster K.F.([6]), Sjouwerman L.([14]), Straubmeier C.([1]), Thum C.([6]), Vogel S.([15]), Wiesemeyer H.([16]), Witzel G.([1]), Zamaninasab M.([1,9]), Zensus A.([9])
([1])University of Cologne, Zülpicher Str. 77, D-50937 Cologne, Germany, ([2])Instituto de Astrofísica de Andalucía, Camino Bajo de Huétor 50, 18008 Granada, Spain, ([3])Center for Space Research, MIT, Cambridge, MA 02139-4307, USA, ([4])Department of Physics and Astronomy, University of California, Los Angeles, CA 90095-1547, USA, ([5])Astronomical Institute, Academy

of Sciences, Bočdní II, CZ-14131 Prague, Czech Republic, (6)IRAM, Domaine Universitaire, 38406 St. Martin d'Hères, France, (7)Institut für Theoretische Physik und Astrophysik, Christian-Albrechts-Universität zu Kiel, Leibnizstr. 15 24118 Kiel, Germany , (8)Steward Observatory, The University of Arizona, 933 N. Cherry Ave. Tucson, AZ 85721, USA, (9)MPIfR, Auf dem Hügel 69, 53121 Bonn, Germany, (10)Harvard-Smithsonian Center for Astrophysics, SMA project, 60 Garden Street, MS 78 Cambridge, MA 02138, USA, (11)Astronomical Institute 'Anton Pannekoek', University of Amsterdam, Kruislaan 403, 1098SJ Amsterdam, the Netherlands, (12)Observatoire Midi-Pyrénées, 14, Avenue Edouard Belin, 31400 Toulouse, France, (13)Instituto de Estructura de la Materia, Consejo Superior de Investigaciones Cientificas, CSIC, Serrano 121, 28006 Madrid, Spain, (14)NRAO, PO Box 0, Socorro, NM 87801, USA, (15)Department of Astronomy, University of Maryland, College Park, MD 20742-2421, USA, (16)IRAM, Avenida Divina Pastora, 7, Núcleo Central, E-18012 Granada, Spain

Abstract:
We report on recent near-infrared (NIR) and X-ray observations of Sagittarius A* (Sgr A*), the electromagnetic manifestation of the $\sim 4 \times 10^6 M_\odot$ super-massive black hole (SMBH) at the Galactic Center. The goal of these coordinated multi-wavelength observations is to investigate the variable emission from Sgr A* in order to obtain a better understanding of the underlying physical processes in the accretion flow/outflow. The observations have been carried out using the NACO adaptive optics (AO) instrument at the European Southern Observatory's Very Large Telescope (July 2005, May 2007) and the ACIS-I instrument aboard the Chandra X-ray Observatory (July 2005). We report on a polarized NIR flare synchronous to a 8×10^{33} erg/s X-ray flare in July 2005, and a further flare in May 2007 that shows the highest sub-flare to flare contrast observed until now. The observations can be interpreted in the framework of a model involving a temporary disk with a short jet. In the disk component flux density variations can be explained due to hot spots on relativistic orbits around the central SMBH. The variations of the sub-structures of the May 2007 flare are interpreted as a variation of the hot spot structure due to differential rotation within the disk.

Appeared in: J. of Physics: Conf. Series, V 131, Proc. of "The Universe Under the Microscope - Astrophysics at High Angular Resolution", p. 012002 (2008).

Large excess of heavy nitrogen in both hydrogen cyanide and cyanogen from comet 17P/Holmes

D. Bockelée-Morvan(1), N. Biver(1), E. Jehin(2), A.L. Cochran(3), H. Wiesemeyer(4), J. Manfroid(2), D. Hutsemékers(2), C. Arpigny(2), J. Boissier(5), W. Cochran(3), P. Colom(1), J. Crovisier(1), N. Milutinovic(6), R. Moreno(1), J.X. Prochaska(7), I. Ramirez(3), R. Schulz(8), and J.-M. Zucconi(9)
(1)LESIA, Observatoire de Paris, 5 Place Jules Janssen, F-92190, Meudon, France, (2)Institut d'Astrophysique et de Géophysique, Sart-Tilman, B-4000, Liège, Belgium, (3)Department of Astronomy and McDonald Observatory, University of Texas at Austin, C-1400, Austin, USA, (4)IRAM, Avenida Divina Pastora, 7, Núcleo Central, E-18012 Granada, Spain, (5)IRAM, 300 rue de la Piscine, Domaine Universitaire, F-38406, Saint Martin d'Hères, France, (6)Department of Physics and Astronomy, University of Victoria, 3800 Finnerty Road, Victoria BC V8P 5C2, Canada, (7)Department of Astronomy and Astrophysics, and UCO/Lick Observatory, University of California, 1156 High Street, Santa Cruz, CA 95064, USA, (8)ESA/RSSD, ESTEC, P.O. Box 299, NL-2200 AG Noordwijk, The Netherlands, (9)Observatoire de Besançon, F-25010 Besançon Cedex, France

Abstract:
From millimeter and optical observations of the Jupiter-family comet 17P/Holmes performed soon after its huge outburst of October 24, 2007, we derive $^{14}N/^{15}N=139\pm26$ in HCN, and $^{14}N/^{15}N=165\pm40$ in CN, establishing that HCN has the same non-terrestrial isotopic composition as CN. The same conclusion is obtained for the long-period comet C/1995 O1 (Hale-Bopp) after a reanalysis of previously published measurements. These results are compatible with HCN being the prime parent of CN in cometary atmospheres. The ^{15}N excess relative to the Earth atmospheric value indicates that N-bearing volatiles in the solar nebula underwent important N isotopic fractionation at some stage of Solar System formation. HCN molecules never isotopically equilibrated with the main nitrogen reservoir in the solar nebula before being incorporated in Oort-cloud and Kuiper-belt comets. The $^{12}C/^{13}C$ ratios in HCN and CN are measured to be consistent with the terrestrial value.

Appeared in ApJ 679, L49

Radio observations of Jupiter-family comets

J. Crovisier(1), N. Biver(1), D. Bockelée-Morvan(1), and P. Colom(1)
(1)LESIA, Observatoire de Paris, 5 place Jules Janssen, F-92195 Meudon, France

Abstract:
Radio observations from decimetric to submillimetric wavelengths are now a basic tool for the investigation of comets. Spectroscopic observations allow us i) to monitor the gas production rate of the comets, by directly observing the water molecule, or by observing secondary products (e.g., the OH radical) or minor species (e.g., HCN); ii) to investigate the chemical composition of comets; iii) to probe the physical conditions of cometary atmospheres:

kinetic temperature and expansion velocity. Continuum observations probe large-size dust particles and (for the largest objects) cometary nuclei.

Comets are classified from their orbital characteristics into two separate classes: i) nearly-isotropic, mainly long-period comets and ii) ecliptic, short-period comets, the so-called Jupiter-family comets. These two classes apparently come from two different reservoirs, respectively the Oort cloud and the trans-Neptunian scattered disc. Due to their different history and — possibly — their different origin, they may have different chemical and physical properties that are worth being investigated.

The present article reviews the contribution of radio observations to our knowledge of the Jupiter-family comets (JFCs). The difficulty of such a study is the commonly low gas and dust productions of these comets. Long-period, nearly-isotropic comets from the Oort cloud are better known from Earth-based observations. On the other hand, Jupiter-family comets are more easily accessed by space missions. However, unique opportunities to observe Jupiter-family comets are offered when these objects come by chance close to the Earth (like 73P/Schwassmann-Wachmann 3 in 2006), or when they exhibit unexpected outbursts (as did 17P/Holmes in 2007).

About a dozen JFCs were successfully observed by radio techniques up to now. Four to ten molecules were detected in five of them. No obvious evidence for different properties between JFCs and other families of comets is found, as far as radio observations are concerned.

Accepted for publication in Planetary & Space Science

Mapping the carbon monoxide coma of comet 29P/Schwassmann-Wachmann 1

M. Gunnarsson([1,2]), D. Bockelée-Morvan([1]), N. Biver([1]), J. Crovisier([1]), and H. Rickman([2])
([1])LESIA, Observatoire de Paris, 5 place Jules Janssen, F-92195 Meudon, France, ([2])Astronomiska Observatoriet, Box 515, S-75120 Uppsala, Sweden

Abstract:
CO is assumed to be the main driver behind the activity of comet 29P/Schwassmann-Wachmann 1, which resides in a near circular orbit at 6 AU from the Sun. Several properties of the outgassing of CO can be deduced from its millimetre-wave emission. Earlier studies have indicated CO production from the nucleus as well as an extended source. We have sought to further investigate the nature of the CO production in comet 29P/Schwassmann-Wachmann 1, through the use of newly available instrumentation. We used the HERA receiver array on the 30-m IRAM telescope to map the 230 GHz CO(J=2–1) line in the comet with an unprecedented sensitivity and spatial coverage, and a high spectral resolution (20 kHz, i.e., 25 m s^{-1}). A 36-point map, 60 by 60″, was obtained in June 2003, and a 25-point map, 96 by 96″, in January 2004.

The CO emission line has a characteristic asymmetric profile. Our analysis is based on a coma model, where the outgassing pattern is derived from the shape of this line at the central position of the map. When comparing to the observations, both maps show a line intensity at offset positions which is 2–3 times stronger than the model prediction. Different explanations to this are evaluated, and it is found that for the global coma character, an extremely low gas temperature in the inner coma reproduces the observed radial profile. A cold inner coma depletes the population of the CO $J=2$ rotational level in the region closest to the nucleus, making spectra observed at offset positions relatively stronger. From the global appearance of the maps, the coma was found to be largely axisymmetric, and the presence of a strong extended source of CO, as indicated from earlier observations using the SEST telescope, was not seen. When examining the maps in more detail, a possible exception to this was seen in an area 30″ south of the comet, where an excess in emission is present in both maps. Model fits to the spectra based on the cold inner coma that we find, with an initial kinetic temperature $T_{kin} = 4$ K, give a measure of Q_{CO}, the CO production rate. Q_{CO} was found to be $(3.9\pm0.2)\times10^{28}$ mol s^{-1} in June 2003, and $(3.7\pm0.2)\times10^{28}$ mol s^{-1} in January 2004. These values are a factor 1.5 higher than that derived using only the information available from non-mapped data, and this adjustment applies also to previously published production rates.

Appeared in A&A 484, 537

Drastic changes in the molecular absorption at redshift $z = 0.89$ toward the quasar PKS 1830−211

Muller S. ([1]) Guélin M. ([2,3])
([1])Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), P.O. Box 23–141, Taipei, 106, Taiwan, ([2])Institut de Radio Astronomie Millimétrique (IRAM), 300 rue de la Piscine, F–38406 St Martin d'Hères, France, ([3])Ecole Normale Supérieure/LERMA, 24 rue Lohmond, F–75005 Paris, France

Abstract:
A 12 year-long monitoring of the absorption caused by a $z = 0.89$ spiral galaxy on the line of sight to the radio-loud gravitationally lensed quasar PKS 1830−211 reveals spectacular changes in the HCO$^+$ and HCN $(2-1)$ line profiles. The depth of the absorption toward the quasar NE image increased by a factor of ~ 3 in 1998-1999 and subsequently decreased by a factor ≥ 6 between 2003 and 2006 (Fig 10). These changes were echoed by similar variations in the absorption line wings toward the SW image. Most likely, these variations result from a motion of the quasar images with respect to the foreground galaxy, which could be due to a new ejected source component: VLBA observations have shown that the separation between the NE and SW images changed in 1997 by as much as 0.2 mas

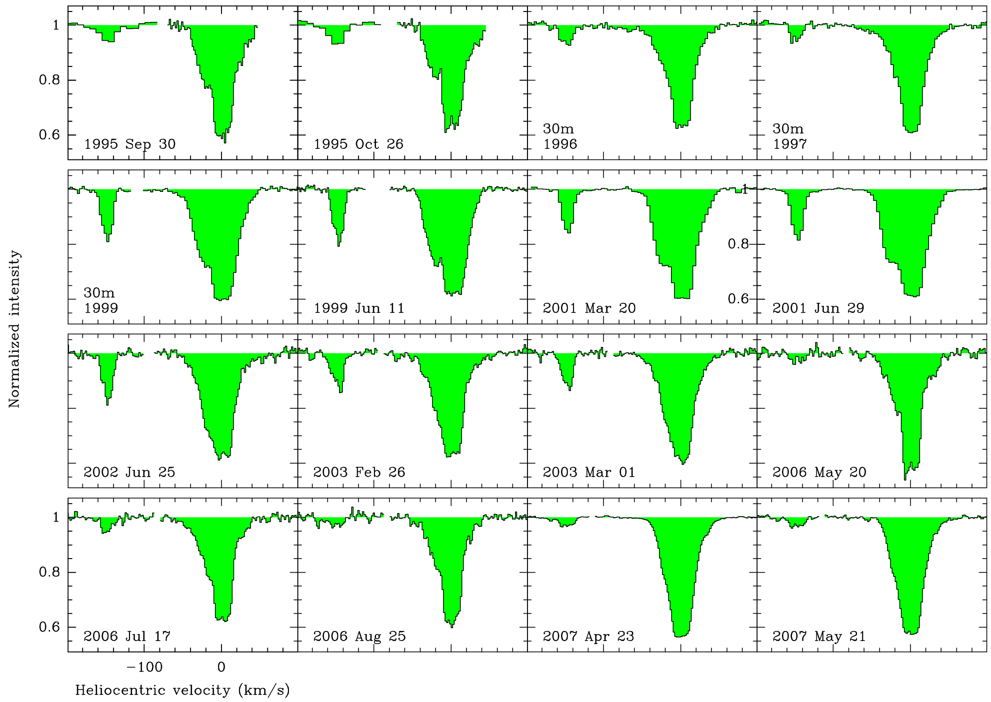

Figure 10: Spectra of the HCO^+ absorption toward PKS 1830−211 obtained either with the Plateau de Bure Interferometer, or the IRAM 30m telescope, at different epochs between 1995 and 2007. The intensity is normalized with respect to the total (NE+SW) continuum flux. The calibration uncertainties on the PdBI are below 1% Note the strong temporal variations of the -147 kms^{-1} absorption component, which arises in front of the NE image of the quasar, and of the blue wing of the main component, which arises in front of the SW quasar image.

within a few months. Assuming that motions of similar amplitude occurred in 1999 and 2003, we argue that the clouds responsible for the NE absorption and the broad wings of the SW absorption should be sparse and have characteristic sizes of $0.5 - 1$ pc.

Appeared in A&A 491, 739

Detection of C_5N^- and vibrationally excited C_6H in IRC +10216

J. Cernicharo(1), M. Guélin(2), M. Agúndez(1), M. C. McCarthy(3,4) and P. Thaddeus(3,4)
(1)DAMIR, Instituto de Estructura de la Materia, CSIC, Serrano 121, 28006 Madrid, Spain, (2)Institut de Radioastronomie Millimétrique, 300 rue de la Piscine, 38406 St. Martin d'Hères, France, (3)Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, U.S.A., (4)School of Engineering and Applied Sciences, Harvard University, 29 Oxford Street, Cambridge, MA 02138, U.S.A.

Abstract:
We report the detection in the envelope of the C-rich star IRC+10216 of four series of lines with harmonically related frequencies: B1389, B1390, B1394 and B1401 (Fig 11). The four series must arise from linear molecules with mass and size close to those of C_6H and C_5N

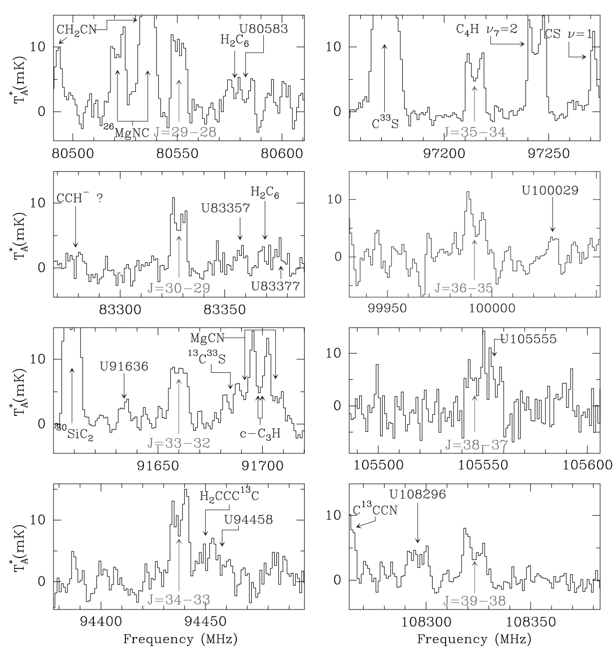

Figure 11: Spectra of IRC +10216, observed with the IRAM 30-m telescope, showing lines from the B1389 series assigned here to C_5N^-. The marginal weak line U83278 is worth noting, because it is within 0.1 MHz of the J=1-0 line of CCH^-.

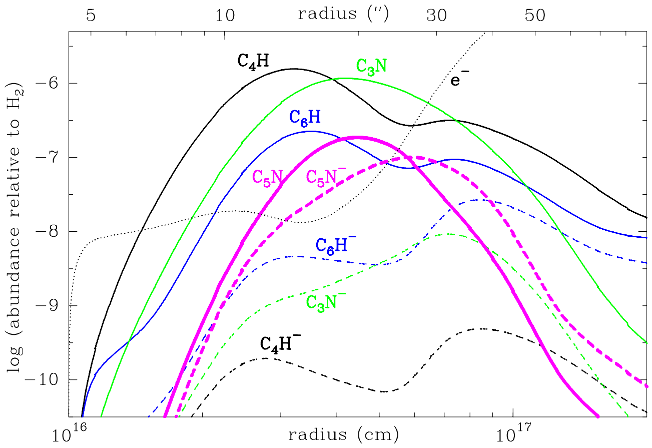

Figure 12: Model abundances of the neutral radicals C_nH, C_nN and their anions in the outer envelope of IRC+10216. The abundance of C_5N^- is predicted to be high at large radii relative to that of its neutral counterpart, in agreement with the observations.

(Fig. 12). Three of the series have half-integer rotational quantum numbers; we assign them to the $^2\Delta$ and $^2\Sigma^-$ vibronic states of C_6H in its lowest (ν_{11}) bending mode. The fourth series, B1389, has integer J with no evidence of fine or hyperfine structure; it has a rotational constant of 1388.860(2) MHz and a centrifugal distortion constant of 33(1) Hz; it is almost certainly C_5N^-.
C_5N^-, which has not been observed so far in the laboratory, is the 5th anion detected in interstellar space. Its abundance is found to be fairly high relative to that of its neutral counterpart (between 1/8 and 1/2.)

Appeared in ApJ 688, L83

A Molecular Einstein Ring at $z = 4.12$: Imaging the Dynamics of a Quasar Host Galaxy Through a Cosmic Lens

Dominik A. Riechers (1,2,3), Fabian Walter(1), Brendon J. Brewer(4), Christopher L. Carilli(5), Geraint F. Lewis(4), Frank Bertoldi(6), and Pierre Cox(7)
(1)MPIA, Königstuhl 17, Heidelberg, D-69117, Germany, (2)Astronomy Department, California Institute of Technology, MC 105-24, 1200 East California Boulevard, Pasadena, CA 91125, (3)Hubble Fellow, (4)Institute of Astronomy, School of Physics, A28, University of Sydney, NSW 2006, Australia, (5)NRAO, P.O. Box O, Socorro, NM 87801, (6)Argelander-Institut für Astronomie, Universität Bonn, Auf dem Hügel 71, Bonn, D-53121, Germany, (7)IRAM, 300 Rue de la Piscine, F-38406 Saint Martin d'Hères, France

Abstract:
We present high-resolution (0.″3) Very Large Array imaging of the molecular gas in the host galaxy of the high-redshift quasar PSS J2322+1944 ($z = 4.12$). These observations confirm that the molecular gas (CO) in the host galaxy of this quasar is lensed into a full Einstein ring and reveal the internal gas dynamics in this system. The ring has a diameter of $\sim$ 1.″5 and thus is sampled over $\sim$ 20 resolution elements by our observations. Through a model-based lens inversion, we recover the velocity gradient of the molecular reservoir in the quasar host galaxy of PSS J2322+1944. The Einstein ring lens configuration enables us to zoom in on the emission and to resolve scales down to $\lesssim 1$ kpc. From the model-reconstructed source, we find that the molecular gas is distributed on a scale of 5 kpc and has a total mass of $M(H_2) = 1.7 \times 10^{10} M_\odot$. A basic estimate of the dynamical mass gives $M_{dyn} = 4.4 \times 10^{10} \sin^{-2} i M_\odot$, that is, only $\sim$ 2.5 times the molecular gas mass and $\sim$ 30 times the black hole mass (assuming that the dynamical structure is highly inclined). The lens configuration also allows us to tie the optical emission to the molecular gas emission, which suggests that the active galactic nucleus does reside within, but not close to the center of, the molecular reservoir. Together with the (at least partially) disturbed structure of the CO, this suggests that the system is interacting. Such interaction, possibly caused by a major "wet" merger, may be responsible for both feeding the quasar and fueling the massive starburst of $680 M_\odot\ yr^{-1}$ in this system, in agreement with recently suggested scenarios of quasar activity and galaxy assembly in the early universe.

Appeared in ApJ 686, 851

Thermal emission from warm dust in the most distant quasars

Ran Wang(1,2), Chris L. Carilli(2), Jeff Wagg(2), Frank Bertoldi(3), Fabian Walter(4), Karl M. Menten(5), Alain Omont(6), Pierre Cox(7), Michael A. Strauss(8), Xiaohui Fan(9), Linhua Jiang(9) and Donald P. Schneider(10)
(1)Department of Astronomy, Peking University, Beijing 100871, China, (2)National Radio Astronomy Observatory, P.O. Box O, Socorro, NM 87801, (3)Argelander-Institut für Astronomie, University of Bonn, Auf dem Hügel 71,53121 Bonn, Germany, (4)Max Planck Institute for Astronomy, Königsstuhl 17, 69117 Heidelberg,Germany, (5)MPIfR, Auf dem Hügel 71, 53121 Bonn,Germany, (6)Institut d'Astrophysique de Paris, CNRS, and Universite Pierre et MarieCurie, Paris, France, (7)IRAM, F-38406 St.Martin d'Hères, France, (8)Department of Astrophysical Sciences, Princeton University, Princeton, NJ 08544, (9)Steward Observatory, University of Arizona, Tucson, AZ 85721, (10)Department of Astronomy and Astrophysics, Pennsylvania State University, University Park, PA 16802.

Abstract:
We report new continuum observations of 14 $z \sim 6$ quasars at 250 GHz and 14 quasars at 1.4 GHz.We summarize all recent millimeter and radio observations of the sample of the 33 quasars known with $5.71 \leq z \leq 6.43$ and

present a study of the rest-frame far-infrared (FIR) properties of this sample. These quasars were observed with the Max Planck Millimeter Bolometer Array (MAMBO) at 250 GHz with mJy sensitivity, and 30% of them were detected.We also recover the average 250 GHz flux density of the MAMBO undetected sources at 4σ by stacking the on-source measurements. The derived mean radio-to-UV spectral energy distributions (SEDs) of the full sample and the 250 GHz nondetections show no significant differences from lower redshift optical quasars. Obvious FIR excesses are seen in the individual SEDs of the strong 250 GHz detections, with FIR-to-radio emission ratios consistent with those of typical star-forming galaxies. Most 250 GHz- detected sources follow the $L_{FIR} - L_{bol}$ relationship derived from a sample of local IR-luminous quasars ($L_{IR} > 10^{12}$L$_\odot$), while the average L_{FIR}/L_{bol} ratio of the nondetections is consistent with that of the optically selected PG quasars. The MAMBO detections also tend to have weaker Lyα emission than the nondetected sources.We discuss possible FIR dust-heating sources and critically assess the possibility of active star formation in the host galaxies of the $z \sim 6$ quasars. The average star formation rate of the MAMBO nondetections is likely to be less than a few hundred M$_\odot$yr^{-1}, but in the strong detections, the host galaxy star formation is probably at a rate of $\gtrsim 10^3$M$_\odot$yr^{-1}, which dominates the FIR dust heating.

Appeared in ApJ 687, 848

Interferometric CO observations of submillimeter-faint, radio-selected starburst galaxies at $z \sim 2$

S. C. Chapman([1,2]), R. Neri([3]), F. Bertoldi,([4]), Ian Smail,([5]), T. R. Greve,([6]), D. Trethewey,([1]), A. W. Blain,([7]), P. Cox,([3]), R. Genzel,([8]), R. J. Ivison,([9,10]), A. Kovacs,([4]), A. Omont,([11]) and A. M. Swinbank([5])
([1])Institute of Astronomy, Madingley Road, Cambridge, CB3 0HA, UK, ([2])University of Victoria, Victoria, BC, V8W 3P6, Canada, ([3])IRAM, St. Martin d'Hères, France, ([4])MPIfR, Bonn, Germany, ([5])Institute for Computational Cosmology, Durham University, South Road, Durham DH1 3LE, UK, ([6])Astronomy Department, MPIA, Königsstuhl 17, D-69117 Heidelberg, Germany, ([7])California Institute of Technology, Pasadena, CA 91125, ([8])MPE, Garching, Germany, ([9])UK Astronomy Technology Centre, Royal Observatory, Blackford Hill, Edinburgh EH9 3HJ, UK, ([10])Institute for Astronomy, University of Edinburgh, Royal Observatory, Blackford Hill, Edinburgh EH9 3HJ, UK, ([11])Institut d'Astrophysique de Paris, CNRS, Université de Paris, Paris, France

Abstract:
High-redshift, dust-obscured galaxies, selected to be luminous in the radio but relatively faint at 850μm, appear to represent a different population from the ultraluminous submillimeter-bright population. They may be star-forming galaxies with hotter dust temperatures, or they may have lower far-infrared luminosities and larger contributions from obscured active galactic nuclei (AGNs). Here we present observations of three $z \sim 2$ examples of this population, which we term "submillimeter-faint radio galaxies" (SFRGs; RG J163655, RG J131236, and RG J123711) in CO$(3-2)$ using the IRAM Plateau de Bure Interferometer to study their gas and dynamical properties.We estimate the molecular gas mass in each of the three SFRGs (8.3×10^9, $< 5.6 \times 10^9$, and 15.4×10^9M$_\odot$, respectively) and, in the case of RG J163655, a dynamical mass by measurement of the width of the CO$(3-2)$ line ($8 \times 10^{10} csc^2 i$M$_\odot$). While these gas masses are substantial, on average they are 4 times lower than submillimeter-selected galaxies (SMGs). Radio-inferred star formation rates ($\langle$SFR$_{radio}\rangle = 970$M$_\odot$ yr^{-1}) suggest much higher star formation efficiencies than are found forSMGs and shorter gas depletion timescales (~ 11 Myr), much shorter than the time required to form their current stellar masses (~ 160 Myr; $\sim 10^{11}$M$_\odot$). By contrast, star formation rates (SFRs) may be overestimated by factors of a few, bringing the efficiencies in line with those typically measured for other ultraluminous star-forming galaxies and suggesting that SFRGs are more like ultraviolet-selected (UV-selected) star-forming galaxies with enhanced radio emission. A tentative detection of RG J163655 at 350μm suggests hotter dust temperatures, and thus gas-to-dust mass fractions, similar to the SMGs.

Appeared in ApJ 689, 889

A sensitive search for [N II]$_{205\mu m}$ emission in a $z = 6.4$ quasar host galaxy

Fabian Walter([1]), Axel Weiss([2]), Dominik A. Riechers([3,7]), Christopher L. Carilli([4]), Frank Bertoldi([5]), Pierre Cox([6]), and Karl M. Menten([2])
([1])MPIA, Königstuhl 17, Heidelberg, D-69117, Germany, ([2])MPIfR, Auf dem Hügel 69, Bonn, D-53121, Germany, ([3])Astronomy Department, California Institute of Technology, MC 105-24, 1200 East California Boulevard, Pasadena, CA 91125, USA, ([4])NRAO, P.O. Box O, Socorro, NM 87801, USA, ([5])Argelander Institut für Astronomie, Universität Bonn, Auf dem Hügel 71, Bonn, D-53121, Germany, ([6])IRAM, 300 Rue de la Piscine, Domaine Universitaire, F-38406 Saint Martin d'Hères, France

Abstract:
We present a sensitive search for the $^3P_1 \rightarrow {}^3P_0$ ground-state fine structure line at 205μm of ionized nitrogen ([N II]$_{205\mu m}$) in one of the highest-redshift quasars (J1148+5251 at $z = 6.42$) using the IRAM 30 m telescope. The line is not detected at a (3σ) depth of 0.47 Jy km s^{-1}, corresponding to a [N II]$_{205\mu m}$ luminosity limit of $L_{[NII]} < 4.0 \times 10^8L_\odot$ and a $L_{[Nii]}/L_{FIR}$ ratio

of $< 2 \times 10^{-5}$. In parallel, we have observed the CO ($J = 6-5$) line in J1148+5251, which is detected at a flux level consistent with earlier interferometric observations. Using our earlier measurements of the [C II] 158μm line strength, we derive an upper limit for the [N II]$_{205\mu m}$/[C II] line luminosity ratio of $\sim 1/10$ in J1148+5251. Our upper limit for the [C II]/[N II]$_{205\mu m}$ ratio is similar to the value found for our Galaxy and M82 (the only extragalactic system where the [N II]$_{205\mu m}$ line has been detected to date). Given the nondetection of the [N II]$_{205\mu m}$ line we can only speculate whether or not high-z detections are within reach of currently operating observatories. However, [N II]$_{205\mu m}$ and other fine-structure lines will play a critical role in characterizing the interstellarmedium at the highest redshifts ($z > 7$) using the Atacama Large Millimeter/submillimeter Array, for which the highly excited rotational transitions of CO will be shifted outside the accessible (sub-)millimeter bands.

Appeared in ApJ 691, L1

The CO line SED and atomic carbon in IRAS F10214+4724

Y. Ao([1,2]), A. Weiss([2]), D. Downes([3]), F. Walter([4]), C. Henkel([2]), and K. M. Menten([2])
([1])Purple Mountain Observatory, Chinese Academy of Sciences, Nanjing 210008, PR China, ([2])MPIfR, Auf dem Hügel 69, 53121 Bonn, Germany, ([3])IRAM, Domaine Universitaire, 38406 St-Martin-d'Hères, France, ([4])MPIA, Königstuhl 17, 69117 Heidelberg, Germany

Abstract:
Using the IRAM 30 m telescope and the Plateau de Bure interferometer we have detected the C I($^3P_2 \rightarrow {}^3P_1$) and the CO $3-2$, $4-3$, $6-5$, $7-6$ transitions as well as the dust continuum at 3 and 1.2 mm towards the distant luminous infrared galaxy IRAS F10214+4724 at $z = 2.286$. The C I($^3P_2 \rightarrow {}^3P_1$) line is detected for the first time towards this source and IRAS F10214+4724 now belongs to a sample of only 3 extragalactic sources at any redshift where both of the carbon fine structure lines have been detected. The source is spatially resolved by our C I($^3P_2 \rightarrow {}^3P_1$) observation and we detect a velocity gradient along the east-west direction. The CI line ratio allows us to derive a carbon excitation temperature of 42^{+12}_{-9} K. The carbon excitation in conjunction with the CO ladder and the dust continuum constrain the gas density to $n(H_2) = 10^{3.6-4.0}$ cm^{-3} and the kinetic temperature to $T_{kin} = 45-80$ K, similar to the excitation conditions found in nearby starburst galaxies. The rest-frame 360μm dust continuum morphology is more compact than the line emitting region, which supports previous findings that the far infrared luminosity arises from regions closer to the active galactic nucleus at the center of this system.

Appeared in A&A 491, 747

GRB 080319B: A Naked-Eye Stellar Blast from the Distant Universe

Racusin J.L.([1]), and 92 international co-authors
([1])Department of Astronomy and Astrophysics, 525 Davey Laboratory, Pennsylvania State University, University Park, Pennsylvania 16802, USA

Abstract:
Long-duration $\gamma-$ray bursts (GRBs) release copious amounts of energy across the entire electromagnetic spectrum, and so provide a window into the process of black hole formation from the collapse of massive stars. Previous early optical observations of even the most exceptional GRBs (990123 and 030329) lacked both the temporal resolution to probe the optical flash in detail and the accuracy needed to trace the transition from the prompt emission within the outflow to external shocks caused by interaction with the progenitor environment. Here we report observations of the extraordinarily bright prompt optical and $\gamma-$ray emission of GRB080319B that provide diagnostics within seconds of its formation, followed by broadband observations of the afterglow decay that continued for weeks. We show that the prompt emission stems from a single physical region, implying an extremely relativistic outflow that propagates within the narrow inner core of a two-component jet.

Appeared in Nature 455, 183

Flares from a candidate Galactic magnetar suggest a missing link to dim isolated neutron stars

Castro-Tirado A.J.([1]) and 41 international co-authors
([1])Instituto de Astrofísica de Andalucía del Consejo Superior de Investigaciones Científicas (IAA-CSIC), PO Box 03004, E-18080 Granada, Spain

Abstract:
Magnetars are young neutron stars with very strong magnetic fields of the order of $10^{14}-10^{15}$G. They are detected in our Galaxy either as soft γ-ray repeaters or anomalous X-ray pulsars. Soft γ-ray repeaters are a rare type of γ-ray transient sources that are occasionally detected as bursters in the high-energy sky. No optical counterpart to the γ-ray flares or the quiescent source has yet been identified. Here we report multi-wavelength observations of a puzzling source, SWIFT J195509+261406. We detected more than 40 flaring episodes in the optical band over a time span of three days, and a faint infrared flare 11 days later, after which the source returned to quiescence. Our radio observations confirm a Galactic nature and establish a lower distance limit of ~ 3.7kpc. We suggest that SWIFT J195509+261406 could be an isolated magnetar whose bursting activity has been detected at optical wavelengths, and for which the long-term X-ray emission is short-lived. In this case, a new manifestation of magnetar activity has been recorded and we can consider SWIFT J195509+261406 to be a link between the

'persistent' soft γ-ray repeaters/anomalous X-ray pulsars and dim isolated neutron stars.

Appeared in Nature 455, 506

A photometric redshift of $z = 1.8^{+0.4}_{-0.3}$ for the AGILE GRB 080514B

Rossi, A.(1) and 30 international co-authors
(1)Thüringer Landessternwarte Tautenburg, Sternwarte 5, 07778 Tautenburg, Germany

Abstract:
The AGILE gamma-ray burst GRB 080514B is the first detected to have emission above 30 MeV and an optical afterglow. However, no spectroscopic redshift for this burst is known. We report on our ground-based optical/NIR and millimeter follow-up observations of this event at several observatories, including the multi-channel imager GROND on La Silla, supplemented by Swift UVOT and Swift XRT data. The spectral energy distribution (SED) of the optical/NIR afterglow is found to decline sharply bluewards to the UV bands, which can be utilized in estimating the redshift. Fitting the SED from the Swift UVOT uvw2 band to the H band, we estimate a photometric redshift of $z = 1.8^{+0.4}_{-0.3}$, which is consistent with the reported pseudo-redshift based on gamma-ray data. We find that the afterglow properties of GRB 080514B do not differ from those exhibited by the global sample of long bursts. Compared with the long burst sample, we conclude that this burst was special because of its high-energy emission properties, even though both its afterglow and host galaxy are not remarkable in any way. Obviously, high-energy emission in the gamma-ray band does not automatically correlate with the occurrence of special features in the corresponding afterglow light.

Appeared in A&A 491, L29

Testing the inverse-Compton catastrophe scenario in the intra-day variable blazar S5 0716+71
III. Rapid and correlated flux density variability from radio to sub-mm bands

L. Fuhrmann(1,2,3), T. P. Krichbaum(1), A. Witzel(1), A. Kraus(1), S. Britzen(1), S. Bernhart(1), C. M. V. Impellizzeri(1), I. Agudo(1,4), J. Klare(1), B. W. Sohn(1,5), E. Angelakis(1), U. Bach(1,3), K. É. Gabányi(1,6,7), E. Körding(8), A. Pagels(1), J. A. Zensus(1), S. J. Wagner(9), L. Ostorero(10,11), H. Ungerechts(12), M. Grewing(13), M. Tornikoski(14), A. J. Apponi(15), B. Vila-Vilaró(16), L. M. Ziurys(15), and R. G. Strom(17)
(1)MPIfR, Auf dem Hügel 69, 53121 Bonn, Germany, (2)Dipartimento di Fisica, Università di Perugia, via A. Pascoli, 06123 Perugia, Italy, (3)INAF - Osservatorio Astronomico di Torino, via Osservatorio 20, 10025 Pino Torinese (TO), Italy, (4)Instituto de Astrofísica de Andalucía, CSIC, Apartado 3004, 18080 Granada, Spain, (5)Korea Astronomy & Space Science Institute, 61-1 Hwaam-dong, 305-348 Daejeon, Korea, (6)Hungarian Academy of Sciences Research Group for Physical Geodesy and Geodynamics, Budapest, Hungary, (7)FÖMI Satellite Geodetic Observatory, Budapest, Hungary, (8)School of Physics & Astronomy, University of Southampton, Southampton, Hampshire SO17 1BJ, UK, (9)Landessternwarte Heidelberg-Königstuhl, Königstuhl, 69117 Heidelberg, Germany, (10)Dipartimento di Fisica Generale "Amedeo Avogadro", Università degli Studi di Torino, via P. Giuria 1, 10125 Torino, Italy, (11)Istituto Nazionale di Fisica Nucleare (INFN), Sezione di Torino, via P. Giuria 1, 10125 Torino, Italy, (12)IRAM, Avenida Divina Pastora 7, Local 20, 18012 Granada, Spain, (13)IRAM, 300 rue de la Piscine, Domaine Universitaire de Grenoble, 38406 Saint-Martin d'Hères, France, (14)Metsähovi Radio Observatory, Helsinki University of Technology, Metsähovintie 114, 02540 Kylmälä, Finland, (15)Arizona Radio Observatory, University of Arizona, 933 N. Cherry Avenue, Tucson, AZ 85721, USA, (16)University of Arizona, Steward Observatory, 933 N. Cherry Ave., Tucson, AZ 85721, USA, (17)ASTRON, Postbus 2, 7990 AA Dwingeloo; and Astronomical Institute, University of Amsterdam, The Netherlands

Abstract:
Aims. The BL Lac object S5 0716+71 was observed in a global multi-frequency campaign to search for rapid and correlated flux density variability and signatures of an inverse-Compton (IC) catastrophe during the states of extreme apparent brightness temperatures.
Methods. The observing campaign involved simultaneous ground-based monitoring at radio to IR/optical wavelengths and was centered around a 500-ks pointing with the INTEGRAL satellite (November 10-17, 2003). Here, we present the combined analysis and results of the radio observations, covering the cm- to sub-mm bands. This facilitates a detailed study of the variability characteristics of an inter- to intra-day variable IDV source from cm- to the short mm-bands. We further aim to constrain the variability brightness temperatures (TB) and Doppler factors (δ) comparing the radio-bands with the hard X-ray emission, as seen by INTEGRAL at 3-200 keV.
Results. 0716+714 was in an exceptionally high state and different (slower) phase of short-term variability, when compared to the past, most likely due to a pronounced outburst shortly before the campaign. The flux density variability in the cm- to mm-bands is dominated by a ~ 4 day time scale amplitude increase of up to $\sim 35\%$, systematically more pronounced towards shorter wavelengths. The cross-correlation analysis reveals systematic

time-lags with the higher frequencies varying earlier, similar to canonical variability on longer time-scales. The increase of the variability amplitudes with frequency contradicts expectations from standard interstellar scintillation (ISS) and suggests a source-intrinsic origin for the observed inter-day variability. We find an inverted synchrotron spectrum peaking near 90 GHz, with the peak flux increasing during the first 4 days. The lower limits to TB derived from the inter-day variations exceed the 1012 K IC-limit by up to 3-4 orders of magnitude. Assuming relativistic boosting, our different estimates of δ yield robust and self-consistent lower limits of $\delta \geq 5 - 33$ - in good agreement with δ_{VLBI} obtained from VLBI studies and the IC-Doppler factors $\delta_{IC} > 14 - 16$ obtained from the INTEGRAL data.
Conclusions. The non-detection of S5 0716+714 with INTEGRAL in this campaign excludes an excessively high X-ray flux associated with a simultaneous IC catastrophe. Since a strong contribution from ISS can be excluded, we conclude that relativistic Doppler boosting naturally explains the apparent violation of the theoretical limits. All derived Doppler factors are internally consistent, agree with the results from different observations and can be explained within the framework of standard synchrotron-self-Compton (SSC) jet models of AGN.

Appeared in A&A 490, 1019

Cavities in inner disks: the GM Aurigae case

A. Dutrey([1]), S. Guilloteau([1]), V. Piétu([2]), E. Chapillon([1,2]), F.Gueth([2]), T. Henning([3]), R. Launhardt([3]), Y. Pavlyuchenkov([3]), K. Schreyer([4]), and D. Semenov([3])
([1])LAB, UMR 5804, Observatoire de Bordeaux, 2 rue de l'Observatoire, 33270 Floirac, France, ([2])IRAM, 300 rue de la Piscine, 38400 Saint Martin d'Hères, France, ([3])Max-Planck-Institut für Astronomie, Königstuhl 17, 69117 Heidelberg, Germany, ([4])Astrophysikalisches Institut und Universitäts-Sternwarte, Schillergässchen 2-3, 07745 Jena, Germany

Abstract:
Context. Recent modeling based on unresolved infrared observations of the spectral energy distribution (SED) of GM Aurigae suggests that the inner disk of this single TTauri star is truncated at an inner radius of 25 AU.
Aims. We attempt to find evidence of this inner hole in the gas distribution, using spectroscopy with high angular resolution.
Methods. Using the IRAM array, we obtained high angular resolution ($\sim 1\farcs5$) observations with a high S/N per channel of the ^{13}CO $J = 2 - 1$ and C^{18}O $J = 2 - 1$ and of the ^{13}CO $J = 1 - 0$ lines. A standard parametric disk model is used to fit the line data in the Fourier-plane and to derive the CO disk properties. Our measurement is based on a detailed analysis of the spectroscopic profile from the CO disk rotating in Keplerian velocity. The millimeter continuum, tracing the dust, is also analyzed.
Results. We detect an inner cavity of radius 19 ± 4 AU at the 4.5σ level. The hole manifests itself by a lack of emission beyond the (projected) Keplerian speed at the inner radius. We also constrain the temperature gradient in the disk.
Conclusions. Our data reveal the existence of an inner hole in GM Aur gas disk. Its origin remains unclear, but can be linked to planet formation or to a low mass stellar companion orbiting close to the central star ($\sim 5 - 15$ AU). The frequent finding of inner cavities suggests that either binarity is the most common scenario of star formation in Taurus or that giant planet formation starts early.

Appeared in A&A 490, L15

Chemistry in disks II. Poor molecular content of the AB Aurigae disk

K. Schreyer([1]), S. Guilloteau([2,3]), D. Semenov([4]), A. Bacmann([2,3]), E. Chapillon([5]), A. Dutrey([2,3]), F. Gueth([5]), T. Henning([4]), F. Hersant([2,3]), R. Launhardt([4]), J. Pety([5]), and V. Piétu([5])
([1])Astrophysikalisches Institut und Universitäts-Sternwarte, Schillergässchen 2-3, 07745 Jena, Germany, ([2])Université Bordeaux 1, Laboratoire d'Astrophysique de Bordeaux (LAB), France, ([3])CNRS/INSU - UMR 5804, BP 89, 33270 Floirac, France, ([4])MPIA, Königstuhl 17, 69117 Heidelberg, Germany, ([5])IRAM, 300 rue de la Piscine, 38406 Saint Martin d'Hères, France

Abstract:
Aims. We study the molecular content and chemistry of a circumstellar disk surrounding the Herbig Ae star AB Aur at (sub-)millimeter wavelengths. Our aim is to reconstruct the chemical history and composition of the AB Aur disk and to compare it with disks around low-mass, cooler T Tauri stars.
Methods. We observe the AB Aur disk with the IRAM Plateau de Bure Interferometer in the C- and D-configurations in rotational lines of CS, HCN, C_2H, CH_3OH, HCO^+, and CO isotopes. Using an iterative minimization technique, observed columns densities and abundances are derived. These values are further compared with results of an advanced chemical model that is based on a steady-state flared disk structure with a vertical temperature gradient, and gas-grain chemical network with surface reactions.
Results. We firmly detect HCO^+ in the $1 - 0$ transition, tentatively detect HCN, and do not detect CS, C_2H, and CH_3OH. The observed HCO^+ and ^{13}CO column densities as well as the upper limits to the column densities of HCN, CS, C_2H, and CH_3OH are in good agreement with modeling results and those from previous studies.
Conclusions. The AB Aur disk possesses more CO, but is less abundant in other molecular species compared to the DM Tau disk. This is primarily caused by intense UV

irradiation from the central Herbig A0 star, which results in a hotter disk where CO freeze out does not occur and thus surface formation of complex CO-bearing molecules might be inhibited.

Appeared in A&A 491, 821

Simultaneous NIR/sub-mm observation of flare emission from Sagittarius A*

A. Eckart([1,2]), R. Schödel([3]), M. García-Marín([1]), G. Witzel([1]), A. Weiss([2]), F. K. Baganoff([4]), M. R. Morris([5]), T. Bertram([1]), M. Dovčiak()6, W. J. Duschl([7,8]), V. Karas([6]), S. König([1]), T. P. Krichbaum([2]), M. Krips([9,14]), D. Kunneriath([1,2]), R.-S. Lu([2,1]), S. Markoff([10]), J. Mauerhan([5]), L.Meyer([5]), J. Moultaka([11]), K.Mužić([1]), F. Najarro([12]), J.-U. Pott([5,13]), K. F. Schuster([14]), L. O. Sjouwerman([15]), C. Straubmeier([1]), C. Thum([14]), S. N. Vogel([16]), H. Wiesemeyer([17]), M. Zamaninasab([1,2]), and J. A. Zensus([2])

([1])I. Physikalisches Institut, Universität zu Köln, Zülpicher Str. 77, 50937 Köln, Germany, ([2])MPIfR, Auf dem Hügel 69, 53121 Bonn, Germany, ([3])Instituto de Astrofísica de Andalucía, Camino Bajo de Huétor 50, 18008 Granada, Spain, ([4])Center for Space Research, Massachusetts Institute of Technology, Cambridge, MA 02139-4307, USA, ([5])Department of Physics and Astronomy, University of California, Los Angeles, CA 90095-1547, USA, ([6])Astronomical Institute, Academy of Sciences, Boční II, 14131 Prague, Czech Republic, ([7])Institut für Theoretische Physik und Astrophysik, Christian-Albrechts-Universität zu Kiel, Leibnizstr. 15, 24118 Kiel, Germany, ([8])Steward Observatory, The University of Arizona, 933 N. Cherry Ave. Tucson, AZ 85721, USA, ([9])Harvard-Smithsonian Center for Astrophysics, SMA project, 60 Garden Street, MS 78 Cambridge, MA 02138, USA, ([10])Astronomical Institute "Anton Pannekoek", University of Amsterdam, Kruislaan 403, 1098SJ Amsterdam, The Netherlands, ([11])LATT, Université de Toulouse, CNRS, 14 avenue Édouard Belin, 31400 Toulouse, France, ([12])DAMIR, Instituto de Estructura de la Materia, Consejo Superior de Investigaciones Científicas, Serrano 121, 28006 Madrid, Spain, ([13])W.M. Keck Observatory (WMKO), CARA, 65-1120 Mamalahoa Hwy., Kamuela, HI-96743, USA, ([14])IRAM, Domaine Universitaire, 38406 Saint-Martin d'Hères, France, ([15])National Radio Astronomy Observatory, PO Box 0, Socorro, NM 87801, USA, ([16])Department of Astronomy, University of Maryland, College Park, MD 20742-2421, USA, ([17])IRAM, Avenida Divina Pastora, 7, Núcleo Central, 18012 Granada, Spain

Abstract:
Context. We report on a successful, simultaneous observation and modeling of the sub-millimeter to near-infrared flare emission of the Sgr A* counterpart associated with the super-massive ($4\times10^6 M_\odot$) black hole at the Galactic center.
Aims. We study and model the physical processes giving rise to the variable emission of Sgr A*.
Methods. Our non-relativistic modeling is based on simultaneous observations that have been carried out on 03 June, 2008. We used the NACO adaptive optics (AO) instrument at the European Southern Observatory's Very Large Telescope and the LABOCA bolometer at the Atacama Pathfinder Experiment (APEX). We emphasize the importance of a multi-wavelength simultaneous fitting as a tool for imposing adequate constraints on the flare modeling.
Results. The observations reveal strong flare activity in the 0.87 mm (345 GHz) sub-mm domain and in the 3.8μm/2.2μm NIR. Inspection and modeling of the light curves show that the sub-mm follows the NIR emission with a delay of 1.5 ± 0.5 h. We explain the flare emission delay by an adiabatic expansion of the source components. The derived physical quantities that describe the flare emission give a source component expansion speed of $v_{exp} \sim 0.005$c, source sizes around one Schwarzschild radius with flux densities of a few Janskys, and spectral indices of $\alpha = 0.8$ to 1.8, corresponding to particle spectral indices $\sim$ 2.6 to 4.6. At the start of the flare the spectra of these components peak at frequencies of a few THz.
Conclusions. These parameters suggest that the adiabatically expanding source components either have a bulk motion greater than v_{exp} or the expanding material contributes to a corona or disk, confined to the immediate surroundings of Sgr A*.

Appeared in A&A 492, 337

First detection of glycolaldehyde outside the galactic center

M. T. Beltrán([1]), C. Codella([2]), S. Viti([3]), R. Neri([4]) and R. Cesaroni([5])

([1])Universitat de Barcelona, Departament d'Astronomia i Meteorologia, Unitat Associada a CSIC, Martí i Franquès 1, 08028 Barcelona, Catalunya, Spain, ([2])INAF, Istituto di Radioastronomia, Sezione di Firenze, Largo E. Fermi 5, I-50125 Firenze, Italy, ([3])Department of Physics and Astronomy, University College London, Gower Street, London WC1E6BT, UK, ([4])IRAM, 300 Rue de la Piscine, F-38406 Saint Martin d'Hères, France, ([5])INAF, Osservatorio Astrofisico di Arcetri, Largo E. Fermi 5, I-50125 Firenze, Italy

Abstract:
Glycolaldehyde is the simplest of the monosaccharide sugars and is directly linked to the origin of life.We report on the detection of glycolaldehyde (CH_2OHCHO) toward the hot molecular core G31.41+0.31 through IRAM PdBI observations at 1.4, 2.1, and 2.9 mm. The CH_2OHCHO emission comes from the hottest ($\geq$ 300 K) and densest ($\geq 2 \times 10^8$ cm^{-3}) region closest ($\leq 10^4$ AU) to

the (proto)stars. The comparison of data with gas-grain chemical models of hot cores suggests for G31.41+0.31 an age of a few 10^5 yr. We also show that only small amounts of CO need to be processed on grains in order for existing hot core gas-grain chemical models to reproduce the observed column densities of glycolaldehyde, making surface reactions the most feasible route to its formation.

Appeared in ApJ 690, L93

Limits on chemical complexity in diffuse clouds: search for CH_3 and HC_5N absorption

H. S. Liszt([1]), J. Pety([2,3]), and R. Lucas([2])
([1])NRAO, 520 Edgemont Road, Charlottesville, VA, 22903-2475, USA. ([2])IRAM, 300 rue de la Piscine, 38406 Saint Martin d'Hères, France, ([3])Obs. de Paris, 61 Av. de l'Observatoire, 75014 Paris, France

Abstract:
Context. An unexpectedly complex polyatomic chemistry exists in diffuse clouds, allowing detection of species such as C_2H, C_3H_2, H_2CO, and NH_3, which have relative abundances that are strikingly similar to those inferred toward the dark cloud TMC-1.
Aims. We probe the limits of complexity of diffuse cloud polyatomic chemistry.
Methods. We used the IRAM Plateau de Bure Interferometer to search for galactic absorption from low-lying $J = 2-1$ rotational transitions of A- and E- CH_3OH near 96.740 GHz and used the VLA to search for the $J = 8-7$ transition of HC_5N at 21.3 GHz.
Results. Neither CH_3OH nor HC_5N were detected at column densities well below those of all polyatomics known in diffuse clouds and somewhat below the levels expected from comparison with TMC-1. The HCN/HC_5N ratio is at least 3 - 10 times higher in diffuse gas than toward TMC-1.

Appeared in A&A 486, 493

Imaging galactic diffuse gas: bright, turbulent CO surrounding the line of sight to NRAO150

J. Pety([1,2]), R. Lucas([1]), and H. S. Liszt([3])
([1])IRAM, 300 Rue de la Piscine, 38406 Saint Martin d'Hères, France ([2])Obs. de Paris, 61 Av. de l'Observatoire, 75014 Paris, France, ([3])NRAO, 520 Edgemont Road, Charlottesville, VA 22903-2475, USA

Abstract:
Aims. To understand the environment and extended structure of the host galactic gas whose molecular absorption line chemistry, we previously observed along the microscopic line of sight to the blazar/radiocontinuum source NRAO150 (aka B0355+508).
Methods. We used the IRAM 30 m Telescope and Plateau de Bure Interferometer to make two series of images of the host gas: i) 22.″5 resolution single-dish maps of ^{12}CO $J = 1-0$ and $2-1$ emission over a 220″ by 220″ field; ii) a hybrid (interferometer+ single dish) aperture synthesis mosaic of ^{12}CO $J = 1-0$ emission at 5.″8 resolution over a 90″-diameter region.
Results. At 22.″5 resolution, the CO $J = 1-0$ emission toward NRAO150 is 30 - 100% brighter at some velocities than seen previously with 1′ resolution, and there are some modest systematic velocity gradients over the 220″ field. Of the five CO components seen in the absorption spectra, the weakest ones are absent in emission toward NRAO150 but appear more strongly at the edges of the region mapped in emission. The overall spatial variations in the strongly emitting gas have Poisson statistics with rms fluctuations about equal to the mean emission level in the line wings and much of the line cores. The $J = 2-1/J = 1-0$ line ratios calculated pixel-by-pixel cluster around 0.7. At 6″ resolution, disparity between the absorption and emission profiles of the stronger components has been largely ameliorated. The ^{12}CO $J = 1-0$ emission exhibits i) remarkably bright peaks, $T_{mb} = 12-13$ K, even as 4″ from NRAO150; ii) smaller relative levels of spatial fluctuation in the line cores, but a very broad range of possible intensities at every velocity; and iii) striking kinematics whereby the monotonic velocity shifts and supersonically broadened lines in 22.″5 spectra are decomposed into much stronger velocity gradients and abrupt velocity reversals of intense but narrow, probably subsonic, line cores.
Conclusions. CO components that are observed in absorption at a moderate optical depth (0.5) and are undetected in emission at 1′ resolution toward NRAO 150 remain undetected at 6″ resolution. This implies that they are not a previously-hidden large-scale molecular component revealed in absorption, but they do highlight the robustness of the chemistry into regions where the density and column density are too low to produce much rotational excitation, even in CO. Bright CO lines around NRAO150 most probably reflect the variation of a chemical process, i.e. the C^+-CO conversion. However, the ultimate cause of the variations of this chemical process in such a limited field of view remains uncertain.

Appeared in A&A 489, 217

Disks around CQ Tauri and MWC758: dense PDR or gas dispersal?

E. Chapillon([1,2,3]), S. Guilloteau([1,2]), A. Dutrey([1,2]), and V. Piétu([3])
([1])Université Bordeaux 1, Laboratoire d'Astrophysique de Bordeaux (LAB), UMR 5804, 2 rue de l'Observatoire, BP 89, 33270 Floirac, France, ([2])CNRS/INSU - UMR 5804, BP 89, 33270 Floirac, France, ([3])IRAM, 300 rue de la Piscine, 38400 Saint Martin d'Hères, France

Abstract:
Context. The overall properties of disks surrounding intermediate PMS stars (HAe) are not yet well constrained

by current observations. The disk inclination, which significantly affects spectral energy distribution modeling, is often unknown.
Aims. We attempted to resolve the disks around CQ Tau and MWC 758 to provide accurate constraints on the disk parameters, in particular the temperature and surface density distribution.
Methods. We report arcsecond resolution observations of dust and CO line emissions with the IRAM array. We also searched for the HCO^+ $J = 1 - 0$ transition. The disk properties are derived using a standard disk model. We use the Meudon PDR code to study the chemistry.
Results. The two disks share some common properties. The mean CO abundance is low despite disk temperatures above the CO condensation temperature. Furthermore, the CO surface density and dust opacity have different radial dependence. The CQ Tau disk appears warmer and perhaps less dense than that of MWC 758. Modeling the chemistry, we find that photodissociation of CO is a viable mechanism to explain its low abundance. The photospheric flux is not sufficient for this: a strong UV excess is required. In CQ Tau, the high temperature is consistent with the expectation for a PDR. The PDR model has difficulty explaining the mild temperatures obtained in MWC 758, for which a low gas-to-dust ratio is preferred. A yet, unexplored alternative could be that, despite currently high gas temperatures CO remains trapped in grains, as the models suggest that large grains can be cold enough to prevent thermal desorption of CO. The low inclination of the CQ Tau disk, $\sim 30°$, challenges previous interpretations given for UX Ori - like luminosity variations of this star.
Conclusions. We conclude that CO cannot be used as a simple tracer of gas-to-dust ratio, the CO abundance being affected by photodissociation and grain growth.

Appeared in A&A 488, 565

Search for cold gas along radio lobes in the cooling core galaxies MS0735.6+7421 and M87

P. Salomé(1) and F. Combes(2)
(1)IRAM, Domaine Universitaire, 300 rue de la piscine, 38400 St Martin d'Hères, France, (2)LERMA, Observatoire de Paris, 61 av. de l'Observatoire, 75014 Paris, France

Abstract:
We report CO observations towards MS0735.6+7421 a distant cooling core galaxy, and towards M87, the nearest cooling core in the center of the Virgo cluster. Both galaxies contain radio cavities that are thought to be responsible for the heating that can regulate or stop the cooling of the surrounding gas. In this feedback process, there could still be some gas cooling along filaments, along the borders of the radio cavities. Molecular gas is known to exist in clusters with cooling cores, in long and thin filaments that can be formed behind the rising bubbles inflated by the central AGN. CO emission was searched for at several locations along the radio lobes of those two galaxies, but only upper limits were found. These correspond to cold gas mass limits of a few $10^9 M_\odot$ for each pointing in MS0735.6+7421, and a few $10^6 M_\odot$ in M87. This non detection means that either the cooling is strongly reduced by the AGN feedback or that the gas is cooling in very localized places like thin filaments, possibly diluted in the large beam for MS0735.6+7421. For M87, the AGN heating appears to have stopped the cooling completely.

Appeared in A&A 489, 101

Observations of the Goldreich-Kylafis effect in star-forming regions with XPOL at the IRAM 30 m telescope

J. Forbrich(1,2), H. Wiesemeyer(3), C. Thum(4), A. Belloche(1), and K. M. Menten(1)
(1)MPIfR, Auf dem Hügel 69, 53121 Bonn, Germany, (2)Harvard-Smithsonian Center for Astrophysics, 60 Garden Street MS 72, Cambridge, MA 02138, USA, (3)IRAM, Avenida Divina Pastora 7, Local 20, 18012 Granada, Spain, (4)IRAM, Rue de la Piscine, 38406 Saint Martin d'Hères, France

Abstract:
Context. The Goldreich-Kylafis (GK) effect causes certain molecular line emission to be weakly linearly polarized, e.g., in the presence of a magnetic field. Compared to polarized dust emission, the GK effect potentially yields additional information along the line of sight through its dependence on velocity in the line profile.
Aims. Our goal was to detect polarized molecular line emission toward the DR21(OH), W3OH/H_2O, G34.3+0.2, and UYSO 1 dense molecular cloud cores in transitions of rare CO isotopologues and CS. The feasibility of such observations had to be established by studying the influence of polarized sidelobes, e.g., in the presence of extended emission in the surroundings of compact sources.
Methods. The observations were carried out with the IRAM 30 m telescope employing the correlation polarimeter XPOL and using two orthogonally polarized receivers. We produced beam maps to investigate instrumental polarization.
Results. While a polarized signal is found in nearly all transitions toward all sources, its degree of polarization in only one case surpasses the polarization that can be expected from instrumental effects. It is shown that any emission in the polarized sidelobes of the system can produce instrumental polarization, even if the source is unpolarized. Tentative evidence of astronomically polarized line emission with $p_L \lesssim 1.5\%$ was found in the CS$(2-1)$ line toward G34.3+0.2.

Appeared in A&A 492, 757

A new activity phase of the blazar 3C 454.3. Multifrequency observations by the WEBT and XMM-Newton in 2007-2008

Raiteri C. M.([1]), Villata M.([1]), Larionov V.M.([2,3]), Gurwell M.A.([4]), Chen W.P.([5]), Kurtanidze O.M.([6]), Aller M.F.([7]), Böttcher M.([8]), Calcidese P.([9]), Hroch F.([10]), Lähteenmäki A.([11]), Lee C.-U.([12]), Nilsson K.([13]), Ohlert J.([14]), Papadakis I.E.([15,16]), Agudo I.([17]), Aller H.D.([7]), Angelakis E.([18]), Arkharov A.A.([2]), Bach U.([18]), Bachev R.([19,]) Berdyugin A.([13]), Buemi C.S.([20]), Carosati D.([21]), Charlot P.([22,23]), Chatzopoulos E.([16]), Forné E.([24]), Frasca A.([20]), Fuhrmann L.([18]), Gómez J.L.([17]), Gupta A.C.([25]); Hagen-Thorn V.A.([2]), Hsiao W.-S.([5]), Jordan B.([26]), Jorstad S.G.([27]), Konstantinova T.S.([2]), Kopatskaya E.N.([2]), Krichbaum T.P.([18]), Lanteri L.([1]), Larionova L.V.([2]), Latev G.([28]), Le Campion J.-F.([22,23]), Leto P.([29]), Lin H.-C.([5]), Marchili N.([18]), Marilli E.([20]), Marscher A.P.([27]), McBreen B.([30]), Mihov B.([19]), Nesci R.([31]), Nicastro F.([32]), Nikolashvili M.G.([33]), Novak R.([34]), Ovcharov E.([28]), Pian E.([35]), Principe D.([8]), Pursimo T.([36]), Ragozzine B.([8]), Ros J.A.([24]), Sadun A.C.([37]), Sagar R.([25]), Semkov E.([19]), Smart R.L.([1]), Smith N.([38]), Strigachev A.([19]), Takalo L.O.([13]), Tavani M.([39]), Tornikoski M.([11]), Trigilio C.([20]), Uckert K.([8]), Umana G.([20]), Valcheva A.([19]), Vercellone S.([40]), Volvach A.([41]) and Wiesemeyer H.([42])

([1])INAF - Osservatorio Astronomico di Torino, Italy, ([2])Astron. Inst., St.-Petersburg State Univ., Russia, ([3])Pulkovo Observatory, St. Petersburg, Russia, ([4])Harvard-Smithsonian Center for Astroph., Cambridge, MA, USA, ([5])Institute of Astronomy, National Central University, Taiwan, ([6])Abastumani Astrophysical Observatory, Georgia, ([7])Department of Astronomy, University of Michigan, MI, USA, ([8])Department of Physics and Astronomy, Ohio Univ., OH, USA, ([9])Osservatorio Astronomico della Regione Autonoma Valle d'Aosta, Italy, ([10])Inst. of Theor. Phys. and Astroph., Masaryk Univ., Czech Republic, ([11])Metsähovi Radio Obs., Helsinki Univ. of Technology, Finland, ([12])Korea Astronomy and Space Science Institute, South Korea, ([13])Tuorla Observatory, Univ. of Turku, Piikkiö, Finland, ([14])Michael Adrian Observatory, Trebur, Germany, ([15])IESL, FORTH, Heraklion, Crete, Greece, ([16])Physics Department, University of Crete, Greece, ([17])Instituto de Astrofíısica de Andalucía (CSIC), Granada, Spain, ([18])MPIfR, Bonn, Germany, ([19])Inst. of Astronomy, Bulgarian Academy of Sciences, Sofia, Bulgaria, ([20])INAF - Osservatorio Astrofisico di Catania, Italy, ([21])Armenzano Astronomical Observatory, Italy, ([22])Université de Bordeaux, Observatoire Aquitain des Sciences de l'Univers, Floirac, France, ([23])CNRS, Laboratoire d'Astrophysique de Bordeaux, UMR 5804, Floirac, France, ([24])Agrupació Astronòmica de Sabadell, Spain, ([25])ARIES, Manora Peak, Nainital, India, ([26])School of Cosmic Physics, Dublin Institute For Advanced Studies, Ireland, ([27])Institute for Astrophysical Research, Boston University, MA, USA, ([28])Sofia University, Bulgaria, ([29])INAF - Istituto di Radioastronomia, Sezione di Noto, Italy, ([30])School of Physics, University College Dublin, Ireland, ([31])Dept. of Phys. "La Sapienza" Univ, Roma, Italy, ([32])INAF - Osservatorio Astronomico di Roma, Italy, ([33])Abastumani Astrophysical Observatory, Georgia, ([34])N. Copernicus Observatory and Planetarium in Brno, Czech Republic, ([35])INAF - Osservatorio Astronomico di Trieste, Italy, ([36])Nordic Optical Telescope, Santa Cruz de La Palma, Spain, ([37])Dept. of Phys., Univ. of Colorado Denver, Denver, CO USA, ([38])Cork Institute of Technology, Cork, Ireland, ([39])INAF, IASF-Roma, Italy, ([40])INAF, IASF-Milano, Italy, ([41])Radio Astronomy Lab. of Crimean Astrophysical Observatory, Ukraine, ([42])IRAM Granada, Spain

Abstract:
Aims. The Whole Earth Blazar Telescope (WEBT) consortium has been monitoring the blazar 3C 454.3 from the radio to the optical bands since 2004 to study its emission variability properties.
Methods. We present and analyse the multifrequency results of the 2007-2008 observing season, including XMM-Newton observations and near-IR spectroscopic monitoring, and compare the recent emission behaviour with the past one. The historical mm light curve is presented here for the first time.
Results. In the optical band we observed a multi-peak outburst in July-August 2007, and other faster events in November 2007-February 2008. During these outburst phases, several episodes of intranight variability were detected. A mm outburst was observed starting from mid-2007, whose rising phase was contemporaneous to the optical brightening. A slower flux increase also affected the higher radio frequencies, the flux enhancement disappearing below 8 GHz. The analysis of the optical-radio correlation and time delays, as well as the behaviour of the mm light curve, confirm our previous predictions, suggesting that changes in the jet orientation likely occurred in the last few years. The historical multiwavelength behaviour indicates that a significant variation in the viewing angle may have happened around year 2000. Colour analysis confirms a general redder-when-brighter trend, which reaches a "saturation" at $R \sim 14$ and possibly turns into a bluer-when-brighter trend in bright states. This behaviour is due to the interplay of different emission components, the synchrotron one possibly being characterised by an intrinsically variable spectrum. All the near-IR spectra show a prominent Hα emission line ($EW_{obs} = 50-120$ Å), whose flux appears nearly constant, indicating that the broad line region is not affected by the jet emission. We show the broad-band SEDs corresponding to the epochs of the XMM-Newton pointings and compare them to those obtained at other epochs, when the source was in different brightness states. A double power-law fit to the EPIC

spectra including extra absorption suggests that the soft-X-ray spectrum is concave, and that the curvature becomes more pronounced as the flux decreases. This connects fairly well with the UV excess, which becomes more prominent with decreasing flux. The most obvious interpretation implies that, as the beamed synchrotron radiation from the jet dims, we can see both the head and the tail of the big blue bump. The X-ray flux correlates with the optical flux, suggesting that in the inverse-Compton process either the seed photons are synchrotron photons at IR-optical frequencies or the relativistic electrons are those that produce the optical synchrotron emission. The X-ray radiation would thus be produced in the jet region from where the IR-optical emission comes.

Appeared in A&A 491, 755

CN Zeeman measurements in star formation regions

Falgarone E.(1), Troland T.H.(2), Crutcher R.M.(3), Paubert G.(4)
(1)LERMA/LRA, CNRS UMR 8112, École Normale Supérieure and Observatoire de Paris, 24 rue Lhomond, 75231 Paris Cedex 05, France, (2)University of Kentucky, Department of Physics and Astronomy, Lexington, KY 40506, USA, (3)University of Illinois, Department of Astronomy, Urbana, IL 61801, USA, (4)IRAM, 7 avenida Divina Pastora, Granada, Spain

Abstract:
Aims. Magnetic fields play a primordial role in the star formation process. The Zeeman effect on the CN radical lines is one of the few methods of measuring magnetic fields in the dense gas of star formation regions.
Methods. We report new observations of the Zeeman effect on seven hyperfine CN $N = 1 - 0$ lines in the direction of 14 regions of star formation.
Results. We have improved the sensitivity of previous detections, and obtained five new detections. Good upper limits are also achieved. The probability distribution of the line-of-sight field intensity, including non-detections, provides a median value of the total field $B_{tot} = 0.56$ mG while the average density of the medium sampled is $n(H_2) = 4.5 \times 10^5 \text{cm}^{-3}$. We show that the CN line probably samples regions similar to those traced by CS and that the magnetic field observed mostly pervades the dense cores. The dense cores are found to be critical to slightly supercritical with a mean mass-to-flux ratio $M/\Phi \sim 1$ to 4 with respect to critical. Their turbulent and magnetic energies are in approximate equipartition.

Appeared in A&A 487, 247

Monitoring Venus' mesospheric winds in support of Venus Express: IRAM 30-m and APEX observations

Lellouch E.(1), Paubert G.(2), Moreno R.(1), Moullet A.(1)
(1)LESIA, Observatoire de Paris, 92195 Meudon Cedex, France, (2)IRAM, Granada, Spain

Abstract:
We report on direct wind measurements in Venus' mesosphere ($90 - 115$ km), performed in support of Venus Express, and based on CO millimeter observations. Most observations, sampling the CO$(2 - 1)$ and CO$(1 - 0)$ lines, were acquired with the IRAM 30-m telescope, over four distinct periods: (i) Summer 2006; (ii) May June 2007, in association with the coordinated ground-based campaign; (iii) August 2007 inferior conjunction and (iv) September 2007. In the latter period, additional measurements (CO$(3 - 2)$) were obtained with the APEX 12-m telescope. Overall, the measurements indicate a large body of temporal variability of the Venus mesospheric field, but general features emerge: (i) winds strongly increase with altitude within the mesosphere, by a factor of $2 - 3$ over a decade in pressure; (ii) many, but not all, of our observations can be viewed as the superposition of zonal retrograde and subsolar-to-antisolar (SSAS) flows of comparable speeds, typically $30 - 50$ m/s near 0.1 mbar ($\sim$ 93km) and $90 - 120$ m/s near 0.01 mbar ($\sim$ 102km) (iii) the wind field was very stable over three consecutive observing days in May June 2007, but much more variable on a similar time base in August 2007 (iv) at a $\sim$ 2000 km resolution, the nightside wind field appears very complex, with evidence that the SSAS flow does not reach high latitudes, and possible evidence for additional meridional winds. Our Summer 2006 observations, which sample Venus' dayside, seem to suggest that a prograde zonal flow is superimposed to the SSAS circulation for this period. This surprising result, which implies a pre-midnight convergence of the wind field, requires confirmation, and fruitful comparisons may be obtained from the analysis of motions in the O_2 emission images, as observed by Venus Express.

Appeared in: Planetary and Space Science 56, 1355

Results of WEBT, VLBA and RXTE monitoring of 3C 279 during 2006-2007s

V.M. Larionov(1,2), S.G. Jorstad(1,21), A.P. Marscher(21), C.M. Raiteri(3), M. Villata(3), I. Agudo(4), M.F. Aller(5), A.A. Arkharov(2), I. M. Asfandiyarov(20), U. Bach(6), R. Bachev(7), A. Berdyugin(28), M. Böttcher(8), C. S. Buemi(16), P. Calcidese(9), D. Carosati(10), P. Charlot(11), W.-P. Chen(12), A. Di Paola(13), M. Dolci(14), S. Dogru(15), V. T. Doroshenko(34,40,41), Yu. S. Efimov(34), A. Erdem(15), A. Frasca(16), L. Fuhrmann(6), P. Giommi(36), L. Glowienka(17), A. C. Gupta(18,44), M.

A. Gurwell[19], V. A. Hagen-Thorn[1], W.-S.Hsiao[12], M. A. Ibrahimov[20], B. Jordan[40], M. Kamada[22], T. S. Konstantinova[1], E. N. Kopatskaya[1], Y. Y. Kovalev[6,23], Y. A. Kovalev[23], O. M. Kurtanidze[24], A. Lähteenmäki[25], L. Lanteri[3], L. V. Larionova[1], P. Leto[37], P. Le Campion[11], C.-U. Lee[26], E. Lindfors[28], E. Marilli[16], I. McHardy[27], M. G. Mingaliev[42], S. V. Nazarov[34], E. Nieppola[25], K. Nilsson[28], J. Ohlert[29], M. Pasanen[28], D. Porter[30], T. Pursimo[31], J. A. Ros[32], K. Sadakane[22], A. C. Sadun[33], S. G. Sergeev[34,41], N. Smith[39], A. Strigachev[7], N. Sumitomo[22], L. O. Takalo[28], K. Tanaka[22], C. Trigilio[16], G. Umana[16], H. Ungerechts[43], A. Volvach[35], and W. Yuan[18]

([1])Astron. Inst., St.-Petersburg State Univ., Russia, ([2])Pulkovo Observatory, St.-Petersburg, Russia, ([3])INAF, Osservatorio Astronomico di Torino, Italy, ([4])Instituto de Astrofísica de Andalucía, CSIC, Granada, Spain, ([5])Department of Astronomy, University of Michigan, MI, USA, ([6])MPIfR, Bonn, Germany, ([7])Inst. of Astron., Bulgarian Acad. of Sciences, Sofia, Bulgaria, ([8])Department of Physics and Astronomy, Ohio Univ., OH, USA, ([9])Oss. Astronomico della Regione Autonoma Valle d'Aosta, Italy, ([10])Armenzano Astronomical Observatory, Italy, ([11])Lab. d'Astrophys., Univ. Bordeaux 1, CNRS, Floirac, France, ([12])Institute of Astronomy, National Central University, Taiwan, ([13])INAF, Osservatorio Astronomico di Roma, Italy, ([14])INAF, Osservatorio Astronomico di Collurania Teramo, Italy, ([15])COMU Observatory, Turkey, ([16])INAF, Osservatorio Astrofisico di Catania, Italy, ([17])Department of Phys. and Astron. Univ. of Aarhus, Denmark, ([18])YNAO, Chinese Academy of Sciences, Kunming, PR China, ([19])Harvard-Smithsonian Center for Astroph., Cambridge, MA, USA, ([20])Ulugh Beg Astron. Inst., Tashkent, Uzbekistan, ([21])Inst. for Astrophys. Research, Boston Univ., MA, USA, ([22])Astronomical Institute, Osaka Kyoiku University, Japan, ([23])Astro Space Centre of Lebedev Physical Inst., Moscow, Russia, ([24])Abastumani Astrophysical Observatory, Georgia, ([25])Metsähovi Radio Obs., Helsinki Univ. of Technology, Finland, ([26])Korea Astronomy and Space Science Institute, South Korea, ([27])University of Southampton, UK, ([28])Tuorla Observatory, Univ. of Turku, Piikkiö, Finland, ([29])Michael Adrian Observatory, Trebur, Germany, ([30])Cardiff University, Wales, UK, ([31])Nordic Optical Telescope, Santa Cruz de La Palma, Spain, ([32])Agrupació Astronòmica de Sabadell, Spain, ([33])Dept. of Phys., Univ. of Colorado, Denver, USA, ([34])Crimean Astrophysical Observatory, Ukraine, ([35])Radio Astron. Lab. of Crimean Astroph. Observatory, Ukraine, ([36])ASI Science Data Centre, Frascati, Italy, ([37])INAF, Istituto di Radioastronomia, Sezione di Noto, Italy, ([38])School of Cosmic Physics, Dublin Inst. for Adv. Studies, Ireland, ([39])Cork Institute of Technology, Cork, Ireland, ([40])Moscow Univ., Crimean Lab. of Sternberg Astron. Inst., Ukraine, ([41])Isaac Newton Institute of Chile, Crimean Branch, Ukraine, ([42])Special Astrophysical Observatory, N. Arkhyz, Russia, ([43])IRAM Granada, Spain, ([44])ARIES, Manora Peak, Nainital, India

Abstract:
Context. The quasar 3C 279 is among the most extreme blazars in terms of luminosity and variability of flux at all wavebands. Its variations in flux and polarization are quite complex and therefore require intensive monitoring observations at multiple wavebands to characterise and interpret the observed changes.
Aims. In this paper, we present radio-to-optical data taken by the WEBT, supplemented by our VLBA and RXTE observations, of 3C 279. Our goal is to use this extensive database to draw inferences regarding the physics of the relativistic jet. Methods. We assemble multifrequency light curves with data from 30 ground-based observatories and the space-based instruments SWIFT (UVOT) and RXTE, along with linear polarization vs. time in the optical R band. In addition, we present a sequence of 22 images (with polarization vectors) at 43 GHz at resolution 0.15 milliarcsec, obtained with the VLBA. We analyse the light curves and polarization, as well as the spectral energy distributions at different epochs, corresponding to different brightness states.
Results. We find that the IR-optical-UV continuum spectrum of the variable component corresponds to a power law with a constant slope of -1.6, while in the $2.4-10$ keV X-ray band it varies in slope from -1.1 to -1.6. The steepest X-ray spectrum occurs at a flux minimum. During a decline in flux from maximum in late 2006, the optical and 43 GHz core polarization vectors rotate by $\sim 300°$.
Conclusions. The continuum spectrum agrees with steady injection of relativistic electrons with a power-law energy distribution of slope -3.2 that is steepened to -4.2 at high energies by radiative losses. The X-ray emission at flux minimum comes most likely from a new component that starts in an upstream section of the jet where inverse Compton scattering of seed photons from outside the jet is important. The rotation of the polarization vector implies that the jet contains a helical magnetic field that extends ~ 20 pc past the 43 GHz core.

Appeared in A&A 492, 389

Instrument performance of GISMO, a 2 millimeter TES bolometer camera used at the IRAM 30 m Telescope

Staguhn Johannes G.([1,2]), Benford Dominic J.([1]), Allen Christine A.([1]), Maher Stephen F.([1,3]), Sharp Elmer H.([1,4]), Ames Troy J.([1]), Arendt Richard G.([1,5]), Chuss David T.([1]), Dwek Eli([1,2]), Fixsen Dale J.([1]), Miller Tim M.([1,6]), Moseley S. Harvey([1]), Navarro Santiago([7]), Sievers Albrecht([7]) and Wollack Edward J.([1])

([1])NASA Goddard Space Flight Ctr., USA, ([2])Univ. of Maryland, College Park, USA, ([3])Science Systems & Applications, USA, ([4])Global Science & Technology, USA, ([5])Univ. of Maryland Baltimore County, USA, ([6])MEI Technologies, USA, ([7])IRAM Granada, Spain

Abstract:
We have developed key technologies to enable highly versatile, kilopixel bolometer arrays for infrared through millimeter wavelengths. Our latest array architecture is based on our Backshort Under Grid (BUG) design, which is specifically targeted at producing kilopixel-size arrays for future ground-based, suborbital and space-based X-ray and far-infrared through millimeter cameras and spectrometers. In November of 2007, we demonstrated a monolithic 8 × 16 BUG bolometer array with 2 mm-pitch detectors for astronomical observations using our 2 mm wavelength camera GISMO (the Goddard IRAM Superconducting 2 Millimeter Observer) at the IRAM 30m telescope in Spain. The 2 mm spectral range provides a unique terrestrial window enabling ground-based observations of the earliest active dusty galaxies in the universe and thereby allowing a better constraint on the star formation rate in these objects. We present preliminary results from our observing run with the first fielded BUG bolometer array and discuss the performance of the instrument.

Appeared in: Mm and Sub-mm Detectors and Instrumentation for Astronomy IV. Eds Duncan, Holland, Withington, Jonas, Proc. of the SPIE Vol. 7020, 702004

Extrasolar planet detection by binary stellar eclipse timing: evidence for a third body around CM Draconis

H. J. Deeg([1]), B. Ocaña([1,2]), V. P. Kozhevnikov([3]), D. Charbonneau([4]), F. T. O'Donovan([5]), and L. R. Doyle([6])
([1])Instituto de Astrofísica de Canarias, C. Via Lactea S/N, 38205 La Laguna, Tenerife, Spain, ([2])IRAM, Av. Divina Pastora 7, Núcleo Central, 18012 Granada, Spain, ([3])Astronomical Observatory, Ural State University, Lenin ave. 51, Ekaterinburg, 620083, Russia, ([4])Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge, MA 02138, USA, ([5])California Institute of Technology, 1200 E. California Blvd., Pasadena, CA 91125, USA, ([6])SETI Institute, 515 N. Whisman Road, Mountain View, CA 94043, USA

Abstract:
Aims. Our objective is to elucidate the physical process that causes the observed observed-minus-calculated (O–C) behavior in the M4.5/M4.5 binary CM Dra and to test for any evidence of a third body around the CM Dra system.
Methods. New eclipse minimum timings of CM Dra were obtained between the years 2000 and 2007. The O–C times of the system are fitted against several functions, representing different physical origins of the timing variations.
Results. Using our observational data in conjunction with published timings going back to 1977, a clear non-linearity in O–C times is apparent. An analysis using model-selection statistics gives about equal weight to a parabolic and to a sinusoidal fitting function. Attraction from a third body, either at large distance in a quasi-constant constellation across the years of observations or from a body on a shorter orbit generating periodicities in O–C times is the most likely source of the observed O–C times. The white dwarf GJ 630.1B, a proper motion companion of CM Dra, can however be rejected as the responsible third body. Also, no further evidence of the shortperiodic planet candidate described by Deeg et al. (2000, A&A, 358, L5) is found, whereas other mechanisms, such as period changes from stellar winds or Applegate's mechanism can be rejected.
Conclusions. A third body, being either a few-Jupiter-mass object with a period of 18.5 ± 4.5 years or an object in the mass range of $1.5 M_{jup}$ to $0.1 M_{\odot}$ with periods of hundreds to thousands of years is the most likely origin of the observed minimum timing behavior.

Appeared in A&A 480, 563

The brightness temperature of Mercury at mm–wavelengths

A. Greve([1]), C. Thum([1]), R. Moreno([1,2]) and N. Yan([3])
([1])IRAM, 300 rue de la Piscine, 38406 St. Martin d'Hères, France, ([2])LESIA (LAM –bat. 18), 5 Place Jules Janssen, 92195 Meudon Cedex, France, ([3])Service d'Aeronomie CNRS/IPSL, 91371 Verrieres-le-Buisson, France

Abstract:
We present observations of Mercury made with the IRAM 30-m telescope at 3, 2 and 1.3 mm wavelength (90, 150 and 230 GHz) during the years 1985 - 2005; we derive from these data the disk–averaged brightness temperatures. The observations at 3 mm combined with those by Epstein & Andrew allow a separation of the data into 40° wide longitude intervals and by this an investigation of the disk-averaged brightness temperature with Mercury's longitude. From the new mm-wavelength data, and data taken from the literature, we derive the disk-averaged brightness temperature as a function of wavelength. On Mercury's night side a significant decrease in brightness temperature occurs towards shorter wavelengths.
We use the three surface models (A,B,C) discussed by Mitchell & de Pater and calculate for the cool and hot surface region the corrresponding diurnal variation of the disk-averaged brightness temperature at 90 GHz. For the same models we calculate the variation of the disk-averaged brightness temperature with wavelength between 1.3 mm and 37 mm, on Mercury's midnight side and noon side. Although the scatter in the observations is large, there seems to be a marginally better agreement with model B and A.

A&A, in print

Surface adjustment of the IRAM 30 m radio telescope

D. Morris([1,2]), M. Bremer([1]), G. Butin([1]), M. Carter([1]), A. Greve([1]), J.W. Lamb([1,3]), B. Lazareff([1]), J. Lopez-Perez([1,4]), F. Mattiocco([1]), J. Peñalver([1]) and C. Thum([1])
([1])IRAM, St Martin d'Hères, France, ([2])Raman Research Institute, Bangalore, India, ([3])California Institute of Technology, OVRO, Big Pine, USA, ([4])OAN, Centro Astronomico de Yebes, Guadalajara, Spain

Abstract:
The techniques used to set and stabilise the surface of the IRAM 30 m radio telescope to a final root mean square accuracy of about 50 μm are described. This involved both phase retrieval and phase coherent holography using a variety of radiation sources at several frequencies. A finite-element model was utilised in improving the temperature control system for the telescope structure. The factors influencing the ultimate surface accuracy are discussed.

Appeared in: IET Microwaves, Antennas & Propagation, Feb. 2009, Vol.3, Issue 1, 99

A kiloparsec-scale hyper-starburst in a quasar host less than 1 gigayear after the Big Bang

F.Walter([1]), D.Riechers([1]), P.Cox([2]), R.Neri([2]), C.Carilli([3]), F.Bertoldi([4]), A.Weiss([5]) and R.Maiolino([6])
([1])Max-Planck-Institut für Astronomie, Königstuhl 17, D-69117 Heidelberg, Germany, ([2])IRAM, 300 rue de la Piscine, F-38406 St-Martin-d'Hères, France, ([3])NRAO, PO Box O, Socorro, New Mexico 87801, USA, ([4])Argelander Institut für Astronomie, Auf dem Hügel 71, D-53121 Bonn, Germany, ([5])MPIfR, Auf dem Hügel 69, D-53121 Bonn, Germany, ([6])L'Istituto Nazionale di Astrofisica, Osservatorio Astronomico di Roma, I-00040 Monte Porzio Catone, Roma, Italy

Abstract:
The host galaxy of the quasar SDSS J114816.64+525150.3 (at redshift $z = 6.42$, when the Universe was less than a billion years old) has an infrared luminosity of 2.2×10^{13} times that of the Sun, presumably significantly powered by a massive burst of star formation. In local examples of extremely luminous galaxies, such as Arp 220, the burst of star formation is concentrated in a relatively small central region of < 100 pc radius. It is not known on which scales stars are forming in active galaxies in the early Universe, at a time when they are probably undergoing their initial burst of star formation. We do know that at some early time, structures comparable to the spheroidal bulge of the Milky Way must have formed. Here we report a spatially resolved image of [CII] emission of the host galaxy of J114816.64+525150.3 that demonstrates that its star-forming gas is distributed over a radius of about 750 pc around the centre. The surface density of the star formation rate averaged over this region is $\sim 1,000\text{year}^{-1}\text{kpc}^{-2}$. This surface density is comparable to the peak in Arp 220, although about two orders of magnitude larger in area. This vigorous star-forming event is likely to give rise to a massive spheroidal component in this system.

Appeared in: Nature 457, 699

A complete ^{12}CO 2–1 map of M51 with HERA: II. Total gas surface densities and gravitational stability

M. Hitschfeld([1]), C. Kramer([1,2]), K.F. Schuster([3]), S. Garcia-Burillo([4]), J. Stutzki([1])
([1])KOSMA, I. Physikalisches Institut, Universität zu Köln, Germany, ([2])IRAM Granada, Spain, ([3])IRAM Grenoble, France, ([4])Observatorio de Madrid, Spain

Abstract:
To date the onset of large-scale star formation in galaxies and its link to gravitational stability of the galactic disk have not been fully understood. The nearby face-on spiral galaxy M51 is an ideal target for studying this subject. This paper combines CO, dust, HI, and stellar maps of M51 and its companion galaxy to study the H_2/HI transition, the gas-to-dust ratios, and the stability of the disk against gravitational collapse.

We combine maps of the molecular gas using ^{12}CO 2–1 map HERA/IRAM-30m data and HI VLA data to study the total gas surface density and the phase transition of atomic to molecular gas. The total gas surface density is compared to the dust surface density from 850μm SCUBA data. Taking into account the velocity dispersions of the molecular and atomic gas, and the stellar surface densities derived from the 2MASS K-band survey, we derive the total Toomre Q parameter of the disk.

The gas surface density in the spiral arms is $\sim 2-3$ higher compared to that of the interarm regions. The ratio of molecular to atomic surface density shows a nearly power-law dependence on the hydrostatic pressure P_{hydro}. The gas surface density distribution in M51 shows an underlying exponential distribution with a scale length of $h_{gas} = 7.6$ kpc representing 55% of the total gas mass, comparable to the properties of the exponential dust disk. In contrast to the velocity widths observed in HI, the CO velocity dispersion shows enhanced line widths in the spiral arms compared to the interarm regions. The contribution of the stellar component in the Toomre Q-parameter analysis is significant and lowers the combined Q-parameter Q_{tot} by up to 70% towards the threshold for gravitational instability. The value of Q_{tot} varies from $1.5-3$ in radial averages. A map of Q_{tot} shows values around 1 on the spiral arms indicating self-regulation at play.

Accepted for publication in A&A

IRAM Astronomy Postdoctoral Position in Granada, Spain

Institut de Radio Astronomie Millimétrique (IRAM)
300 rue de la Piscine, F - 38406 St-Martin-d'Hères, France
Email submission and inquiries: cox@iram.fr (Pierre Cox, Director)

Posting date: February 2009,
Closing date: March 31, 2009

Applications are invited for a post-doctoral astronomer at IRAM Granada/Spain, starting as soon as possible.
IRAM is an international research organisation for millimeter/submillimeter astronomy supported by the CNRS (France), the Max-Planck Gesellschaft (Germany), and the IGN (Spain). IRAM operates a 30-meter single-dish telescope located 50km from Granada in the Spanish Sierra Nevada and an interferometer of six 15-meter antennas located at Plateau de Bure in the French Alps near Grenoble.
We are seeking for candidates with a PhD in astronomy and preferably demonstrated observational experience with millimeter astronomical facilities using bolometers and heterodyne receivers. Knowledge in some areas related to software or hardware of a millimeter telescope is of advantage.
The successful candidate shall contribute 50% of the time to join a small team of astronomers at IRAM/Granada who jointly manage, and constantly improve, flexible, pooled observations with the 30m telescope.
The PostDoc will also participate in the astronomer-on-duty service and will typically spend about one week every 2 months at the observatory, aiding visiting astronomers to conduct the observations, and providing expertise in the analysis and interpretation of 30m data.
Another 50% of the time shall be dedicated to astronomical research, strengthening the Granada science support group. The PostDoc will have the opportunity to contribute to accepted Herschel projects on galactic nuclei and external galaxies, i.e. HERMES, HEXGAL, HERCULES, the group is involved in under the lead of the station manager, Carsten Kramer. Accompanying research using both IRAM facilities will be encouraged and supported.
The appointment is initially for two years with the possibility of extension. To apply, please send curriculum vitae, bibliography, and statement of research interests, and arrange for three letters of reference. Selection of candidates will start beginning of April and will continue until the position is filled.

Carsten KRAMER

The IRAM Newsletter is edited by Michael Bremer at IRAM-Grenoble (e-mail address: bremer@iram.fr).

In order to reduce costs we are now sending paper copies of this Newsletter to astronomical libraries only. The IRAM Newsletter is available in electronic form by using the World Wide Web: from the IRAM home pages (http://www.iram.fr/ or http://www.iram.es/), click on item "Events & News" and follow the links...

The NEWSLETTER e-mail list can be subscribed (and cancelled) via a web-based facility (for more details see http://www.iram.fr/mailman/listinfo/newsletter ; this facility is not mirrored on http://www.iram.es). The list is used to send warning messages when a new edition of the Newsletter is available, but also to provide fast information, if needed. The list members are not visible on the web or to fellow subscribers to reduce the risk of unsolicited commercial e-mail.

Please keep M. Bremer informed of any problem you may encounter.

IRAM Addresses:

	Address:	Telephone:	Fax:
Grenoble	Institut de Radioastronomie Millimétrique, 300 rue de la Piscine, Domaine Universitaire, 38406 St Martin d'Hères Cedex, France		
	from abroad:	(33) 476 82 49 00	(33) 476 51 59 38
	from France:	0 476 82 49 00	0 476 51 59 38
Plateau de Bure	Institut de Radioastronomie Millimétrique, Observatoire du Plateau de Bure, 05250 St Etienne en Dévoluy, France		
	from abroad:	(33) 492 52 53 60	(33) 492 52 53 61
	from France:	0 492 52 53 60	0 492 52 53 61
Granada	Instituto de Radioastronomía Milimétrica, Avenida Divina Pastora 7, Núcleo Central, 18012 Granada, España	(34) 958 80 54 54	(34) 958 22 23 63
Pico Veleta	Instituto de Radioastronomía Milimétrica, Estación Radioastronómica IRAM-IGN del Pico Veleta, Sierra Nevada, 18012 Granada, España	(34) 958 48 20 02	(34) 958 48 11 48

E-Mail Addresses:

- IRAM-Grenoble: username@iram.fr
- IRAM-Granada: username@iram.es

The username is generally the last name of the person to be contacted.