IRAM Newsletter

Number 23 September 18, 1995

Calendar

December 7-8th, 1995: IRAM User Meeting in Grenoble, France.

December 11-13th, 1995: ESO/IRAM/NFRA/OSO Worshop on Science with Large Millimeter Arrays, Garching, Germany.

March 4th, 1996: Deadline for the submission of observing proposals for the period May 15, 1996 to Nov. 15, 1996.

Contents

Invitation: IRAM User Meeting at Grenoble

December 7th and 8th, 1995

This meeting is intended to provide a forum for discussing the current status of the 30m telescope and the Plateau de Bure Interferometer, the development projects which are under way, and the options for future developments.

Also, there will be an opportunity to highlight recent scientific results. Both, short contributions and posters are foreseen.

If you are interested in attending the meeting, you are kindly asked to fill in the questionnaire at the end of this Newsletter and to return it before November 3rd, 1995 to Mrs.G.Matoso, 300 rue de la Piscine, F38406 St.Martin d'Heres, France (FAX: 33-76 51 59 38, e-mail: Matoso@iram.fr).

Preliminary Agenda

December 7th

09:00–09:10	Opening of the meeting
09:10–10:00	Status report on the 30m Telescope and Discussion
10:00–10:30	Status report on the Key Project and Discussion
10:30–11:00	Coffee Break
11:00–11:30	Status report on VLBI Observations and Discussion
11:30–12:15	Future Heterodyne-Receivers at the 30m Telescope and Discussion
12:15–12:45	Future Bolometers at the 30m Telescope and Discussion
12:45–14:00	Lunch Break
14:00–15:00	Status report on the PdB Interferometer and Discussion
15:00–15:45	Options for the Future and Discussion
15:45–16:15	Coffee break
16:15–17:00	Time allocation policy and other topics of general interest
17:00–18:30	Short Contributions
18:30– ?	Informal Reception at IRAM

December 8th

09:00–10:45	Short Contributions
10:45–11:15	Coffee break
11:15–12:45	Short Contributions and Poster Session
12:45–14:00	Lunch

Depending on the number of short contributions and posters which will be announced, the end of the meeting may be shifted.

30m Telescope

Frequency switching report available under MOSAIC

The IRAM Technical Report 228/95 “Frequency Switching at the 30m Telescope” (Thum *et al.*) is now available under Mosaic and can be retrieved following the links in the IRAM Grenoble home page `http://iram.fr/www/iram.html`. As reported in Newsletter Nr. 22 (July 1995), frequency switching can be done with three receivers (3mm, 230G1, 2mm) simultaneously. Thus, one limitation mentioned in the Technical Report (Chapter 6.1, page 24) does not exist any more.

HP Unix workstation at the Granada office

After the installation of a Unix workstation HP 9000 model 715/80 at the telescope in February, an identical machine has now been installed at the Granada office and is available for data reduction. The installation of a second Unix workstation at the telescope will be done during this month. This increases the data reduction and computing power at the 30m telescope significantly.

Improvement of Ethernet reliability

The installation of an Ethernet repeater at the telescope improved the reliability of the computer network. In the past the network sometimes went down due to connector problems, cable problems, observers disconnecting devices...etc.

The repeater divides the Ethernet into several subnets (computer, control room, receivers, lab, backup). The failure of one subnet does not affect the other branches.

1.3 mm receiver problems during July/August

The months of July and August brought a few receiver problems. In July the 1.3 mm G2 receiver suddenly degraded seriously, and after several tests it was clear that we had to replace the mixer. The receiver group in Grenoble could supply a replacement on short notice, and the G2 receiver was back in operation after 10 days. Unfortunately, the receiver is not as stable as it used to be. We are investigating the cause for the different behaviour.

Then, at the beginning of August the backshort of the 1.3 mm G1 mixer broke mechanically and had to be replaced. Because a spare backshort was available, the repair (including warm-up, cool-down, and testing) took only five days. The 1.3 mm G1 receiver performance is as before.

New LO box for 2 mm and 1.3 mm G2 receivers

We installed a new common LO box for the 2 mm and 1.3 mm G2 receivers. The LO for these two receivers is now remotely tuned from the control room and done much quicker. However, sky frequencies below 133 GHz cannot be reached at the moment due to a limitation of the Gunn oscillator. We are working on extending the 2 mm frequency range towards the lower end. The accessible frequency range for the 1.3 mm G2 receiver has not changed.

Wolfgang WILD

Interferometer

Summer maintenance and track extension

Summer maintenance of the antennas is completed. The track extension is going on schedule, and will be completed before this winter.

High frequency resolution on correlator unit 5

The upgrade of correlator unit 5 to double the available frequency resolution (channel separation from 78 kHz to 39 kHz) is now implemented and tested. The available bandwitdh is limited to 6 MHz (160 channels).

New configurations

We have revised the list of configurations to take into account the advent of the 1.3 mm receivers and of the new stations. The standard set includes four basic arrays built upon a primary set of eight 4-antenna configurations (Table 1):

The arrays, named AB, BC, CD and DD are reasonably suited for all declinations (see Table 2).

- AB, made of A1, A2, B2, C1
  This is the largest configuration, which provides an angular resolution $\sim 1.2''$ at 115 GHz ($0.6''$ at 230 GHz), but offers little sensitivity to extended structures.
- BC, made of B1, B2, C1, C2
  This is the standard high resolution mode.
- CD, made of C1, C2, D1
  This is the standard low resolution mode. Beware that "low" resolution is already $1.5''$ at 230 GHz, however.
- DD, made of D1 and D2
  This configuration has been created to provide "very" low resolution at 230 GHz.

Mosaicing is usually done with CD or DD, but the combination BC+D1 can also make sense for high resolution mosaics. Lower spatial resolution projects will usually not be considered, given the limited field of view of the IRAM interferometer. The antenna beam size is $50''$ at 100 GHz and the shortest possible spacing is 24 m, to avoid collisions between two antennas. Even taking into account projection effects that shorten the effective baseline, sources larger than about $30''$ are heavily resolved at 110 GHz.

Non imaging projects, such as detection experiments, size measurements, snapshots, etc., should use a subset of the standard configurations. This subset can either be specified by the observer, or left undefined until final scheduling if any configuration is appropriate (a detection experiment for example).

Stéphane GUILLOTEAU

Computers

New interferometer control

With the construction of the 5th antenna, and after our evolution towards the use of VME and Ethernet to control the correlators and receivers, we have redesigned the interferometer control and especially the antenna control system.

The new antenna control system is based on a hierarchy of VME microprocessors and microcontrollers. The VME microprocessors may communicate with each other or with the UNIX station (bure01) in charge of monitoring, driving the operations but also of collecting the data. The task to task communications are based on TCP/IP and use Ethernet links, optical or coaxial cables.

Two kinds of data transfer are needed: periodic and heavy traffic from the correlator micros to the UNIX station, and asynchronous and medium traffic for antenna and receiver control. These transfers have characteristics so opposed that we foresaw to use two different subnetworks. The subnet dedicated to the correlators is attached to bure01 only. The antenna and receiver microprocessors are on the general subnet, on which one finds also the second UNIX station (bure02), foreseen for near real time data reduction, and the router for communications to/from other sites.

In each antenna there are 2 VME microprocessors, one in the receiver cabin, in charge of the receivers and the subreflector, and the second in the pedestal, mainly in charge of driving the Az and El axes while avoiding the sun. In the antennas, the housekeeping, including the change of station, the survival configuration and the deicing, are performed by microcontrollers which are linked to bure01 via the VME microprocessors.

The distribution of tasks has been largely modified, since VME micros based on Motorola 68030 chips operating at 25MHz can perform all coordinate transformations and sun tests for an Alt-Az mount. The central UNIX station (bure01) is still in charge, for each new observed source, of computing the true equatorial coordinates, taking into account nutation, precession and all possible additional corrections. These calculations should be repeated every hour for long observations. Let us note here that all this computing does not require a very precise knowledge of the universal time (UT).

The VME microprocessors (in the pedestals) calculate the azimuth and the elevation. This transformation from equatorial to horizontal coordinates needs the UT, which is set by reading a universal time server, and synchronized via a time bus. This time bus is distributed all over the site; the antenna control uses only its one second pulse. The universal time server on the site is a microprocessor (named 'clock'), located in the computer room, also connected to the one second pulse, and which can read the time from our UT master clock, in seconds integral or in fraction of seconds.

Table 1: Available configurations

Configuration	AB	BC	CD	DD	Stations
A1	o				W27–W20–N29–E23
A2	o				W23– E04 –N29–E24
B1		o			E24 – E16 –N11–N17
B2	o	o			W12–W09–E24–N20
C1	o	o	o		W20–W05–N09–N17
C2		o	o		W09– E10 –N03–N15
D1			o	o	W05–W00–E03–N05
D2				o	W10–W01–E03–N09

Table 2: Beam sizes (in arc seconds)

Configuration DD

Dec.	85 GHz		115 GHz		230 GHz		PA
(°)	Maj.	Min.	Maj.	Min.	Maj.	Min.	(°)
-20	14.06	5.31	10.39	3.93	5.20	1.96	4.
0	9.06	5.67	6.70	4.19	3.35	2.09	7.
20	7.17	6.04	5.30	4.47	2.65	2.23	16.
40	6.49	6.10	4.80	4.51	2.40	2.25	-120.
60	6.43	5.81	4.76	4.29	2.38	2.15	-99.
80	6.44	6.04	4.76	4.46	2.38	2.23	86.

Configuration CD

Dec.	85 GHz		115 GHz		230 GHz		PA
(°)	Maj.	Min.	Maj.	Min.	Maj.	Min.	(°)
-20	8.72	3.57	6.45	2.64	3.22	1.32	-2.
0	5.56	3.77	4.11	2.79	2.06	1.39	-7.
20	4.47	3.99	3.30	2.95	1.65	1.48	-17.
40	4.18	3.90	3.09	2.89	1.54	1.44	101.
60	4.17	3.73	3.09	2.76	1.54	1.38	93.
80	4.19	3.91	3.10	2.89	1.55	1.45	91.

Configuration BC

Dec.	85 GHz		115 GHz		230 GHz		PA
(°)	Maj.	Min.	Maj.	Min.	Maj.	Min.	(°)
-20	6.08	2.10	4.49	1.55	2.25	.78	10.
0	3.84	2.22	2.84	1.64	1.42	.82	-160.
20	3.05	2.32	2.25	1.71	1.13	.86	32.
40	2.71	2.37	2.00	1.75	1.00	.87	50.
60	2.61	2.34	1.93	1.73	.97	.86	69.
80	2.54	2.48	1.88	1.83	.94	.92	50.

Configuration AB

Dec.	85 GHz		115 GHz		230 GHz		PA
(°)	Maj.	Min.	Maj.	Min.	Maj.	Min.	(°)
-20	4.13	1.44	3.06	1.06	1.53	.53	-176.
0	2.71	1.55	2.00	1.15	1.00	.57	9.
20	2.09	1.66	1.54	1.23	.77	.61	15.
40	1.84	1.71	1.36	1.26	.68	.63	-146.
60	1.76	1.65	1.30	1.22	.65	.61	-98.
80	1.76	1.67	1.30	1.24	.65	.62	-94.

At boot time the "antenna control" VME micros, on the first occurrence of a one second pulse, request from the time server (clock) the time, in integral seconds, corresponding to that pulse, and check that the answer is received well before the next one second pulse occurs. Besides, the "antenna control" VME micros obtain time with higher resolution using interrupts at 64Hz, incrementing a counter, which is resynchronised every 1s on the time bus pulse.

As stated before, the equatorial coordinates sent by bure01 to the "antenna control" VME micros vary only slowly with time; just like offsets, pointing parameters and homology coefficients, they need not be applied on a pre-determined second. However, drift scans require a synchronisation between bure01 and the "antenna control" VME micros. To solve this specific problem, periodic operations on bure01 are synchronised on the reception of periodic (synchro) messages issued by the time server VME micro (clock). The period of these synchro messages is one second and each message is dated. This time is used to stamp each request sent to the "antenna control" VME micros and triggered on the synchro messages.

The control of the subreflectors is performed in the "receiver control" VME micros, since these micros are located close to the subreflector motor amplifiers. These micros monitor and control the motors upon requests from either a local test program or a task communicating with the companion "antenna control" VME micro, which provides the motor positions dependent on the current antenna elevation, the homology parameters and extra subreflector tilts and translations, as requested.

The tests so far have been performed with one antenna disconnected from our current control system (CAMAC based). The antenna was fully equipped with VME modules, some of which were specifically developed at IRAM, such as the time bus interface, the incremental encoder and resolution enhancement interface, and the subreflector 5-motor interface. In observation mode, the commands concerning the antenna position, prepared on the VMS system for the current interferometer control system, were reformatted to the new command syntax and forwarded to an UNIX station. This station, synchronised on the universal one second pulse, executed the commands and transferred the resulting requests to the VME micro in the antenna. With the subreflector and the main pointing axes operating in this way, and pointing to quasars and planets, we could get interferometric correlations with the other antennas.

Alain PERRIGOUARD

Report on Recent Observations

CO AND DUST IN NGC 3079: GAS PROPERTIES AND THE CO - H_2 CONVERSION RATIO

Report by: J. Braine([1]), M. Guélin([1]), M. Dumke([2]), N. Brouillet([3]), F. Herpin([3]), R. Wielebinski([2])
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We present a 245 GHz continuum map of the (mostly) thermal dust emission from the edge-on spiral NGC 3079 taken with the 19-channel MPIfR bolometer mounted on the IRAM 30meter telescope. At about $2'$ (12 kpc) North of the center, a strong secondary maximum is detected at 245 GHz corresponding to an HI and radio continuum peak. The CO lines were detected here but very weak. This is a clear detection of the dust associated with the *atomic* gas component in an external galaxy.

The CO(1–0) and CO(2–1) lines were observed and detected out to a radius of 13 kpc for an assumed distance of 20 Mpc. The line width of the nuclear spectrum exceeds the global line width (*i.e.* as determined by the rotation curve at $r > 2$ kpc) by over $100\,\mathrm{km\,s^{-1}}$. No evidence for a compact nuclear source is seen in any of these maps (roughly $11''$ resolution).

Assuming that the 245 GHz dust emission can be decomposed into emission from dust in the atomic and in the molecular interstellar medium, we derive the emissivity of the dust associated with the relatively diffuse atomic gas. Based on this value, and taking the emissivities for the diffuse atomic gas as lower limits (cf. Hildebrandt 1983), we estimate $N(\mathrm{H_2})/I_{\mathrm{CO}(2-1)}$ conversion factors of $1 - 2 \times 10^{20}\,\mathrm{cm^{-2}}\,(\mathrm{K\,km\,s^{-1}})^{-1}$ in the disk and $\ll 8 \times 10^{19}\,\mathrm{cm^{-2}}\,(\mathrm{K\,km\,s^{-1}})^{-1}$ in the nucleus, far below standard estimates. The star formation efficiency must be very high in the central region.

An interesting feature of our data is the variation of the CO(2–1) line to continuum ratio, from ≈40% in the nuclear region decreasing by a factor 10 with radius (see Fig. 1). We interpret this as being largely due to a decrease in the gas temperature and suggest that the CO(2–1) line to continuum ratio may be a useful thermometer for studies of the ISM in galaxies.

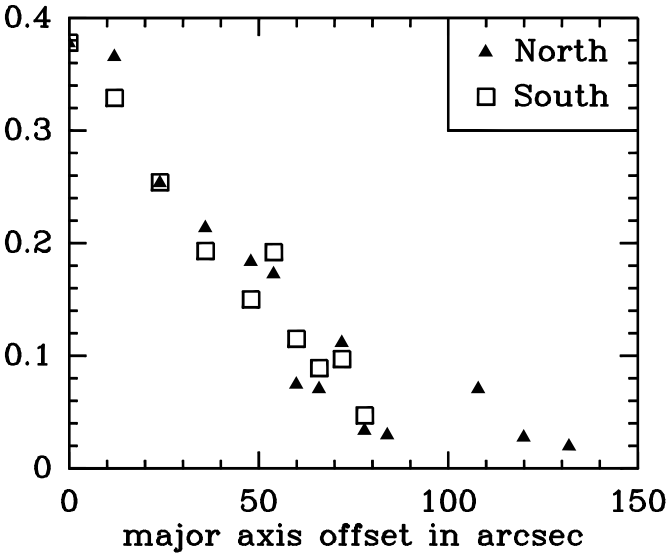

Figure 1: CO(2–1) line to continuum ratio as a function of radial distance in NGC 3079

Scientific Results

A precessing jet in the L 1157 molecular outflow

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([2])Centro Astronómico de Yebes, Apartado 148, E-19080 Guadalajara, Spain

Abstract: The blue-shifted lobe of the L 1157 molecular outflow has been imaged in the CO $J = 1 - 0$ line, and in the λ 2.6 mm continuum, with angular resolution of $3.5'' \times 3''$ ($\sim 7\ 10^{-3}$ pc at the distance of L 1157, 440 pc) at the IRAM interferometer. The data consist of a mosaic of 10 partially overlapping fields, complemented with short spacing information from the IRAM 30-m telescope.

The images reveal the presence of at least two prominent limb brightened cavities which have been likely created by the propagation of large bow shocks due to episodic events in a precessing, highly collimated jet. A simple spatio-kinematic model involving two different ejection events provides an accurate description of the observations. We find that the outflow is inclined by $\sim 80°$ to the line of sight, and that the axis of the underlying jet precesses on a cone of $6°$ opening angle, with a period of $\sim$4000 yr. We discuss the constraints derived from the present observations on several recent models for jet driven molecular outflows. We conclude that, similarly to what happens in other outflows (e.g.: L1448), the large opening angle of the L 1157 CO outflow is originated by the large size of the propagating bow shocks, since the precession in L 1157 happens in a narrow cone. However, the observed shape of the cavities evacuated by the bow shock propagation are not well accounted for by current models of gas entrainment by bow shocks.

The pointing of the IRAM 30–m telescope

A. Greve([1]), J.–F. Panis([2]), C. Thum([1])
([1])IRAM (Grenoble)
([2])IRAM (Granada)

Abstract: The original pointing model of the IRAM 30–m millimeter wavelength radio telescope is based on nine parameters which are updated from special pointing measurements made approximately every two weeks. The pointing models derived from these measurements provide a pointing accuracy of $\sim 3.5''$ (rms) which, however, degrades slowly with time. Application by the observer of instantaneous pointing corrections recovers the inherently precise operation of the telescope.

The data analyzed here show that the number of pointing parameters used for the 30–m telescope can be reduced to six because the astronomical positions of pointing sources are today accurately known, and because the telescope does not show hysteresis or long–term irreversible changes of its mechanical behaviour so that the gravitational bending can be described by a unique and time–independent function, as should be the case.

There are indications that the inclination of the azimuth axis is influenced by seasonal thermal effects, which merit further monitoring for eventual quasi real time correction. The other pointing parameters show random variations in time which makes it difficult to trace any particular source which sets their ultimate accuracy, although we suspect residual thermal effects to be the main source of perturbation.

Search for CO emission in globular clusters

S. Leon , F. Combes
([1])IRAM (Granada)
([2])Observatoire de Paris (France)

Abstract: We have searched for CO(1-0) and CO(2-1) emission towards six globular clusters with the IRAM 30-m telescope. At a very low noise level (rms between 3 and 12 mK) we found no evidence of CO signals. Our derived 3σ upper limits are below the solar mass for the molecular content of these objects, down to 0.07 $M_\odot$ for NGC 5272. Since mass loss from AGB stars and post-turnoff stars should provide up to 100 $M_\odot$ of intracluster gas between two disk crossings, we conclude that the gas must have been removed through ram-pressure stripping in a hot gaseous halo, as suggested by recent [OIII] and X-ray observations. For some clusters, however, the present hot gas density in the halo is not sufficient for efficient ram-pressure stripping.

Search for Interstellar Glycine

F. Combes(1), Nguyen-Q-Rieu(1), G. Wlodarczak(2)
(1)Observatoire de Paris (France)
(2)Université de Lille (France)

Abstract: Because of its central biological significance, glycine has extensively been searched for in the 1980s, after the laboratory determination of its millimeter-wave spectrum in 1978. Using the 30m IRAM telescope, we have recently carried out high sensitivity observations to search for both conformers I and II of glycine in several spectral regions at 3 mm (around 101 GHz, 107 GHz, 111 GHz), at 2 mm (around 136 GHz and 144 GHz), and at 1.4 mm (around 217 GHz and 223 GHz) with a bandwidth of 512 MHz. The targets were Orion and Sagittarius-B2. We covered spectral regions which included 98 expected lines of glycine: some did show some signal at various levels (10mK-1K), but many were not detected, while comparable signals are expected. Since the level of confusion is reached in Orion, we believe that glycine is below the confusion limit, and will be impossible to detect in this source, as well as other complex molecules of similar or lower abundance ($\lesssim 10^{-11}$). During these observations, we detected 334 lines in Orion, 157 of which are unidentified.

New Preprints

The following preprints are available from IRAM:

363. The pointing of the IRAM 30-m Telescope
A. Greve, J.-F. Panis and C. Thum 1995 *A & A Supplement Series*

364. New observations and a new interpretation of CO(3-2) in IRAS F10214+4724
D. Downes, P.M. Solomon, S.J.E. Radford
1995 *Astrophys. Journal*

365. millimeter-wavelength observations of compact steep-spectrum sources
H. Steppe, S. Jeyakumar, D.J. Saikia, C.J. Salter
1995 *Astron. and Astrophys.*

The IRAM Newsletter is edited by Robert LUCAS at IRAM-Grenoble (e-mail address: lucas@iram.fr).
The IRAM Newsletter is available in electronic form:

- by using the World Wide Web and NCSA Mosaic: from the IRAM home page (http://iram.fr/www/iram.html), click on item "Newsletter" and follow the links...
- by means of an anonymous ftp account, opened at IRAM for Internet users. To access those files, please connect through ftp to iram.fr (or 193.48.252.22) and read the README file. Several subdirectories are available:

Directory	Contents
/dist/newsletter	Recent issues of this Newsletter (one subdirectory per issue)
e.g. /dist/newsletter/jul95	jul95.ps is the Postscript file for the July 1995 issue.
/dist/doc	Documentation on IRAM telescopes and software
/dist/proposal	Proposal forms and Latex files to aid proposal preparation
/dist/soft	distribution files for reduction software

- by means of an electronic mail file server installed at IRAM (on the VAX machine IRAM04). This file server is a file distribution service that uses electronic mail facilities to deliver files. To communicate with it you should send a message to the electronic address:

  newsserv@iram.grenet.fr

  For instance, to obtain a copy of the May 1992 issue, just send the one line message:

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  More information may be obtained by sending the one line message:

  HELP

  Note that this file server also contains Postscript files of the proposal forms and of Plateau de Bure documentation.

We also compile a list of e-mail addresses of IRAM users (e.g., in order to send warning messages when the Newsletter is available, but also to provide fast information, if needed). If you feel your address should be on this list, please send the one line message:

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Both addresses are valid on Internet, EARN-Bitnet and EAN .... Please keep R. Lucas informed of any problem you may encounter.

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Plateau de Bure	Institut de Radioastronomie Millimétrique, Observatoire du Plateau de Bure, 05250 St Etienne en Dévoluy, France	(33) 92 52 53 60	(33) 92 52 53 61
Granada	Instituto de Radioastronomía Milimétrica, Avenida Divina Pastora 7, Núcleo Central, 18012 Granada, España	(34) 58 22 88 99	(34) 58 22 23 63
Pico Veleta	Instituto de Radioastronomía Milimétrica, Estación Radioastronómica IRAM-IGN del Pico Veleta, Sierra Nevada, 18012 Granada, España	(34) 58 48 80 00	(34) 58 48 80 82

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- IRAM-Granada: username@iram.es, or through PSI: PSI%02145258020628::username

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

If you are interested in attending the next IRAM User Meeting, please cut off this page, fill in the following questionnaire and return it before November 3rd to:
Mrs G. Matoso, IRAM (300 rue de la Piscine, F-38406 Saint-Martin d'Hères, France - Fax (33) 76 51 59 38, e-mail: Matoso@iram.fr).

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USER MEETING
IRAM–Grenoble
December 7/8, 1995

Registration Form

Name: ....
Surname: ....
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Do you need hotel reservation ?
From ....Dec 1995 to ....Dec 1995
(Number of nights: ....)

- Single Room ☐
- Double Room ☐

I will attend:

- Yes ☐
- No ☐
- Perhaps ☐

I will present a contribution:

- Yes ☐
- No ☐

I prefer:

- An oral contribution ☐
- A poster ☐

The titles(s) of my papers(s) is (are): ....
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