



# Report from the event supported by RadioNet

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**TITLE** 10<sup>TH</sup> IRAM MILLIMETRE INTERFEROMETRY SCHOOL

**DATE:** 1 – 5 OCTOBER 2018

**LOCATION:** GRENOBLE / FR

**MEETING WEBPAGE:** <http://www.iram-institute.org/EN/content-page-367-7-67-367-0-0.html>

**HOST INSTITUTE:** IRAM

**RADIONET  
BENEFICIARY / NO:** IRAM / 3

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RadioNet has received funding from the EU's Horizon 2020 research and innovation programme under the grant agreement No 730562

# Report:

## 1 SCIENTIFIC SUMMARY

Since 1998, IRAM has been organizing in Grenoble a millimeter interferometry school every two years (with the exception of 2014). The tenth school was organized on **October 1-5 2018**. This event was supported by the RadioNet networking activity “New skills for astronomers” (WP4).

Note that, since 2001, IRAM Granada has also been organizing schools dedicated to the millimeter single dish techniques, shifted one year relative to the interferometry school.

### **Motivation of the school**

Science using interferometric observations in the (sub)millimeter domain is a very active and very important field in modern astronomy, as testified by the large investments that funding agencies are dedicating to develop and operate major instruments. ALMA is now reaching full operations and will be a transformational instrument during the coming decades. NOEMA is approaching completion (10 out of 12 antennas in operations, the last two in construction) and will complement ALMA in the Northern sky while also providing unique observational capabilities, e.g. for spectral surveys.

It is therefore critical to train the community and especially the young astronomers (PhD students, postdocs) to the millimeter interferometry techniques, so that the superb scientific capabilities of the instruments available can be fully exploited. The millimeter interferometry school series is an important aspect of the effort devoted by IRAM to the user formation.

### **Organization**

The program of the school included general presentations of the aperture synthesis techniques in the millimeter domain; specific lectures on calibration and imaging of the data; and lectures focused on the NOEMA array. ALMA was also presented. Two afternoons (Thursday + Friday) were dedicated to tutorials: 8 groups of students were formed, each of them helped by a tutor. Real data set from NOEMA were distributed, so that participants can experience the data analysis techniques and tools. Emphasis was on imaging and data analysis.



A web page was setup to host the information related to this school:

<http://www.iram-institute.org/EN/content-page-367-7-67-367-0-0.html>

The page now gives access to all presentations given during the school. It will remain active on the IRAM web site, as are the pages of the previous schools.

### **1.1 RADIONET RELEVANCE**

The main goal of the school was to form future users of the IRAM NOEMA array, one of the RadioNet infrastructures.

## 1.2 IMPACT

65 astronomers, mostly young PhD students and postdocs, received a solid introduction to the millimeter interferometry techniques, including data processing. After ten such schools, more than 600 astronomers have received this formation. Since the basics of aperture synthesis are obviously common to all wavelength ranges, this school series also support the radio-astronomical community at large, by promoting the use of interferometers in modern science.

## 2 AGENDA OF THE EVENT

A copy of the agenda of the school is given in appendix. The school started on Monday 9h and was concluded on Friday 18h.

## 3 PARTICIPANTS

We received 87 requests for participation to the school, with a large number of countries being represented. The final number of participants was 65 (30 women + 35 men). The final attendance list is provided as annex to that document. The vast majority of the participants were PhD students or young postdocs.

Country	Nb. Participants
France	19
Germany	13
Spain	9
United Kingdom	4
China	4
Italy	4
Denmark	3
Hungary	3
Japan	2
India	1
Netherlands	1
Russia	1
Sweden	1



Group picture of participants and lecturers

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### 3.1 RADIONET NEWSLETTER

In the registration form, people were asked whether they agreed to be added to the RadioNet newsletter distribution list. 72 persons, out of 87 people who registered, agreed to receive that newsletter. The list is provided in Annex 4.

## 4 RADIONET FINANCIAL CONTRIBUTION

The RadioNet contribution of 9000 € was used to support the organization of the school, more specifically to fund part of the cost of the buffet that was organized every day for all participants. In addition, IRAM also funded a school dinner in a Grenoble restaurant, support for a number of participants (in practice: hotels were paid by IRAM) and a couple of other minor expenses. The total cost of the school was 20625 €.

## 5 CONFIRMATION:

Following the Regulation (EU) 2016/679 - General Data Protection Regulation-, we ask you to confirm that RadioNet is allowed to publish this report, incl. participants lists, statistic's details, pictures, etc.


## Annex 1 – Program of the school

	Monday	Tuesday	Wednesday	Thursday	Friday
09:00-09:30	Registration	NOEMA - <i>R. Neri</i>	Imaging & deconvolution (I) - <i>J.Pety</i>	ALMA - <i>E.Chapillon</i>	Polyfix - <i>J. Boissier</i>
09:30-10:00	Welcome			How to use ALMA - <i>E. Chapillon</i>	How to use NOEMA - <i>M. Krips</i>
10:00-10:30	mm astronomy science - <i>R. Neri</i>	Break	Break	Break	Break
10:30-11:00	Break				
11:00-11:30	Antennas and their calibration - <i>C. Kramer</i>	Calibration principles - <i>F. Gueth</i>	Imaging & deconvolution (II) - <i>J.Pety</i>	Low SN analysis - <i>F. Gueth</i>	Demo PMS - <i>C. Lefevre</i>
11:30-12:00	Lunch break	Lunch break	Lunch break	Lunch break	Lunch break
12:00-12:30					
12:30-13:00	Tutorials Introduction	Atmospheric Phase correction - <i>M. Bremer</i>	UV plane analysis - <i>C. Herrera</i>	Tutorials (I)	Tutorials (II)
13:00-13:30		Absolute flux calibration - <i>M. Krips</i>	Self-calibration - <i>V. Pietu</i>		
13:30-14:00	Interferometry - <i>J.Pety</i>	Break	Break	Tutorials (I)	Tutorials (II)
14:00-14:30	Break				
14:30-15:00	mm interferometers - <i>F. Gueth</i>	Real-time calibrations - <i>V. Pietu</i>	NOEMA Pipeline - <i>A. Castro-Carrizo</i>	Tutorials (I)	Tutorials (II)
15:00-15:30		Break	Break		
15:30-16:00	Break	Break	Break	Tutorials (I)	Tutorials (II)
16:00-16:30					
16:30-17:00	Break	Break	Break	Tutorials (I)	Tutorials (II)
17:00-17:30					
17:30-18:00	Break	Break	Break	Tutorials (I)	Tutorials (II)
18:00-18:30					

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## Annex 2 – School poster



**10<sup>th</sup> IRAM millimeter interferometry school**  
1 – 5 October, 2018  
Grenoble, France  
[www.iram-institute.org](http://www.iram-institute.org)

- Fundamentals of millimeter interferometry
- Atmospheric phase correction
- Data calibration and imaging techniques
- NOEMA and its new capabilities
- ALMA



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