

**Newsletter No. 7**  
of the  
**European RTN Network RAAG**  
Contract No. HPRN-CT-2001-00271  
March 1, 2003

Through a contract with the Universität Passau in Germany, the European Community has established the Research Training Network RAAG (*Real Algebraic and Analytic Geometry*). This bi-monthly newsletter, to be distributed among the Network researchers and other interested mathematicians by e-mail, will inform about the activities and the progress of the Network and about matters of interest to the Network's researchers. Further information about the Network, and about RAAG in general, may be found on the Network's website at

<http://www.ihp-raag.org/>

The Network RAAG is part of the European IHP programme (Improving the Human Research Potential). General information about this programme and about RTN networks is available at

<http://www.cordis.lu/improving/home.html>

The website

<http://improving.cordis.lu/rtn/>

offers short presentations of the different networks supported by the European Community.

### **Management of the Network**

Daniel Richardson, the Local Coordinator of the British team, has a new deputy, James Beaumont (also at Bath, e-mail: [cssjb@bath.ac.uk](mailto:cssjb@bath.ac.uk)).

Niels Schwartz in his capacity as Scientific Coordinator of the Network

- attended a conference in Hannover, Germany, which informed about RTN networks under the 6. Framework Programme of the EC,
- visited the British team at the University of Bath in Bath, United Kingdom,
- visited the Polish team at the Uniwersytet Jagiellonski in Kraków, Poland.

Currently the first Annual Report about the Network's progress is being prepared. It covers the period from March 1, 2002, to February 28, 2002, and will be submitted to the EC as soon as possible after February 28.

## The website

The Network's website is the primary means by which the Network presents itself to the general public. The website has been developed under the responsibility of Frederic Mangolte ([Frederic.Mangolte@univ-savoie.fr](mailto:Frederic.Mangolte@univ-savoie.fr)); his deputy is Didier D'Acunto ([Didier\\_Dacunto@mat.ucm.es](mailto:Didier_Dacunto@mat.ucm.es)). Both the content and the design of the website are evolving constantly. Everybody should take a look from time to time. Criticism and suggestions concerning all aspects of the website are invited and are very welcome.

The website contains sections that address especially young researchers – the section "Young Researchers" (which contains information for and about the Network's young researchers) and the "Forum" (which offers opportunities for informal communication). Take a little time to visit these pages, in particular if you are a young researcher!

## Young researchers

Some of the Network's young researchers will organize a Network meeting for young researchers. Here is the announcement:

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 REAL ALGEBRAIC AND ANALYTIC GEOMETRY  
 RAAG Meeting of Young Reaserchers  
 September 1- 5 2003  
 Coma-Ruga , Spain

### F i r s t   A n n o u n c e m e n t

Dear Colleague,

The RAAG meeting of young reaserchers will take place near Barcelona, in the youth hostel of Coma-Ruga, from September 1 to 5. The goal of this meeting is to allow the young researchers of our Network to present their works, regardless of the usual stress of more formal conferences.

We advise you to arrive on the 31st of August in Barcelona, a bus will leave Barcelona to Coma-Ruga in the end of the afternoon.

If you are interested in attending this meeting, please tell us BEFORE THE 15th OF APRIL by mail to the following address :

[raagyoung2002@math.univ-rennes1.fr](mailto:raagyoung2002@math.univ-rennes1.fr)

If you want to give a lecture, don't forget to mention it.

**ACCOMMODATION:**

The participants will be accommodated in four-bed rooms. The lunches will be provided by the youth hostel.

**EXPENSES:**

The expenses from 31st of August in the evening to the lunch of the 5th of September are covered by your respective RAAG Teams.

**WHAT IS A YOUNG REASERCHER?**

The notion of young reasercher is not well defined, but if you are older than 90 years old, you are definitely not concerned by this mail.

If you need more informations you can tell us or have a look at the Network's web page:

<http://ihp-raag.org/young/index.php>

Sincerely yours

E.Brugalle, S. Corvez, L. Lopez de Medrano

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**Training and appointments**

The training of young researchers is one of the main purposes of the Network. An important part of the training programme is to offer positions and fellowships to young researchers, giving them an opportunity to work with leading real geometers and participate in research of the highest quality.

**Current appointments:**

- Dr. Hervé Perdry from France does post-doctoral work with Laureano Gonzalez-Vega in Santander, from July 1, 2002, to March 31, 2003.

- Dr. Markus Schweighofer from Konstanz, Germany, works as a post-doc in Rennes, from September 1, 2002, to August 31, 2003.
- M. Dumnicki from Poland works as a pre-doc with Jacek Bochnak in Amsterdam, from September 1, 2002, to August 31, 2003.
- Helene Pennaneac'h from France is a post-doc fellow at the Università di Pisa, where she works with Francesca Acquistapace and Fabrizio Broglia, from September 1, 2002, to August 31, 2003.
- Remi Soufflet from France is a post-doctoral Network fellow at the Uniwersytet Jagiellonski in Kraków, where he works with Wieslaw Pawlucki, from September 15, 2002, to September 14, 2003.
- Igor Klep from Slovenia has as a pre-doc position in Regensburg, from October 1, 2002, to September 30, 2003.
- Didier D'Acunto from Chambéry, France, is a post-doc at the Universidad Complutense in Madrid, October 1, 2002, to May 31, 2003.
- Olivier Ruatta from France is a post-doc fellow at the Università di Pisa to work with Francesca Acquistapace and Fabrizio Broglia, from October 1, 2002, to March 31, 2003.
- Artur Piekosz from Poland works as a post-doc with Alex Wilkie at Oxford University, October 1, 2002, to July 31, 2003.
- Dr. M. Karas from Poland works as a post-doc with Jacek Bochnak in Amsterdam, from January 1, 2003, to July 31, 2003.

**Expired appointments:**

- José F. Fernando from the Universidad Complutense, Madrid, did post-doctoral work with Claus Scheiderer in Duisburg, from March 1 to August 31, 2002. After the end of his term he returned to Madrid.

**Future appointments:**

Several positions for young researchers are available within the next few months; it is expected that more positions will be added in the near future. Vacancies are usually advertised on the EC's CORDIS server at <http://improving.cordis.lu/rtn/>, in this Newsletter and on the Network's website at <http://www.ihp-raag.org/>.

The application deadline for one position has expired; the successful candidate is:

- A post-doc position in Pisa for work with Francesca Acquistapace and Fabrizio Broglia, beginning March 1, 2003. Dr. J. Fernando will be appointed to this position for 6 months.

**Vacancies**

- A post-doc position in Kraków, Poland. The successful candidate is expected to study metric properties in  $\sigma$ -minimal structures and Lipschitz stratifications, in collaboration with Professor Wieslaw Pawlucki. The position is available for 9 months, beginning on October 1, 2003. The application deadline is May 31, 2003. Applications should be sent to

Prof. Dr. Wieslaw Pawlucki  
Instytut Matematyki

Uniwersytet Jagiellonski  
ul. Reymonta 4  
30-059 Kraków  
Poland  
e-mail [pawlucki@im.uj.edu.pl](mailto:pawlucki@im.uj.edu.pl)

- A post-doc position in Regensburg, Germany. The successful candidate is expected to study elimination of imaginaries in valued o-minimal expansions of real closed fields in collaboration with Prof. Dr. Manfred Knebusch and Dr. Marcus Tressl. The position is available for 12 months, beginning on May 1, 2003. The application deadline is March 31, 2003. Applications should be sent to

Dr. Marcus Tressl  
Naturwissenschaftliche Fakultät I  
Universität Regensburg  
93040 Regensburg  
Germany  
e-mail [Marcus.Tressl@mathematik.uni-regensburg.de](mailto:Marcus.Tressl@mathematik.uni-regensburg.de)

- A pre-doc position at the Université de Rennes. The successful candidate is expected to work, with Prof. M. Coste and Prof. I. Itenberg, about real algebraic geometry, in particular recent developments in the application of combinatorial techniques to real enumerative problems. The appointment will be for a period of 12 months and starts on September 1, 2003.

All interested young researchers (nationals of an EU Member State or an Associated State, usually not older than 35 years) who are working towards their doctoral degrees are invited to apply for this position. Applications (including C.V., a letter of recommendation, and a work plan) should be sent, not later than March 31, 2003, to

Prof. Michel Coste  
Institut de Recherche Mathématique de Rennes  
Université de Rennes I  
Campus de Beaulieu  
35042 Rennes Cedex  
France  
e-mail: [Michel.Coste@univ-rennes1.fr](mailto:Michel.Coste@univ-rennes1.fr)

- A post-doc position at the Université de Rennes. The successful candidate is expected to work, in collaboration with Prof. D. Grigoriev and Prof. M.-F. Roy, about complexity issues related to real algebraic geometry. The appointment will be for a period of up to 12 months and starts on September 1, 2003.

All interested young researchers (nationals of an EU Member State or an Associated State, usually not older than 35 years) are invited to apply for this position.

Applications (including C.V., a letter of recommendation, a work plan, and the list of publications) should be sent, not later than March 31, 2003, to

Prof. Michel Coste  
Institut de Recherche Mathématique de Rennes  
Université de Rennes I  
Campus de Beaulieu  
35042 Rennes Cedex  
France  
e-mail: [Michel.Coste@univ-rennes1.fr](mailto:Michel.Coste@univ-rennes1.fr)

### **Other positions and opportunities**

The Research Unit "Algebra & Logic" of the University of Saskatchewan at Saskatoon (<http://math.usask.ca/fvk/alg.htm>) has money to support graduate students from Canada or from abroad, at the Master's or Ph.D. level. Suitable candidates are encouraged to apply.

The members of the Research Unit "Algebra & Logic" are

- Murray Bremner ([bremner@math.usask.ca](mailto:bremner@math.usask.ca))
- Franz-Viktor Kuhlmann ([fvk@math.usask.ca](mailto:fvk@math.usask.ca))
- Salma Kuhlmann ([skuhlman@math.usask.ca](mailto:skuhlman@math.usask.ca))
- Murray Marshall ([marshall@math.usask.ca](mailto:marshall@math.usask.ca))

Details about the graduate program, the funding, application forms and deadlines may be obtained by contacting any one of the members of the Research Unit, or

- Patrick Browne ([browne@math.usask.ca](mailto:browne@math.usask.ca)), Graduate Chair of the Mathematical Sciences Group. Postal address  
University of Saskatchewan  
McLean Hall  
106 Wiggins Road  
Saskatoon, SK S7N 5E6  
Canada

Besides the regular financial support (teaching fellowships, university scholarships), all members of the Mathematical Sciences Group hold NSERC Grants (NSERC: National Science and Engineering Research Council of Canada) which may be used to support their graduate students with additional funds. Moreover, graduate students can earn money through marking or by working in the Math Help Center.

NSERC offers several scholarships and fellowships programs for students and fellows from abroad who wish to study at a Canadian University (<http://www.nserc.ca>). In particular, the NSERC-NATO SCIENCE FELLOWSHIPS are very attractive and are intended to support Post-Doctoral Fellows from the former East European Block to study at a Canadian University for two years. In last year's competition, the Algebra & Logic Group at the University of Saskatchewan was successful in getting such a NATO Fellowship.

The Algebra & Logic Group has been very active in the last few years, and will continue to be so. Its main research interests are:

- Real Algebraic Geometry and Semialgebraic Geometry,
- Quadratic Form Theory,
- Valuation Theory and its various applications,
- Model Theory of Fields (Valued Fields, Ordered Fields, Hardy Fields),
- Ordered Algebraic Structures

The group's Algebra & Logic Seminar has been running since 1997; the schedule, topics and speakers can be found on the seminar's homepage (<http://math.usask.ca/fvk/algsem.htm>). Other past and future activities of the group include

- An active colloquium: <http://math.usask.ca/fvk/colloqg8.htm>
- The International Conference and Workshop on Valuation Theory, 1999
- The Annual Colloquiumfest, a series of short conferences taking place each year in March, the Fourth Annual Colloquiumfest coming up in March 2003: <http://math.usask.ca/fvk/mb4.htm>
- Invitations to outside researchers for short or long term visits.

The atmosphere in the group is very supportive of research.

Finally, Saskatoon is a very pleasant city, with lots of nature around and a fair amount of cultural events. The Campus is one of the nicest in North America. Saskatoon is a rather inexpensive place to live, so usually the funding provided by the Research Unit is sufficient to cover a moderate way of living for students.

## Visits, extended stays and lectures

- Vicki Powers of Emory University in Atlanta currently spends a year at the Universidad Complutense in Madrid.
- Murray Marshall will visit Paris from January 2 to March 7, 2003. His hosts are D. Gondard (Paris 6) and M. Dickmann (Paris 7).
- Vincent Astier is in Regensburg from September 1, 2002, to August 20, 2003, to work with Marcus Tressl.
- Tobias Kaiser (Regensburg) currently spends a year as a post-doc at the University of Illinois at urbana-Champaign, where he works with Lou van den Dries.
- Alberto Zanoni visited Santander in January.
- Claus Scheiderer (Duisburg) visited Madrid for joint work with Jose Fernando and Jesus Ruiz. He gave an informal seminar lecture.
- Henri Lombardi and Herve Perdry visited Madrid in February 2003.
- Marcus Tressl (Regensburg) visited Paris 7 in January 2003.
- Johan Huisman (Rennes) gave a colloquium lecture in Konstanz.
- Tadeusz Mostowski will visit Nice for one month, in February 2003.

- E. Shustin will be in Rennes for one month, in March 2003.
- E. Bierstone will be in Nice for one month, in June and July 2003.

## Network meetings

The Network organizes a large number of meetings: every year an Annual General Conference and several workshops in areas of active research, as well as schools that offer introductory courses about special topics. The future meetings that have been scheduled so far are:

- March 31 – April 5, 2003, in Pisa, Italy,  
Annual General Network Conference (RAAG 2003)  
Organizers are Acquistapace, Broglia, Schwartz  
For the Third Announcement: See below
- June 25 – 28, 2003, in Lisbon, Portugal,  
Network school on  
o-minimal structures  
Organizers are Edmundo, Richardson et al.
- June 29 – July 5, 2003, in Rennes, France,  
Network school on  
Computer applications of real geometry  
Organizers are Coste, Gonzalez-Vega, Roy
- September 1 – 5, 2003  
RAAG Meeting of Young Reaserchers  
Coma-Ruga , Spain  
E.Brugalle, S. Corvez, L. Lopez de Medrano  
For the First Announcement: See above, in the section "Young researchers"
- October 23 – 25, 2003, in Dortmund, Germany,  
Network workshop on  
Real Algebra  
Organizers are Prestel, Scheiderer, Schwartz
- Annual General Network Conference RAAG 2004: Spain  
Organizers are Andradas, Schwartz et al.
- Annual General Network Conference RAAG 2005: Germany  
Organizers are Schwartz et al.

Information about these meetings, including links to, and addresses of, the websites and home pages, can be found on the Network's website (<http://www.ihp-raag.org/>) as they become available.

The Third Announcement for the Annual General Network Meeting RAAG 2003 was published on February 27, 2003:

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REAL ALGEBRAIC AND ANALYTIC GEOMETRY– RAAG03  
Annual Meeting of the Network RAAG  
March 31-April 5 2003  
Pisa, Italy

Third Announcement

Dear Colleague,  
enclosed you find some information about the 2003 annual meeting on Real Algebraic and Analytic Geometry that will be held in Pisa, at the Dipartimento di Matematica "L.Tonelli", from March 31 to April 5, in the framework of the special bimester "Topics on Complex and Real Geometry" of the *Centro di Ricerca Matematica Ennio De Giorgi* (<http://www.crm.sns.it/geometry/>):

March 31 is the arrival day; lectures are scheduled from April 1 until April 5, noon in the Aula Magna of the Dipartimento di Matematica; participants are expected to leave in the afternoon of April 5 or on April 6.

All participants are lodged in the  
Hotel Fossabanda  
Piazza Santa Croce, 5  
56125 Pisa  
Italy  
Tel. +39 050 970911  
Fax +39 050 9711044  
<http://www.fossabanda.it/>

To get to the hotel from the airport or from the railway station the best is to take a taxi: the price should be around 7 euros.

The best way to get to the Department from the hotel is a relaxing 20 minutes walk; as the weather in Pisa can be rather variable in April, do not forget the umbrella.

Reception: In the Hotel Fossabanda, March 31 from 2.00 p.m.; the conference program, as well as tourist information, will be available.

Meals:

Lunches from Tuesday, April 1, to Saturday, April 5, are partially supported by the organization; you will be asked to pay (cash) 8 Euros each lunch. We shall take lunches in two restaurants rather close to the Department. For the other meals you may find several restaurants, pizzerias or pubs.

Coffee breaks are offered by the Centro De Giorgi.

Some information about the town of Pisa

Pisa is quite small: For your reference consider that to go on foot from the railway station to the Leaning Tower takes around 25 minutes.

You can retrieve much of the information you may need at the official website of the Town of Pisa: <http://www.comune.pisa.it/doc/cittapisa.htm>. Most pages are in Italian. A short English version can be found at <http://www.comune.pisa.it/english/>. You can find a map of the town at

<http://www.comune.pisa.it/turismo/itinerari/mappamonumentale-gb.html>

or at

<http://www.dm.unipi.it/mappa2/mappa-pisa.html>,

where some interesting places are marked with capital letters. On this map the Dipartimento di Matematica is close to the letter "M" and the Hotel Fossabanda is close to the letter "G".

If you need to locate some other address in Pisa we suggest that you look it up at

<http://www.kwmappe.kataweb.it/>

or at

<http://mappe.virgilio.it/tcol/home.jsp>.

Inserting an address you can get a detailed map of its surroundings; you may also zoom in (or out).

Some other useful web addresses:

The airport of Pisa: <http://www.pisa-airport.com/homepage01bis.html>

Rent a car:

[http://www.pisa-airport.com/English\\_file/totale\\_eng/daperaeropoautonoleggi\\_eng.htm](http://www.pisa-airport.com/English_file/totale_eng/daperaeropoautonoleggi_eng.htm)

Taxi:

[http://www.pisa-airport.com/English\\_file/paginemain\\_eng/daperaerotaximain\\_eng.htm](http://www.pisa-airport.com/English_file/paginemain_eng/daperaerotaximain_eng.htm)

Trains: To check train timetables you may use the official site of the

FS, <http://62.110.170.238/home/en/index.html>, or (better) the one of

SBB (Schweizerischen Bundesbahnen), [http://www.sbb.ch/index\\_e.htm](http://www.sbb.ch/index_e.htm), or the one of

DB(Deutsche Bahn), <http://www.bahn.de/>.

Bus:

To get from the airport to the center you must get on bus n.3, which stops also at the station; to get from the railway station to the Department you should take bus n.2.

You can check timetables of buses at the site <http://www.cpt.pisa.it/>. This site is in Italian, but if you click on "Percorsi", then, "Servizio Urbano di Pisa", you can check various routes and maps "cartine". Timetables are also at the bus stops.

Bus tickets: You may buy them (0,80 euros for 60 minutes) in the airport or in the railway station or in Tabacchi shops. They are available also on the bus, but at a more expensive price.

Participants.

Here is the list of already confirmed people: we are waiting for the answers of some invited speakers.

Akriche Mouadh	Francoise Jean-Pierre	Pieroni Federica
Andradas Carlos	Ghiloni Riccardo	Pierzchala Rafal
Astier Vincent	Gondard Danielle	Powers Victoria
Bernig Andreas	Grelowski Krzysztof	Prestel Alexander
Bochnak Jacek	Huisman Johan	Recio Tomas
Bonnard Isabelle	Itenberg Ilia	Richardson Daniel
Brasselet Jean-Paul	Klep Igor	Risler Jean-Jacques
Brugale Erwan	Kurdyka Krzysztof	Rubio Rosario
Cirre Javier	Lattarulo Michele	Schwartz Niels
Comte George	Le Bouffant Gwendal	Schweighofer Markus
Coste Michel	Lopez De Medrano Lucia	Shiota Masahiro
D'Acunto Didier	Mangolte Frederic	Soufflet Remi
Delzell Charles	Marciniak Malgorzata	Stasica Anna
Dickmann Max	Mikosz Malgorzata	Stasica Jacek
Domitrz Wojciech	Monnier Jean-Philippe	Strozyna Ewa
Dutertre Nicolas	Moriceau Sebastien	Szafraniec Zbigniew
Dzedzej Adam	Mormul Piotr	Trotmann David
Edmundo Mario	Nowak Krzysztof	Valette Guillaume
Elkhadiri Abdelhafed	Nowel Aleksandra	Van Hamel Jost
Fernando Jose	Ortiz Rodriguez Adriana	Velez Pilar
Fichou Goulwen	Parusinski Adam	Welschinger Jean-Yves
Fischer Andreas	Pawlucki Wieslaw	Zajac Mariusz
Fornasiero A Giulio	Pennaneac'h Helene	Zell Thierry
Fortuna Elisabetta	Pernazza Ludovico	Zhang Digen

F. Acquistapace, F. Broglia, A. Parusinski, T. Recio, N. Schwartz.  
(The Scientific Committee)

Local Organizers

Francesca Acquistapace  
([acquistf@dm.unipi.it](mailto:acquistf@dm.unipi.it))

Fabrizio Broglia  
([broglia@dm.unipi.it](mailto:broglia@dm.unipi.it))

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## Other events

There are several meetings and events coming up in, or related to, RAAG that are not organized by the Network.

- A bimester on *Topics in Complex and Real Geomerty*, to be held in Pisa, Italy, from March 15 to May 15, 2003, organized by Broglia and Tomassini; web-address: [www.crm.sns.it](http://www.crm.sns.it).
- A Special Session on RAAG as part of the Joint Meeting of the AMS and the Spanish Math Society, June 18 – 21, 2003, in Sevilla, Spain, organized by Andradas, Diaz, Powers, Sottile; webaddress: visit the AMS' website.
- A Special Semester on *Topological Aspects of Real Algebraic Geometry*, January – May 2004, at the MSRI in Berkeley, USA, organized by Akbulut, Mikhalkin, Powers, Shapiro, Sottile, Viro; webaddress: visit the MSRI's website at [www.msri.org](http://www.msri.org).
- The Fourth Annual Colloquiumfest, this time about the topic *Model Theory and Ordered Structures*, March 21 – 22, 2003, at the University of Saskatchewan, Saskatoon, Canasda, organized under the roof of the Research Unit Algebra and Logic of the University of Saskatchewan (<http://math.usask.ca/fvk/alg.htm>) by F.-V. Kuhlmann ([fvk@math.usask.ca](mailto:fvk@math.usask.ca)), S. Kuhlmann ([skuhlman@math.usask.ca](mailto:skuhlman@math.usask.ca)), M. Marshall ([marshall@math.usask.ca](mailto:marshall@math.usask.ca)).

The preliminary list of speakers includes:

- Lou van den Dries (University of Illinois, Urbana, USA)
- Philip Ehrlich (Ohio University, Athens, Ohio, USA)
- Tobias Kaiser (University of Illinois, Urbana, USA)
- Klaus Keimel, (Technische Universität Darmstadt, Germany)
- Margarita Otero (Universidad Autónoma Madrid, Spain)
- Thomas Rohwer (University of Illinois, Urbana, USA)
- Thomas Scanlon (University of California, Berkeley, USA)
- Patrick Simonetta (Université Paris 7, France)
- Patrick Speissegger (University of Wisconsin, Madison, USA)
- Charles Steinhorn (Vassar College, Poughkeepsie, New York, USA)

Further information is available on the Valuation Theory Homepage: (<http://math.usask.ca/fvk/Valth.html>)

- The Banach Center organizes a conference on *Conformal Geometry, Discrete Groups and Surfaces*, June 29 to July 5, 2003, in the *Mathematical Research and Conference Center*, Bedlewo, Poland. Information at

<http://univ.gda.pl/~surfaces/>

- The *Eager Annual Conference 2003* will be held in Aussois (in the French Alps) from September 6 to September 11, 2003. The conference will present some central recent developments in algebraic geometry. In addition to invited lectures there will be tutorials aimed particularly at young researchers. The main themes

are: new homological methods, with applications in algebra, geometry and physics. In particular, the following topics will be addressed:

- Derived categories and the Fourier-Mukai transform.
- Syzygies, progress on Grenn's conjecture, exterior algebra methods.
- Motivic integration,  $p$ -adic integration,  $k$ -jets.

For more information and for registration (before May 15, 2003), see

<http://www-fourier.ujf-grenoble.fr/CONGRES/Eager03/index.html>.

- The *abdus salam international center for theoretical physics* organizes a *Summer School and Conference on Real Algebraic Geometry and its Applications*, August 4 to August 22, 2003, in Trieste. The special aim is to help researchers, particularly young researchers, from developing countries. But students and post-docs from other countries are also welcome. Currently no webaddress is available.

Links to the websites of all these events are also available on the Network's website at <http://www.ihp-raag.org/>.

## Past meetings

From January 6 to January 10, 2003, the network organized a Winter School and Conference on *Real Algebraic and Analytic Geometry and Motivic Integration*. The following report about the event was supplied by Michel Coste:

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### THE PROGRAM :

Three courses

- M. Coste , *Real algebraic sets* (3 hours)
  - F. Loeser, *Motivic integration* (5 hours)
  - K. Kurdyka and A. Parusinski, *Arc-symmetric sets* (4 hours)
- and 14 lectures
- O. Viro, *Integral Radon transformation against Euler characteristic*
  - F. Bittner, *Euler characteristic of varieties of characteristic zero*
  - Dimca, *Euler characteristic: old and new*
  - L. Bonavero, *Weak factorization theorem*
  - Bonnard, *Blow-Nash Functions*
  - J. Adamus, *Vertical components in fibre powers of analytic mappings*
  - C. McCrory, *Virtual Betti numbers of real algebraic varieties*
  - T. Fukui, *Blow-analytic equivalence*

- G. Fichou, *Motivic-type invariants of blow-Nash equivalence via arc-symmetric sets*
- M. Lejeune-Jalabert, *The Denef-Loeser series for toric surface singularities*
- L. Paunescu, *Invariants associated to blow-analytic analytic homeomorphisms*
- Luengo, *The monodromy conjecture for quasi-ordinary singularities*
- W. Veys, *Stringy invariants for general singular varieties*
- Weber, *Koszul duality for toric varieties*

#### THE PARTICIPANTS

56 participants: from France (22, RAAG: 17), Poland (13, RAAG: 12), Italy (6, RAAG: 6), Germany (3, RAAG:3), Spain (2, RAAG:1), Belgium (3), Netherlands (2), Sweden, United States, Canada, Japan, Australia.

#### THE SCIENTIFIC CONTENT :

The space of analytic arcs on an algebraic variety appeared already in the work of O. Zariski and J. Nash in relation with the resolution of singularities. In the 1990's, M. Kontsevich introduced the technique of motivic integration on this space, which gave remarkable results concerning Hodge numbers and the McKay correspondence. The approach of Kontsevich was then developed by J. Denef and F. Loeser who introduced new invariants of algebraic varieties and of the Milnor fiber, and gave a new interpretation of classical invariants in terms of the space of arcs. This theory of motivic integration was the subject of a remarkable series of lectures by F. Loeser. The talks by M. Lejeune and I. Luengo illustrated the use of zeta functions associated to spaces of arcs in the study of singularities

In real algebraic and analytic geometry, analytic arcs appear in the study of the geometry and the topology of constructible sets and in the theory of equisingularity. The semialgebraic arc-symmetric sets introduced by K. Kurdyka are used in local arguments in order to obtain global geometrical results. For instance, these arc-symmetric sets have been used recently to prove that every injective endomorphism of a real algebraic variety is surjective; this generalizes the theorems of Ax (complex case) and of Borel (real smooth case). The theory of arc-symmetric sets and some of its applications were presented in the course of K. Kurdyka and A. Parusinski. Arc-symmetric sets satisfy local topological properties similar to the ones of real algebraic sets, such as Sullivan's condition saying that the Euler characteristic of a link is always even. These properties can be studied by the technique of algebraically constructible functions and Nash constructible functions introduced by C. McCrory and A. Parusinski. The course of M. Coste was an introduction to the local topological properties of real algebraic sets and the technique of algebraically constructible functions. Nash constructible functions and the related concept blow-Nash were presented in the lecture of I. Bonnard. Due to the local properties of arc-symmetric sets, and also to the fact that they are more flexible than real algebraic sets, this class should become an important tool in the study of singularities of real algebraic sets and also of their motives.

Along with arc-symmetric sets, one considers arc-analytic and blow-analytic functions whose theory has been developed by K. Kurdyka, E. Bierstone and P. Milman, A. Parusinski. These functions were used for the study of blow-analytic equivalence. This notion of equivalence between real analytic function germs has been introduced in the beginning of 1980's by T.-C. Kuo and then been developed by the Japanese school and L. Paunescu, using techniques related to the resolution of singularities and to toric geometry. The lectures by T. Fukui and L. Paunescu gave a survey of these developments. Several lectures (notably the one by G. Fichou) showed striking analogies between the theory of Denef and Loeser and some recent constructions of invariants of blow-analytic equivalence.

One of the recurring themes of the school was the notion of an *additive invariant* of algebraic varieties over a field  $k$  (real algebraic geometers are, of course, specially interested in the case  $k=\mathbf{R}$ ). An additive invariant  $c$  takes its values in an abelian group, depends only on the isomorphism class, and satisfies the additivity relation  $c(X) = c(X \setminus Y) + c(Y)$  for  $Y$  a closed subvariety of  $X$  (the prototype is Euler characteristic with compact supports). The universal additive invariant takes a variety over  $k$  to its class in the Grothendieck group  $K_0(k)$  which is one of the basic ingredients of the theory of motivic integration. In her lecture, F. Bittner presented applications of her result on the presentation of  $K_0(k)$  with classes of projective smooth varieties as generators and relations coming from blowing up with smooth centers. Bittner's result uses the weak factorization theorem for birational mappings; L. Bonavero succeeded in giving the flavour of the proof of this theorem in his lecture. Additive invariants were also central in many talks; one can quote those by A. Dimca and V. Weys, and the talk by C. McCrory which presented the *virtual Betti numbers*, which are new additive invariants for real algebraic varieties. The additivity in the semialgebraic context appeared also in the lecture by O. Viro, via constructible functions and their integration against Euler characteristic.

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AMAM, the first EMS -SMAI -SMF Joint Conference on *Applied Mathematics and Applications of Mathematics*, took place in Nice, France, from February 10 to 13, 2003 (<http://acm.emath.fr/amam/>).

As part of the conference a mini symposium *Real geometry and applications* (<http://www-sop.inria.fr/galaad/conf/03amam.html>) was organized jointly by Bernard Mourrain and Marie-Francoise Roy. The mini symposium was part of the section "Applied geometry".

The mini symposium indicated connections with the work of two European projects: GAIA: Intersection algorithms for geometry based IT-applications using approximate algebraic methods (<http://www.oslo.sintef.no/am/gaiatwo/>)

RAAG: Real Algebraic and Analytic Geometry Network. (<http://www.ihp-raag.org/index.php>)

Lecturers were

- Tor Dokken (SINTEF Applied Mathematics, Oslo, Norway)

*Curves, surfaces and approximation*

- Laureano Gonzalez-Vega (Universidad de Cantabria, Spain)  
*Symbolic methods for CAGD*
  - Pablo Parrilo (ETH Zürich, Switzerland)  
*Optimization and sums of squares*
  - Fabrice Rouillier (INRIA Nancy, France)  
*Efficient real solutions and robotics*
- (Information supplied by Marie-Francoise Roy)

**Note on the reimbursement of travel expenses**

A considerable part of the Network's budget is dedicated to travel expenses. As a rule, only Network researchers can be supported by Network money. Some exceptions are possible, but they must be approved in advance by the Network Coordinator. Considering the extensive meetings program and other traveling activities of Network researchers, it will be impossible to satisfy all requests for reimbursement of travel expenses. The organizers of Network meetings are always encouraged to look for supplementary funding. If and when the Network runs out of travel money, the individual researchers themselves will have to search for other sources of support. The Network does not accept a legal or moral obligation to pay all expenses of all its researchers.

**New preprints and publications**

Marcus Tressl ([Marcus.Tressl@mathematik.uni-regensburg.de](mailto:Marcus.Tressl@mathematik.uni-regensburg.de)) and his deputy Vincent Astier ([Vincent.Astier@mathematik.uni-regensburg.de](mailto:Vincent.Astier@mathematik.uni-regensburg.de)) are responsible for posting preprints and publications on the Network's website. Their preprint server can be reached via a link on the Network's website (<http://www.ihp-raag.org/>), or directly at [http://www.uni-regensburg.de/Fakultaeten/nat\\_Fak\\_I/RAAG/](http://www.uni-regensburg.de/Fakultaeten/nat_Fak_I/RAAG/). All Network researchers are asked to make every new preprint available to them so that it can be added to the website. This is an important part of the intended function of the website as an information center on RAAG.

Here is a list of new preprints and publications by Network researchers:

- Artur Piekosz: Extending analytic  $K$ -subanalytic functions.
- Marcus Tressl: Pseudo Completions and Completion in Stages of o-minimal
- Jean-Marie Lion, Patrick Speissegger: A geometric proof of the definability of Hausdorff limits.

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**Next newsletter**

The next issue of the Newsletter will be published on May 1, 2003.