CENTRE DE RECERCA MATEMÀTICA

REPORT OF ACTIVITIES 2006

PRESENTATION

This Report is a faithful reflection of the scientific activity carried out at the Centre de Recerca Matemàtica over the year 2006, an activity that fully satisfies the proposal passed by the Governing Board, both in terms of its volume and its scientific quality.

In this presentation, however, we would like to highlight five events —three scientific and two organisational— that will have a noticeable effect on the future development of the CRM.

In the scientific area, special mention is made of the following:

• The project *Shaping New Directions in Mathematics for Science and Society* (MATHFSS), a support action passed as part of the European Union's NEST programme, in which four European institutes participate: IHÉS (France), EURANDOM (The Netherlands), ENI (Israel), and CRM, the latter acting as co-ordinator. The aim of this project, which takes place between December 2005 and December 2007, is to foster international collaboration and establish educational mathematical content involving the following research subjects:

- Systems Biology

- Risk Assessment

- Mathematical Neuroscience

- Digital Content Security

• The ongoing consolidation of the CRM as a meeting point for young researchers that are beneficiaries of temporary contracts or post-doctorate scholarships obtained in competitive calls. A total of 20 researchers fulfilling these conditions, from 10 different countries, have performed research studies at the CRM over a considerable number of months during the year 2006. These figures confirm the CRM's capacity as a training centre for young researchers during the post-doctorate period.

• The organisation of a trimester of thematic research on *Fourier Analysis and Geometric Measure Theory*, which was partially undertaken at the Universidad Autónoma de Madrid and at the CRM. Along with the advanced course on *Combinatorial and Computational Geometry: Trends and Topics for the Future*, held in Alcalá de Henares, this is an example of the CRM's desire to collaborate, given its vast experience, with Spanish mathematical research groups.

In terms of aspects not of a strictly scientific nature, there are two that deserve to be mentioned here, after both have been in progress for almost a year:

• The Spanish Ministry of Science and Education's passing of the project *Ingenio Mathematica* within the framework of the *Consolider-Ingenio 2010* programme. The CRM is one of the five promotional nodes of the project with by far the greatest volume of activity, budget and experience in comparison to the others. Undoubtedly, participation in this project will lead to repercussions in terms of an increase in the funding that the CRM receives from the state government.

• The process of selecting a new Director, which began in the month of February and concluded in late November with the designation of Joaquim Bruna as the new Director of CRM from the month of February 2007.

It is my obligation, and I do so with my full sincerity and sentiment, to remember and thank all those people who have helped me to run the Centre de Recerca Matemàtica over all these twenty three years as Director, since the very first moments when the idea was conceived and founded, through the different periods of growth, until the consolidation of its legal structure in the year 2002, the adaptation of adequate premises, the definition of its different activities, etc.

My special recognition goes to Carles Casacuberta and to Jordi Quer, Associate Directors of the CRM in recent years, who have relieved me of a large amount of my work; also to the members of the Scientific Advisory Board, who have used their criteria and prestige to design the types of activity that the CRM has had to carry out at every moment, and the Governing Board, for the support that I have always received from them as Director. But this farewell requires a few delicate words especially addressed to the administrative and technical support staff. I want to thank them not only for the help they have represented for me and the efficiency with which they have done their jobs, but, most of all, for the way they have felt the CRM to be their own and have made every effort and given all their time to ensure that our researchers receive the most exquisite care and that our activities have become a model of organisation. So, thank you.

Manuel Castellet

Director

ÍNDEX

ACRONYMS

AGAUR	Agència de Gestió d'Ajuts Universitaris i de Recerca
CNRS	Centre National de la Recherche Scientifique
CRM	Centre de Recerca Matemàtica
CSIC	Consejo Superior de Investigaciones Científicas
DURSI	Departament d'Universitats, Recerca i Societat de la Informació
EMS	Societat Matemàtica Europea
EPDI	European Post-Doctoral Institute for the Mathematical Sciences
ERCOM	European Research Centres on Mathematics
FFSB	Fundació Ferran Sunyer i Balaguer
ICM	International Congress of Mathematicians
ICREA	Institució Catalana de Recerca i Estudis Avançats
IEC	Institut d'Estudis Catalans
IMA	Institute for Mathematics and its Applications
IMSI	International Mathematical Sciences Institutes
MATHFSS	Mathematics for Science and Society
MEC	Ministerio de Educación y Ciencia
NEST	New and Emerging Science and Technology
SCM	Societat Catalana de Matemàtiques
UAB	Universitat Autònoma de Barcelona
UAH	Universidad de Alcalá
UAM	Universidad Autónoma de Madrid
UB	Universitat de Barcelona
UdC	Universidad de Cantabria
UdG	Universitat de Girona
UE	European Union
UPC	Universitat Politècnica de Catalunya
UPF	Universitat Pompeu Fabra
UPM	Universidad Politécnica de Madrid

1. THE CENTRE DE RECERCA MATEMÀTICA

The Centre de Recerca Matemàtica (CRM) is a Consortium, with its own legal status, integrated by the Institut d'Estudis Catalans and the Catalan Government. The Centre de Recerca Matemàtica is a research institute associated with the Universitat Autònoma de Barcelona.

The CRM is, in essence, a horizontal infrastructure that gives support to all mathematical research groups in Catalonia, and encourages the pursuit of new emerging lines of research.

The CRM has the following goals:

- To consolidate its Research Programmes.
- To attract the best post-doctoral fellows on the basis of the competitive programmes of various administrations and agencies.
- To stimulate the best research programmes of the Catalan researchers.
- To establish mechanisms that guarantee a more efficient service for Catalan mathematicians.
- To enable the CRM to take a new step towards becoming as competitive as the best European research centres and those of the other scientifically developed countries of similar characteristics.

To achieve these goals, the CRM invites outstanding scientists from around the world to do research visits, gives the oportunity to both scientific institutions and young researchers to get in contact with them, carries out research programmes, organises conferences, seminars and other scientific meetings, and spreads the results of research.

The statutes of the CRM provide for the following governing bodies:

- The Governing Board, composed of the Minister of the DURSI, who acts as president, the President of the IEC, three members designated by the Government and three by the IEC.
- The Director, who is appointed by the Governing Board.
- The Scientific Advisory Board, whose members are proposed by the Director and approved by the Governing Board.
- Administrative and technical support:

Centre de Recerca Matemàtica
Apartat 50
E-08193 Bellaterra
Phone: +34-935811081
Fax: +34-935812202
E-mail address: crm@crm.cat
Web: www.crm.cat

Creation, by John Robinson

1.1 THE INSTITUT D'ESTUDIS CATALANS

The Institut d'Estudis Catalans (Institute for Catalan Studies, IEC), founded in 1907, is an academic, scientific and cultural body whose sphere of activities includes all aspects of Catalan language and culture.

The aim of the IEC is to promote scientific research, in particular research related to all aspects of Catalan culture. It contributes to the planning, co-ordination and implementation of research in different fields of science, technology and humanities. Moreover, its own activities further the progress and development of society in general, and, when necessary, acts as an advisor to the government and other institutions.

The IEC is made up of five different sections defined by broad subject units in science, technology and humanities. Each section is formed by a maximum of twenty-eight full members. There are twenty-six societies affiliated to the IEC, with more than 9,000 members. One of them is the Catalan Mathematical Society (SCM).

Web: www.iecat.net

1.2 THE GENERALITAT DE CATALUNYA

The Generalitat de Catalunya is the institution in which the self-government of Catalonia is politically organised through a Parliament and an Autonomous Government. It was created in the thirteenth century, bearing the same name, as an executive body, by the General Courts of the Confederation of the Catalan-Aragonese Crown.

The Generalitat de Catalunya participates in the CRM Consortium by means of the Department competent on research issues.

Web: www.gencat.cat

Members of the Scientific Advisory Board

2. GOVERNING BODY AND SECRETARIAT

2.1 THE GOVERNING BOARD

The CRM is governed by a Governing Board that this year 2006 has consisted of

President:
The Minister of Education and Universities, Joan Manuel del Pozo

Members:
The President of the Institut d'Estudis Catalans, Salvador Giner

The Secretary General of Universities and Research, Joaquim Prats

The Director General of Research, Xavier Testar

The Subdirector General of Research, Josep Maria Vilalta

Salvador Alegret, full member of the Institut d'Estudis Catalans

Joan Girbau, full member of the Institut d'Estudis Catalans

Ricard Guerrero, full member of the Institut d'Estudis Catalans

The Governing Board met three times in 2006. The first meeting was on February 13, and after passing the activity report and settlement of the budget for the year 2005, and the activity project and budget for 2006, the mechanisms were agreed for the selection of a new Director, given that Manuel Castellet had announced to the chairman of the Board, on that date the Minister for Universities, Research and the Information Society, Carles Solà, that it was his desire to be relieved of the post.

The members of the Governing Board designated by the Generalitat de Catalunya had to be renewed in the month of July as a consequence of the changes in the Catalan Government this year.

The other two meetings, on October 19 and November 22, chaired by Joan Manuel del Pozo, Minister for Education and Universities, were dedicated to the selection of a new Director of the CRM from the four candidates that had presented themselves for election. Having analysed the curricula and manifestos of the candidates and the reports made by the expert committee, the Board agreed to name as the new Director of the CRM Joaquim Bruna, professor at the UAB, who will take over his new position during the first quarter of 2007.

2.2 THE DIRECTOR

The Governing Board elects a Director to serve for a period of four years. The current Director is Manuel Castellet, professor at the UAB, who was re-elected for the period 2002-2006 at the July 25, 2002 meeting of the Governing Board, and later, confirmed for the same post until the first trimester of 2007.

2.3 DESIGNATION OF A NEW DIRECTOR

By will of the current Director of the Centre de Recerca Matemàtica, Manuel Castellet, who was its creator in 1984, at the beginning of 2006 the Governing Board of the CRM initiated an open procedure for the selection of a new Director.

Four candidates presented their names following the announcement of the position on April. Two of them were professors at Catalan universities and two were from foreign institutions.

The procedure was delayed by the changes to the Catalan Government and the calling of new parliamentary elections. Finally, after collecting expert reports, the Governing Board, at its meeting of November 22, agreed to name as Director of the CRM for the next four years Joaquim Bruna, professor of Mathematical Analysis at the Universitat Autònoma de Barcelona, who will take over his new position during the first quarter of 2007.

Joaquim Bruna i Floris (Barcelona, 1953) obtained his doctoral degree at the Universitat Autònoma de Barcelona (UAB), where he is currently a professor. He carried out his post-doctorate studies at the Université de Paris Sud, and was a guest professor at the French universities of Provence (Marseille), Paul Sabatier (Toulouse), Bordeaux, and Orléans; and at the North American universities of Madison-Wisconsin and New York at Albany. He has also been involved in research at numerous centres, including the Institute Mittag-Leffler (Sweden), the Norwegian Institute of Technology, and Bar-Ilan University (Israel).

He has authored over sixty research articles. His field of study is real analysis, harmonic and complex analysis, function theory and the mathematical foundations of signal processing. He has supervised seven doctoral theses and is currently supervising two more. He was a member of the program committee of the International Mathematical Union for the International Congress of Mathematicians 2006 (ICM 2006), held last August in Madrid, and a member of the working committee of the *Programa Nacional de Matemáticas.*

He is a member of the SCM since it opened and a member of its scientific committee from 2004. He was director of the IEC's *Fundació Ferran Sunyer i Balaguer* (1996-2000), a member of the executive committee of the European Consortium for Mathematics in Industry, ECMI (2003-2004), and an elected academician at the *Real Acadèmia de Ciències i Arts de Barcelona* from 2004.

2.4   ASSOCIATE DIRECTORS

The Governing Board agreed at its meeting of June 22, 2004, to the Director's proposal, to nominate Carles Casacuberta (UB) and Jordi Quer (UPC) as Associate Directors of the CRM.

Thanks to these appointments, the CRM acquired a Directorate that facilitates the management of the Centre as well as its interrelations with mathematicians working at Catalan universities.

2.5   THE SCIENTIFIC ADVISORY BOARD

The Governing Board, in its meeting of November 2002, nominated the first membership of the Scientific Advisory Board of the CRM. The current list of members is the following: Joan Bagaria, ICREA-UB; Àngel Calsina, UdG; Carles Casacuberta, UB and president of the SCM; Vicent Caselles, UPF; Alberto Facchini, Università degli Studi di Padova; Evarist Giné, University of Connecticut; Joan Girbau, UAB; Antoni Huerta, UPC; Jaume Llibre, UAB; Consuelo Martínez, Universidad de Oviedo; Xavier Massaneda, UB; M. Pilar Muñoz, UPC; Joan Carles Naranjo, UB;

David Nualart, UB; Pere Pascual, UPC and director of the FFSB; Joan Porti, UAB; Jordi Quer, UPC; Oriol Serra, UPC.

In 2006, the CRM's Scientific Advisory Board held three ordinary meetings on April 22, June 26, and December 12, respectively.

Of the issues on the agendas of the three meetings, which were subjected to the Scientific Advisory Board for their consideration and feedback, the following should be highlighted:

- The calling and resolution of the two Research Programmes for the 2007-2008 academic year.

- The creation of three CRM doctorate scholarships in areas of emerging research in Catalonia.

- The role of the CRM in the calling of the Spanish *Consolider-Ingenio 2010* programme.

- The possibility of incorporating permanent or very long term researchers into the CRM.

- The main outline of the new contract programme with the Generalitat de Catalunya.

- The state government's initiative to create an *Instituto Español de Matemáticas*.

2.6   SECRETARIAT

The staff of the CRM is in charge of organising the logistic aspects of the scientific activities and to make sure that the researchers have fruitful and trouble-free visits. The Administration gives support to the Director in all his duties. The members of the staff are:

Mrs. Ana García-Donas
agarcia@crm.cat
Phone: +34-935811081

Mrs. Núria Hernández
nhernandez@crm.cat
Phone: +34-935811081

Mrs. Neus Portet
nportet@crm.cat
Phone: +34-935814086

Mrs. Consol Roca
croca@crm.cat
Phone: +34-935812953

Mrs. Mari Paz Valero
mpvalero@crm.cat
Phone: +34-935811081

The following people have given administrative support to the CRM: Neus Castells, Núria Domènech, Núria García-Donas, Pere Menal, and Patricia Quintero.

General CRM e-mail address:
crm@crm.cat

Carnival 2006

2.7   EXTERNAL SERVICES

In order to make the running of the CRM more flexible without increasing the number of work contracts, three companies offering external services perform the following tasks:

- Economic management and accounting: Consultors Rodao & Associats

- Computer technical service: GetPut Software S.L.

- Support for the data base management programme: Àgil Grup

3. FACILITIES

3.1 PREMISES

The CRM has facilities in the UAB Faculty of Sciences with a total floor space of 1.225 square metres, divided into seven individual offices, six double ones, three triple ones, a secretary's office with five work places, a management office, an office for deputy-management, a storeroom, an auditorium with capacity for one hundred people, a lecture room for twenty-five people, two work and meeting rooms, and a common leisure area which includes computers and network connections for general use. The CRM's old large lecture room (which had places for up to fifty people) has been converted into four double offices for the use of visiting researchers. All the premises have heating and air conditioning.

3.2 COMPUTER EQUIPMENT

The CRM has a LAN Ethernet net of 100 Mbps. There are 48 working stations connected to the net and five printers. All workstations are part of a Windows Domain supplied by a central server (HP Netserver LC10) that at the same time works as a mail server and DNS server of the CRM's own domain (crm.cat). A second server is used as a back-up and as an SQL server (data base for the CRM's manage-

ment software). This LAN net is connected to Internet through the UAB net. Wi-Fi connection is also available.

3.3 LIBRARY

CRM visitors have free access to all the scientific infrastructure of the UAB, consisting of essentially the Science and Engineerings Library, which contains 448 paper journals, 432 electronic journals and 14.415 books devoted to Mathematics. The Library catalog is available online.

Web: www.bib.uab.cat

3.4 HOUSING

The CRM has a few rented furnished apartments for the use of its visitors in Sant Cugat del Vallès (a small town connected by train to the UAB campus and to Barcelona), in Barcelona, and in the *Vila Universitària* of the UAB campus. Most of the apartments consist of a dining room with kitchen, a bathroom, and one bedroom with two single beds. A few of them have two or three bedrooms and are suitable for families.

The rent, including utilities, ranges from 600 to 800 euros per month. Upon request, the apartments may be provided with a telephone connection at the visitors' expenses.

4. CONTRACT PROGRAMME WITH THE CATALAN GOVERNMENT

As part of the relations between the Centre de Recerca Matemàtica and the Catalan Government, a Contract Programme was signed on June 18, 2003 by the Minister for the Department of Universities, Research and the Information Society and the Director of the Centre de Recerca Matemàtica for a period of four years covering the period 2003-2006, and which was extended to the year 2007.

This Contract Programme specifies an annual subsidy that is provided by the DURSI in order to provide the CRM with the necessary means to perform its duties, defines the overall strategic objectives and proposes a set of specific actions. Each of these actions is associated to one or more indicators that make it possible to measure the degree to which the centre complies with its objectives, which are analysed once a year by the Monitoring Commission established by the same Contract Programme. During the year 2006, the Director of the CRM, in agreement with the Directorate Team, and in consideration of the proposals and opinions of the Scientific Advisory Board and the suggestions of the present Contract Programme's Monitoring Commission, has maintained contact between the Minister and other representatives of the area of Universities and Research in order to produce a new Contract Programme that can substitute the present after 2007. Although these meetings have laid the foundations for this new document, given the political climate of recent months in the build-up to the elections and the several changes made to the Catalan Government, it was eventually not possible for the new Contract Programme to be produced and signed. In order to prevent the good operation of the Centre from being affected by this setback, the adopted solution, as in the case of many other partner research centres in the same situation, was to sign an extension of the Contract Programme for the year 2007. This extension covers practically all of the same strategic objectives and actions of the Contract Programme signed in 2003. As for the annual subsidy to be received by the Centre de Recerca Matemàtica from the Generalitat de Catalunya, an increase of 25% has been established with respect to last year.

Specifically, the strategic objectives of the CRM for the year 2007 are as follows:

• To strengthen the best Catalan research teams.

• To organise research activities that can support local researchers and promote the publication of their scientific results at the highest level in order to be competitive in the international arena.

• To promote research in Catalonia in innovative areas.

• To consolidate the CRM as one of the most active research institutes in Europe.

• To produce a Strategic and Functional Plan for the next few years.

4.1 MEETING OF THE MONITO-RING COMMISSION OF THE CONTRACT PROGRAMME

On July 12, the Monitoring Commission of the Contract Programme met to evaluate the degree to which the objectives and commitments assumed by the CRM under terms of the Contract Programme have been accomplished, and also to propose any measures considered necessary to guarantee this compliance in the future. At this year's meeting the Generalitat was represented by the Subdirector General of Research, Josep Maria Vilalta, and the Head of the Research Structures Service, Iolanda Font de Rubinat; and the CRM was represented by the two Associate Directors, Carles Casacuberta and Jordi Quer. Also present as guests were the Director of the CRM, Manuel Castellet, and a Research Structures Service expert, Imma Nadal.

The meeting analysed the indicators established by the Contract Programme in reference to CRM activity during the year 2005. Based on the data presented in the report for the year 2005, complemented by additional information supplied by the Centre, the commission was able to state that the Contract Programme had been complied with, and in some cases had been considerably surpassed. The commission evaluated the activity of the centre in 2005 very highly and saw no need to propose any specific changes that could improve its activity in the future.

ACTIVITIES IN 2006

5. VISITING RESEARCHERS

5.1   LIST OF VISITORS

O. Penacchio   Topology, 01.10.2003 - 09.02.2006
                        Galatasaray Üniversiti Istanbul

S. Tikhonov   Harmonic Analysis, 01.09.2004 - 31.12.2006
                        University of Alberta

C. Lecuire   Geometry, 01.01.2005 - 30.09.2006
                        Université Paul Sabatier

D. Pasca   Dynamical Systems, 01.03.2005 - 31.08.2006
                       CUNY, Hunter College

J. Wildeshaus   Algebraic Geometry, 01.09.2005 - 31.07.2006
                       Université de Paris XIII

B. Deroin   Differential Geometry, 01.09.2005 - 31.08.2006
                       Centre National de la Recherche Scientifique

A. Yaman   Algebra, 01.09.2005 - 30.11.2008
                       Centre de Recerca Matemàtica

A. Gasull   Dynamical Systems, 15.09.2005 - 28.02.2006
                       Universitat Autònoma de Barcelona

J. I. Burgos   Algebraic Geometry, 19.09.2005 - 31.07.2006
                       Universitat de Barcelona

J. Yu   Dynamical Systems, 26.09.2005 - 26.03.2007
                       Shangai Jiaotong University

F-A. Buica   Dynamical Systems, 01.10.2005 - 31.07.2006
                       Babes-Bolyai University

J. Yang   Dynamical Systems, 24.10.2005 - 16.03.2006
                       Peking University

H. Wu   Dynamical Systems, 30.10.2005 - 19.08.2006
                       Southeast University, P. R. China

D. U. Lee   Algebraic Geometry, 01.11.2005 - 31.07.2006
                       Korea Institute for Advanced Science

A. Tarta   Dynamical Systems,
                       15.11.2005 - 31.08.2006, 11.11.2006 - 15.01.2007
                       Babes-Bolyai University

Y. Ding   Dynamical Systems, 26.11.2005 - 30.10.2006
                       Wuhan Institute of Physics and Mathematics

J. Parcet   Analysis, 01.12.2005 - 30.09.2006
                       CSIC, Madrid

R. Litcanu	Number Theory, 04.01.2006 - 31.07.2006 Universitatea Alexandru Ioan Cuza
T. Goudon	Differential Equations, 09.01.2006 - 24.02.2006 Université de Lille 1
S. Friedman	Logic and Foundations, 09.01.2006 - 28.02.2006, 01.09.2006 - 30.09.2006 Universität Wien
F. Lemma	Algebraic Geometry, 09.01.2006 - 09.03.2006 Université de Paris XIII
A. Brooke-Taylor	Logic and Foundations, 11.01.2006 - 18.01.2006 Universität Wien
A. Poltoratski	Complex Analysis, 12.01.2006 - 12.04.2006 Texas A&M University
L. Peng	Differential Equations, 16.01.2006 - 08.04.2006 Beihang University
A. del Río	Algebra, 22.01.2006 - 04.02.2006 Universidad de Murcia
P. Lafitte-Godillon	Applied Mathematics, 22.01.2006 - 04.02.2006 Université de Lille 1
E. Jespers	Algebra, 23.01.2006 - 05.02.2006 Vrije Universiteit Brussel
K. Thompson	Logic and Foundations, 26.01.2006 - 03.02.2006 Universität Wien
V. Maillot	Algebraic Geometry, 26.01.2006 - 28.02.2006 Université de Paris VI
J. Villadelprat	Differential Equations, 01.02.2006 - 15.07.2006 Universitat Rovira i Virgili
A. Guillamon	Applied Mathematics, 01.02.2006 - 31.07.2006 Universitat Politècnica de Catalunya
J. T. Lázaro	Dynamical Systems, 01.02.2006 - 31.07.2006 Universitat Politècnica de Catalunya
C. Li	Dynamical Systems, 02.02.2006 - 31.07.2006 Peking University
H. Zoladek	Dynamical Systems, 05.02.2006 - 17.02.2006 Uniwersytet Warszawski
S. Fuchino	Logic and Foundations, 09.02.2006 - 07.03.2006 Chubu University
K. Köhler	Geometry, 12.02.2006 - 10.03.2006, 02.07.2006 - 16.07.2006 Universität Düsseldorf

P. Mardesic	Algebra, 14.02.2006 - 25.02.2006, 17.04.2006 - 01.05.2006 Université de Bourgogne
M. Sombra	Algebra, 15.02.2006 - 15.07.2006 Universitat de Barcelona
K. Künnemann	Algebra, 17.02.2006 - 15.04.2006 Universität Regensburg
H. Darmon	Number Theory, 19.02.2006 - 26.02.2006 McGill University
C. Mourougane	Complex Analysis, 19.02.2006 - 04.03.2006 Université de Paris VI
W. Gubler	Number Theory, 19.02.2006 - 24.03.2006 Universität Dortmund
C.-L. Chai	Algebraic Geometry, 20.02.2006 - 25.02.2006 Pennsylvania State University
D. Rössler	Algebraic Geometry, 20.02.2006 - 25.02.2006 Université de Paris VII
M. Scharlemann	Topology, 28.02.2006 - 01.04.2006 University of California at Los Angeles
S. Walcher	Dynamical Systems, 01.03.2006 - 31.03.2006 RWTH Aachen
J. Llibre	Dynamical Systems, 01.03.2006 - 31.07.2006 Universitat Autònoma de Barcelona
J. Kramer	Number Theory, 07.03.2006 - 22.04.2006 Humboldt Universität zu Berlin
V. Gonchenko	Dynamical Systems, 10.03.2006 - 04.04.2006 Nizhny Novgorod State Technical University
Z. Ditzian	Analysis, 21.03.2006 - 30.03.2006 University of Alberta
Y. Takeda	Algebra, 22.03.2006 - 15.07.2006 Kyushu University
M. J. Bridgeman	Geometry, 01.04.2006 - 31.05.2006 Boston College
D. Rössler	Algebraic Geometry, 03.04.2006 - 07.04.2006 Université de Paris VII
E. H. Essaky	Probability and Statistics, 08.04.2006 - 30.09.2006 Université Cadi Ayyad
T. Hahn	Algebraic Geometry, 13.04.2006 - 22.04.2006 Humboldt Universität zu Berlin

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J. Garnett	Analysis, 15.04.2006 - 14.07.2006 University of California at Los Angeles
L. Vega	Analysis, 17.04.2006 - 21.04.2006 Universidad del País Vasco
J. Bennett	Harmonic Analysis, 17.04.2006 - 29.04.2006 University of Birmingham
P. Schapira	Algebraic Geometry, 18.04.2006 - 25.04.2006 Université de Paris VI
A. Volberg	Analysis, 18.04.2006 - 14.05.2006 Michigan State University
S. Tindel	Probability and Statistics, 18.04.2006 - 18.05.2006 Université Henri Poincaré Nancy 1
C. Gasbarri	Algebraic Geometry, 18.04.2006 - 27.05.2006 Università di Roma "Tor Vergata"
B. Coll	Applied Mathematics, 19.04.2006 - 13.05.2006 Universitat de les Illes Balears
R. Prohens	Dynamical Systems, 19.04.2006 - 14.05.2006 Universitat de les Illes Balears
A. Vargas	Analysis, 20.04.2006 - 10.06.2006, 26.06.2006 - 15.07.2006 Universidad Autónoma de Madrid
A. Ruiz	Analysis, 20.04.2006 - 10.06.2006, 03.07.2006 - 09.07.2006 Universidad Autónoma de Madrid
K. Astala	Analysis, 20.04.2006 - 11.06.2006 University of Helsinki
J. M. Martell	Analysis, 20.04.2006 - 16.06.2006 Universidad Autónoma de Madrid
J. Mateu	Analysis, 24.04.2006 - 28.04.2006, 01.06.2006 - 15.07.2006 Universitat Autònoma de Barcelona
C. Pérez	Harmonic Analysis, 24.04.2006 - 30.04.2006 Universidad de Sevilla
J. Verdera	Analysis, 24.04.2006 - 11.05.2006; 01.06.2006 - 15.07.2006 Universitat Autònoma de Barcelona
S. Treil	Analysis, 28.04.2006 - 13.07.2006 Brown University
J. Orobitg	Analysis, 02.05.2006 - 04.05.2006, 01.06.2006 - 15.07.2006 Universitat Autònoma de Barcelona
J. P. Milisic	Differential Equations, 02.05.2006 - 05.05.2006 Universität Johannes Gutenberg
C. Simeoni	Differential Equations, 02.05.2006 - 28.05.2006 Université de Nice – Sophia Antipolis

W. Li	Dynamical Systems, 04.05.2006 - 19.07.2006 Peking University
D.-C. Cisinski	Algebraic Geometry, 07.05.2006 - 13.05.2006 Université de Paris XIII
R. Brown	Differential Equations, 07.05.2006 - 21.05.2006 University of Kentucky
X. Tolsa	Analysis, 08.05.2006 - 12.05.2006, 01.06.2006 - 15.07.2006 Universitat Autònoma de Barcelona
D. J. Wright	Number Theory, 10.05.2006 - 01.06.2006 Oklahoma State University
P. Auscher	Analysis, 14.05.2006 - 28.05.2006 Université de Paris XI
L. Grafakos	Harmonic Analysis, 14.05.2006 - 07.06.2006 University of Missouri-Columbia
D. Shafer	Dynamical Systems, 15.05.2006 - 15.06.2006 University of North Carolina at Charlotte
M. Ferrante	Probability and Statistics, 16.05.2006 - 16.08.2006 Università degli Studi di Padova
S. Hofmann	Harmonic Analysis, 17.05.2006 - 27.05.2006 University of Missouri-Columbia
J. Li	Differential Equations, 18.05.2006 - 13.08.2006 China Agricultural University
S. Kurylev	Analysis, 20.05.2006 - 01.06.2006 Loughborough University
C. Christopher	Differential Equations, 29.05.2006 - 08.07.2006 University of Plymouth
P. Mattila	Analysis, 31.05.2006 - 10.06.2006 University of Helsinki
M. J. González	Analysis, 05.06.2006 - 09.06.2006 Universidad de Cádiz
S. Kawaguchi	Algebraic Geometry, 05.06.2006 - 16.07.2006 Kyoto University
D. Faraco	Analysis, 06.06.2006 - 09.06.2006 Universidad Autónoma de Madrid
H. Giacomini	Dynamical Systems, 06.06.2006 - 25.06.2006 Université de Tours
T. Carbery	Analysis, 06.06.2006 - 30.06.2006 University of Edinburgh
P. Koskela	Analysis, 08.06.2006 - 15.06.2006 Jyväskylä Universitet

D. Schlomiuk	Dynamical Systems, 08.06.2006 - 12.07.2006 Université de Montréal
D. Blottiere	Algebraic Geometry, 13.06.2006 - 30.06.2006 Université de Paris XIII
M. Csornyei	Analysis, 16.06.2006 - 30.06.2006 University College London
G. Dafni	Analysis, 16.06.2006 - 16.07.2006 Concordia University
H. Darmon	Number Theory, 16.06.2006 - 16.07.2006 McGill University
X. Ma	Differential Geometry, 17.06.2006 - 15.07.2006 École Polytechnique, Palaiseau
R. Schul	Analysis, 19.06.2006 - 08.07.2006 University of California at Los Angeles
E. Nursultanov	Harmonic Analysis, 24.06.2006 - 10.07.2006 Lomonosov Moscow State University
M. A. Alfonseca	Analysis, 26.06.2006 - 30.06.2006 Kansas State University
J. Giné	Dynamical Systems, 26.06.2006 - 08.07.2006 Universitat de Lleida
H. Pajot	Analysis, 27.06.2006 - 02.07.2006 Université de Grenoble 1
I. Uriarte	Analysis, 29.06.2006 - 20.07.2006 University of Helsinki
G. David	Harmonic Analysis, 02.07.2006 - 13.07.2006 Université de Paris Sud
S. Lee	Harmonic Analysis, 02.07.2006 - 15.07.2006 Seoul National University
B. C. Ngo	Algebraic Geometry, 09.07.2006 - 16.07.2006 Université de Paris XI
O. Makarenkov	Differential Equations, 12.07.2006 - 02.08.2006 Voronezh State University
L. H. El Fadil	Algebra, 16.07.2006 - 23.07.2006 University of Fez
F. Otto	Differential Equations, 24.07.2006 - 29.07.2006 Universität Bonn
S. Radomirovic	Number Theory, 31.08.2006 - 31.12.2007 Norwegian University of Science and Technology
J. Tan	Differential Equations, 31.08.2006 - 28.02.2008 Centre de Recerca Matemàtica

D. Herbera   Algebra, 01.09.2006 - 15.02.2007
                        Universitat Autònoma de Barcelona

A. Blanchet   Differential Equations, 01.09.2006 - 31.05.2007
                        Centre de Recerca Matemàtica

M. Noy   Discrete Mathematics, 01.09.2006 - 31.07.2007
                        Universitat Politècnica de Catalunya

D. Welsh   Discrete Mathematics, 01.09.2006 - 31.07.2007
                        University of Oxford

L. Ciobanu   Algebra, 01.09.2006 - 31.12.2007
                        Centre de Recerca Matemàtica

J. Dubois   Geometry, 01.09.2006 - 31.08.2008
                        Centre de Recerca Matemàtica

B. Fine   Algebra, 05.09.2006 - 10.09.2006
                        Fairfield University

A. Duncan   Algebra, 05.09.2006 - 22.09.2006
                        Newcastle University

E. Ventura   Algebra, 05.09.2006 - 31.10.2006
                        Universitat Politècnica de Catalunya

A. Miasnikov   Algebra, 05.09.2006 - 05.11.2006
                        McGill University

S. Cleary   Algebra, 06.09.2006 - 30.10.2006
                        The City College of New York

K. St. John   Discrete Mathematics, 06.09.2006 - 30.10.2006
                        Lehman College

L. Angeleri   Algebra, 12.09.2006 - 24.09.2006
                        Università degli Studi dell'Insubria

J. Trlifaj   Algebra, 12.09.2006 - 07.10.2006
                        Univerzita Karlova

O. Bernardi   Discrete Mathematics, 12.09.2006 - 31.07.2007
                        Centre de Recerca Matemàtica

S. Bazzoni   Algebra, 15.09.2006 - 28.02.2007
                        Università degli Studi di Padova

C. Busch   Algebraic Topology, 17.09.2006 - 27.09.2006
                        Katholische Universität Eichstätt-Ingolstadt

C. McDiarmid   Discrete Mathematics, 17.09.2006 - 30.09.2006
                        University of Oxford

A. Steger   Discrete Mathematics, 18.09.2006 - 29.09.2006
                        ETH Zürich

J. Kung   Discrete Mathematics, 18.09.2006 - 06.11.2006
                        University of North Texas

P. Prihoda	Algebra, 18.09.2006 - 17.09.2007 Centre de Recerca Matemàtica
R. Gilman	Algebra, 20.09.2006 - 09.10.2006 Stevens Institute of Technology
J. Stovicek	Algebra, 21.09.2006 - 30.09.2006 Norwegian University of Science and Technology
P. Eklof	Algebra, 23.09.2006 - 08.10.2006 University of California at Irvine
V. Diekert	Algebra, 24.09.2006 - 10.10.2006 Universität Stuttgart
S. Felsner	Discrete Mathematics, 24.09.2006 - 17.10.2006 Technische Universität Berlin
P. A. Guil	Algebra, 01.10.2006 - 13.12.2006 Universidad de Murcia
S. Elizalde	Discrete Mathematics, 01.10.2006 - 30.09.2008 Centre de Recerca Matemàtica
D. Orden	Discrete Mathematics, 02.10.2006 - 16.10.2006 Universidad de Alcalá
A. Cárceles	Algebra, 02.10.2006 - 02.12.2006 Universidad de Murcia
G. Aranda	Algebra, 11.10.2006 - 31.08.2007 Centre de Recerca Matemàtica
P. Laurençot	Applied Mathematics, 16.10.2006 - 20.10.2006 Université Paul Sabatier
H. Reich	Algebraic Topology, 23.10.2006 - 15.12.2006 Universität Münster
P. Weil	Discrete Mathematics, 28.10.2006 - 04.11.2006 Université de Bordeaux 1
S. Estrada	Algebra, 30.10.2006 - 10.11.2006 Universidad de Murcia
C. Semple	Discrete Mathematics, 19.11.2006 - 01.12.2006 University of Canterbury
B. Huisgen-Zimmermann	Algebra, 30.11.2006 - 09.12.2006 University of California at Santa Barbara

Visitor person–months
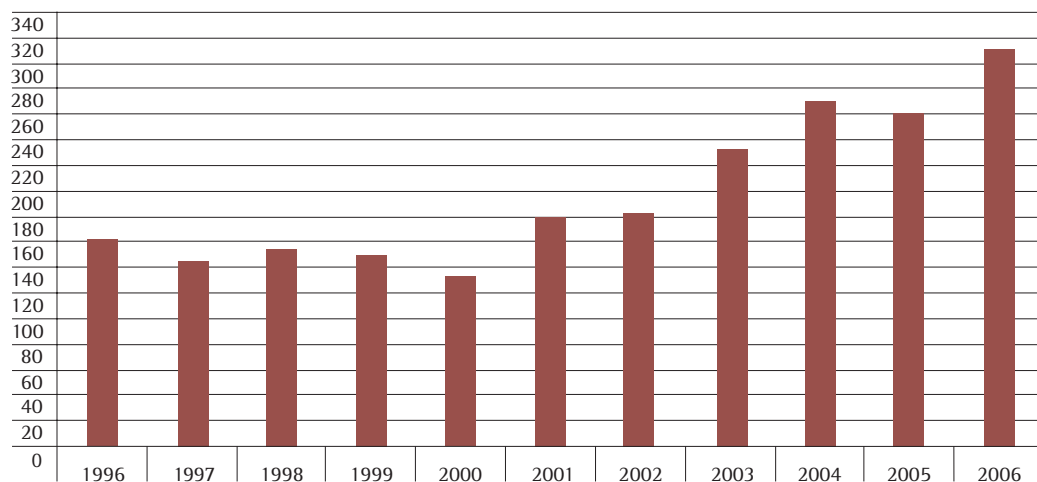
5.2   POST–DOCTORAL FELLOWS

Among the researchers who visited the CRM during 2006, we would like to highlight the presence of 19 post-doctorate laureates that stayed longer than nine months, and who have contributed, one more year, to reaffir-

ming one of the foundational aims of the CRM: to facilitate research done by young researchers and the contact between these and senior scientists. The list of fellows is the following:

Olivier Penacchio	01.10.2003 – 09.02.2006
Cyril Lecuire	01.01.2005 – 30.09.2006
Daniel Pasca	01.03.2005 – 31.08.2006
El Hassan Essaky	01.05.2005 – 30.09.2006
Asli Yaman	29.08.2005 – 30.11.2008
Sergey Tikhonov	01.09.2005 – 31.12.2006
Jiang Yu	26.09.2005 – 26.03.2007
Florina-Adriana Buica	01.10.2005 – 31.07.2006
Hao Wu	30.10.2005 – 19.08.2006
Dong Uk Lee	01.11.2005 – 31.07.2006
Yiming Ding	26.11.2005 – 30.10.2006
Adrien Blanchet	01.09.2006 – 31.05.2007
Olivier Bernardi	01.09.2006 – 31.07.2007
Laura Ciobanu	01.09.2006 – 31.12.2007
Sasa Radomirovic	01.09.2006 – 31.12.2007
Pavel Prihoda	01.09.2006 – 28.02.2008
Jérôme Dubois	01.09.2006 – 31.08.2008
Gonzalo Aranda	01.10.2006 – 31.08.2007
Sergi Elizalde	01.10.2006 – 30.09.2008

5.3   THE RAMÓN Y CAJAL PROGRAMME

The Spanish Government's Ramón y Cajal Programme makes it possible to contract, for a period of five years, young researchers that have completed the first stage of their post-doctorate studies.

Doctor Javier Parcet, of the Universidad Autónoma de Madrid, worked at the CRM as a Ramón y Cajal researcher for the period from December 2005 to September 2006, when he asked for his contract to be transferred to the Consejo Superior de Investigaciones Científicas, in Madrid. Javier Parcet was awarded this year with the José Luis Rubio de Francia Prize.

5.4   BEATRIU DE PINÓS CONTRACTS

The Generalitat de Catalunya's Beatriu de Pinós programme, which was presented for the first time this year, provides aid for the employment contracts of doctors of any nationality in any area of knowledge for a period of two years.

The first Beatriu de Pinós contract to be signed by the CRM was with Sergi Elizalde, a researcher on Discrete Mathematics, with a PhD from the Universitat Politècinica de Catalunya, who did his post-doctoral studies at the University of Massachusetts Dartmouth, and who joined the CRM on October 1, 2006.

6. SCIENTIFIC ACTIVITIES

▌6.1   RESEARCH PROGRAMMES

6.1.1   STRUCTURE

On November 22, 2002, the CRM Governing Board passed a resolution consisting on a quadrennial strategic plan that includes two Research Programmes per year, together with other complementary activities.

Goal

To foster, during a year, the work of two outstanding research groups from Catalan institutions, by hosting visitors and post-doctoral fellows.

Scientific research staff

• One full time local researcher; eventually, two one semester each.

• One full time visiting researcher; eventually, two one semester each.

• Two post-doctoral fellows.

• Twenty-four months of visiting researchers for periods of one to three months.

• Other local or visiting researchers.

Activities

• Research.

• Seminars.

• A conference or workshop.

• An advanced intensive course at a doctoral or recent post-doctoral level.

The annual Research Programmes started in the academic year 2003-2004. An open call is made public at least a year and a half before the expected start of the programme. Each programme has to be approved by the CRM Governing Board, at the proposal of the Director, who is counselled by the Scientific Advisory Board, which evaluates the applications received.

6.1.2   RESEARCH PROGRAMME ON HILBERT'S 16TH PROBLEM

Period

From September 1, 2005 to July 31, 2006

Scientists in charge

Local   Armengol Gasull (UAB)

Jaume Llibre (UAB)

Visiting   Chengzhi Li (Peking University)

Jiazhong Yang (Peking University)

Main research topic

Polynomial vector fields, limit cycles, centres and algebraic solutions

Other research topics

• Abelian integrals

• Centre-focus problem

• Hilbert's 16th Problem, strong and weak version

Visiting researchers

Florina-Adriana Buica
Babes-Bolyai University

Colin Christopher
University of Plymouth

Bartomeu Coll
Universitat de les Illes Balears

Jean-Pierre Françoise
Université de Paris VI

Armengol Gasull
Universitat Autònoma de Barcelona

Hector Giacomini
Université de Tours

Jaume Giné
Universitat de Lleida

Vladimir S. Gonchenko
Res. Inst. for Applied Mathematics and Cybernetics

Antoni Guillamon
Universitat Politècnica de Catalunya

Iliya Dimov Iliev
Bulgarian Academy of Science

Víctor Jiménez
Universidad de Murcia

José Tomás Lázaro
Universitat Politècnica de Catalunya

Chengzhi Li
Peking University

Jinming Li
China Agricultural University

Weigu Li
Peking University

Jaume Llibre
Universitat Autònoma de Barcelona

Oleg Makarenkov
Voronezh State University

Pavao Mardesic
Université de Bourgogne

Daniel Pasca
CUNY, Hunter College

Linping Peng
Beihang University

Violetta Pilyugina
St. Petersburg State University

Rafael Prohens
Universitat de les Illes Balears

Dana Schlomiuk
Université de Montréal

Douglas Shafer
University of North Carolina at Charlotte

Gregorz Swirszcz
IBM T. J. Watson Research Center

Alexandrina-Alina Tarta
Babes-Bolyai University

Clàudia Valls
Universitat de Barcelona

Jordi Villadelprat
Universitat Rovira i Virgili

Sebastian Walcher
RWTH Aachen

Hao Wu
Southeast University, China

Jiazhong Yang
Peking University

Jiang Yu
Shangai Jiaotong University

Zhifen Zhang
Peking University

Henryk Zoladek
Uniwersytet Warszawski

Activities

Seminar

A weekly seminar on Hilbert's 16th Problem, co-ordinated by Armengol Gasull and Jaume Llibre.

Conference

Barcelona Conference in Planar Vector Fields, from February 13 to 17, 2006, co-ordinated by Armengol Gasull and Jaume Llibre.

Advanced course

Advanced Course on Limit Cycles of Differential Equations, from June 26 to July 8, 2006, co-ordinated by Armengol Gasull and Jaume Llibre.

Final report

The research programme into Hilbert's 16th Problem was held during the 2005-2006 academic year at the Centre de Recerca Matemática, co-ordinated by professors Armengol Gasull and Jaume Llibre of the Univer-

sitat Autònoma de Barcelona, and by professors Chengzhi Li and Jiazhong Yang of Peking University. The main body of this programme consisted of the visits of 34 foreign researchers who, throughout the whole academic year, stayed for different periods of time at the CRM for specific research objectives in the field of the qualitative theory of differential equations. Midway through the year, from February 13 to 17, the *Barcelona Conference in Planar Vector Fields* was held, and at the end of the year, from June 26 to July 8, the A*dvanced Course on Limit Cycles of Differential Equations* was held. The scientific evaluation of the programme was excellent. The organisers enjoyed the visits of some first rate researchers on a world scale, who brought their expertise to Catalonia and helped develop their lines of research within the Catalan and Spanish mathematical community. Holding the programme in Barcelona has provided a new impetus for our country in the field of the qualitative theory of differential equations.

Among the core activities of the programme were the weekly seminar debate sessions. Two of these seminars were held every week for the whole year, which constituted one of the main events in the weekly schedule. Many of the informal conversations between visitors that went on in the corridors after the debates were largely inspired by the we-

ekly talks. To enjoy the presence of enough experts to maintain such a steady flow of debates was one of the biggest successes of a programme that was able to expose the participants to some of the most recent and cutting-edge subjects in the field. The level of the debates was extremely high. The biggest number of visitors came in February 2006. But, apart from the seminar conferences and the numerous and beneficial informal conversations, the real research work took place in the offices, where several collaborations came into being, both between visitors and local researchers and between visitors and each other.

Overall, both the volume and the quality of the research done as part of the programme were considerably high. This was reflected by the number of contributions to the CRM preprint collection that were directly or indirectly generated by this programme (a total of 28 articles were collected). All of these are in the process of being published in international journals. So, globally, the development of this research programme was evaluated in a very positive way, both on an objective level and in terms of the results obtained indirectly, in reference to the magnificent image that it has helped present of our country and of the local community working on the qualitative theory of differential equations.

Name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
D. Pasca	X	X	X	X	X	X	X	X	X	X	X
J. Llibre		X	X	X	X	X	X	X	X	X	X
A. Gasull		X	X	X	X	X	X	X	X	X	X
Z. Zhang		X	X	X	X	X					
J. Yu		X	X	X	X	X	X	X	X	X	X
A. Buica		X	X	X	X	X	X	X	X	X	X
C. Valls			X								
V. Jiménez			X	X							
V. Pilyugina			X	X							
J. P. François			X	X							
J. Yang			X	X	X	X	X				
H. Wu			X	X	X	X	X	X	X	X	X
G. Swirszcz			X	X							
I. Iliev				X	X						
A. Tarta			X	X	X	X	X	X	X	X	X
L. Peng					X	X	X	X	X	X	
J. Villadelprat						X	X	X	X	X	X
T. Lázaro						X	X	X	X	X	X
A. Guillamon						X	X	X	X	X	X
H. Zoladek						X					
C. Li						X	X	X	X	X	X
P. Mardesic							X	X			
S. Walcher							X	X			
V. Gonchenko							X	X			
R. Prohens								X	X		
B. Coll								X	X		
W. Li									X	X	X
J. Li									X	X	X
D. Shafer										X	
C. Christopher										X	X
D. Schlomiuk										X	X
H. Giacomini											X
J. Giné											X
O. Makarenkov											X

6.1.3 RESEARCH PROGRAMME ON ARAKELOV GEOMETRY AND SHIMURA VARIETIES

Period

From September 1, 2005 to July 31, 2006

Scientists in charge

Local   José Ignacio Burgos (UB)

Visiting   Jörg Wildeshaus (Université de Paris XIII)

Main research topic

Arakelov geometry and Shimura varieties

Altres temes de recerca

- Modular forms and values of L-functions
- Arithmetic Riemann-Roch Theorem
- Integral models of Shimura varieties
- Theory of motives
- Intersection theory on algebraic stacks

Visiting researchers

David Blottière
Université de Paris XIII

José Ignacio Burgos
Universitat de Barcelona

Ching-Li Chai
Pennsylvania State University

Denis-Charles Cisinski
Université de Paris XIII

Henri Darmon
McGill University

L. Houssain El Fadil
University of Fez

Jens Funke
New Mexico State University

Carlo Gasbarri
Università di Roma "Tor Vergata"

Henri Gillet
University of Illinois at Chicago

Walter Gubler
Universität Dortmund

Tobias Hahn
Humboldt Universität zu Berlin

Shu Kawaguchi
Kyoto University

Kai Köhler
Universitat Düsseldorf

Jürg Kramer
Humboldt Universität zu Berlin

Ulf Kühn
Humboldt Universität zu Berlin

Klaus Künnemann
Universität Regensburg

Dong Uk Lee
Korea Institute for Advanced Science

Francesco Lemma
Université de Paris XIII

Razvan Litcanu
Universitatea Al. I. Cuza

Xiaonan Ma
École Polytechnique, Palaiseau

Vincent Maillot
Université de Paris VI

Heinrich Massold
ETH Zürich

Christophe Mourougane
Université de Paris VI

Bao Chau Ngo
Université de Paris XI

Marc-Hubert Nicole
University of Tokyo

Damian Rössler
Université de Paris VII

Pierre Schapira
Université de Paris VI

Martín Sombra
Universitat de Barcelona

Christophe Soulé
Institut des Hautes Études Scientifiques

Yuichiro Takeda
Kyushu University

Jörg Wildeshaus
Université de Paris XIII

Activities

Seminar

A weekly seminar on Arakelov Geometry and Shimura Varieties, co-ordinated by José Ignacio Burgos and Jörg Wildeshaus.

Introductory course

Introduction to Shimura Varieties, from September 20 to 23, 2005, given by Víctor Rotger (UPC).

Advanced course

Advanced Course on Arakelov Geometry and Shimura Varieties, from February 20 to 25, 2006, co-ordinated by José Ignacio Burgos and Jörg Wildeshaus.

Conference

Recent Developments in the Arithmetic of Shimura Varieties and Arakelov Geometry, from July 10 to 15, 2006, co-ordinated by José Ignacio Burgos. This conference was an *EMS Conference* financed by the European Commission.

Final report

The Arakelov Geometry and Shimura Varieties research programme was held during the 2005-2006 academic year, co-ordinated by professors José Ignacio Burgos, of the Universitat de Barcelona, and Jörg Wildeshaus, of the Université de Paris XIII. The main body of this programme consisted of the visits of 30 foreign researchers who, distributed over the length of the course, stayed at the CRM for different periods, making a total of 75 months.

The program began with an intensive *Introduction to Shimura Varieties* course given by Víctor Rotger, of the Universitat Politècnica de Catalunya, from September 20 to 23, 2005, and which was continued throughout the academic year by a weekly semester on the specific material of the programme, in which local and visiting researchers presented the most recent results in the field. For much of the course, the *Four functors formalism working group* was active, enabling participants to be introduced to Joseph Ayoub's doctoral thesis on the construction of the six Grothendieck functors in motivic cohomology. The *Advanced Course on Arakelov Geometry and Shimura Varieties*, in February 2006, with 18 classes and parallel activities, and the Recent *Developments on the Arithmetic of Shimura Varieties and Arakelov Geometry* congress, in July 2006, were the moments of greatest academic intensity.

Arakelov theory studies the geometry and arithmetic of sets of solutions for polynomial equations with integral coefficients. More precisely, it studies smooth schemes of finite type defined over rings of integers in a number field.

A central theorem in Arakelov theory is the Arithmetic Riemann-Roch Theorem. It was proved by Faltings in the case of arithmetic surfaces and generalised to higher dimensions by Gillet and Soulé, participants in the research programme, using Quillen and Deligne's ideas and Bismut and Lebeau's in-depth results of global analysis. Two of the researchers on the programme, Köhler and Roessler, have proved the equivariant version of the theorem, i.e., the arithmetic Lefschetz fixed-point theorem.

Shimura varieties are obtained as quotients of a symmetric hermitian domain by an arithmetic group, and their geometry is very rich, owing to the great number of their special subvarieties. They include moduli spaces of abelian varieties with additional structure, modular and Shimura curves, Hilbert's modular surfaces, and Siegel's modular solids.

Specialists consider that the progress made in the study of the arithmetical proper-

ties of Shimura varieties suggest that this area will prove itself fundamental in future research into arithmetic geometry, as shown by the advances made in the Langlands programme.

During the course, intense work was performed in relation to the aforementioned issues and questions, as well as on the most recent developments in the theory of motives and, in particular, the construction of the six Grothendieck functors in motivic cohomology. Professors Gillet and Soulé gave conferences on motivic cohomology and Diophantine approximation both in the seminar and the congress.

Name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
J. Wildeshaus	X	X	X	X	X	X	X	X	X	X	X
J. Funke	X	X	X	X							
J. I. Burgos	X	X	X	X	X	X	X	X	X	X	X
H. Gillet		X	X								
U. Kühn		X									
J. Kramer		X					X	X			
F. Künnemann						X	X	X			
H. Massold		X	X								
M. H. Nicole		X	X								
D. U. Lee			X	X	X	X	X	X	X	X	X
C. Soulé			X								
R. Litcanu					X	X	X	X	X	X	X
F. Lemma					X	X	X				
V. Maillot						X					
M. Sombra						X	X	X	X	X	
K. Köhler						X	X			X	
W. Gubler						X	X	X			
C. L. Chai						X					
H. Darmon										X	X
D. Roessler						X					
Ch. Mourougane											
Y. Takeda							X	X	X	X	
T. Hahn								X			
C. Gasbarri								X	X		
P. Schapira								X			
B. Gross									X	X	
D. C. Cisinski									X		
S. Kawaguchi										X	X
X. Ma										X	
D. Blottière										X	X
B. C. Ngo											X

6.1.4 RESEARCH PROGRAMME ON DISCRETE AND CONTINUOUS METHODS ON RING THEORY

Period

From September 1, 2006 to July 31, 2007

Scientists in charge

Local   Dolors Herbera (UAB)

Visitant Silvana Bazzoni
(Università degli Studi di Padova)

Main research topic

From finite dimensional algebras and abelian groups to C*-algebra and exchange rings

Other research topics

• Cotorsion pairs or pairs of categories of modules that are orthogonal with respect to the Ext functor

• Decomposition theory for modules as direct sums of submodules

• Structure of algebras of finitely presented monoids and study of finite groups appearing in relation to the Yang-Baxter equation

• Algebraic K- theory; classification of C^*-algebras

Visiting researchers

Lidia Angeleri
Università degli Studi dell'Insubria

Gonzalo Aranda
Centre de Recerca Matemàtica

Silvana Bazzoni
Università degli Studi di Padova

Ana Isabel Cárceles
Universidad de Murcia

Ángel del Río
Universidad de Murcia

Paul Eklof
University of California at Irvine

George Elliott
University of Toronto

Sergio Estrada
Universidad de Murcia

Kenneth Goodearl
University of California at Los Angeles

Pedro Antonio Guil
Universidad de Murcia

Dolors Herbera
Universitat Autònoma de Barcelona

Ivo Herzog
Ohio State University at Lima

Birge Huisgen-Zimmermann
University of California at Los Angeles

Eric Jespers
Vrije Universiteit Brussel

Dan Kucerovsky
University of New Brunswick

Martin Mathieu
Queen's University of Belfast

Jan Okninski
Uniwersytet Warszawski

Enrique Pardo
Universidad de Cádiz

David Pask
University of Newcastle

Francesc Perera
Universitat Autònoma de Barcelona

Pavel Prihoda
Centre de Recerca Matemàtica

Gennady Puninskiy
University of Manchester

Iain Raeburn
University of Newcastle

Jacqui Ramagge
University of Newcastle

Vladimir Retakh
State University of New Jersey

Mikael Rordam
Syddansk Universitet

Mercedes Siles Molina
Universidad de Málaga

Jan Stovicek
Norwegian University of Science and Technology

Andrew Toms
University of New Brunswick

Jan Trlifaj
Univerzita Karlova

Friedrich Wehrung
Université de Caen

Robert Lee Wilson
State University of New Jersey

Wilhelm Winter
Universität Münster

Activities

Seminar

A weekly seminar on Discrete and Continuous Methods on Ring Theory, co-ordinated by Dolors Herbera and Silvana Bazzoni.

Conference

Barcelona Conference on C*-Algebras and Their Invariants, from June 11 to 15, 2007, co-ordinated by Francesc Perera.

Advanced course

Advanced Course on Quasideterminants and Universal Localization, from January 30 to February 10, 2007, co-ordinated by Silvana Bazzoni and Dolors Herbera.

6.1.5 RESEARCH PROGRAMME ON ENUMERATIVE COMBINATORICS AND RANDOM STRUCTURES

Period

From September 1, 2006 to July 31, 2007

Scientists in charge

Local   Marc Noy (UPC)

Visiting   Dominic Welsh (University of Oxford)

Main research topic

Enumeration and probabilistic methods in Combinatorics

Other research topics

• Enumeration of graphs and maps on surfaces

• Asymptotic methods

• Random graphs

Visiting researchers

Olivier Bernardi
Centre de Recerca Matemàtica

Antonio Bernini
Università degli Studi di Firenze

Mireille Bousquet-Mélou
Université de Bordeaux 1

Michael Drmota
Technische Universität Wien

Enrica Duchi
Université Denis Diderot

Sergi Elizalde
Centre de Recerca Matemàtica

Stefan Felsner
Technische Universität Berlin

Philippe Flajolet
INRIA Rocquencourt

Stephanie Gerke
ETH Zürich

Mihyun Kang
Humboldt Universität zu Berlin

Christian Krattenthaler
Universität Wien

Joseph P. Kung
University of North Texas

Martin Loebl
KAM MFF UK

Tomasz Luczak
Emory University

Jean-François Marckert
Université de Bordeaux 1

Colin McDiarmid
University of Oxford

Marc Noy
Universitat Politècnica de Catalunya

David Orden
Universidad de Alcalá

Simeone Rinaldi
Institute of Electronic Engineering

Francisco Santos
Universidad de Cantabria

Gilles Schaeffer
École Polytechnique, Palaiseau

Charles Semple
University of Canterbury

Angelika Steger
ETH Zürich

Dominic Welsh
University of Oxford

Nick Wormald
University of Waterloo

Activities

Seminar

A weekly seminar on Enumerative Combinatorics and Random Structures, co-ordinated by Marc Noy.

Conference

Conference on Enumeration and Probabilistic Methods in Combinatorics, from June 25 to 29, 2006, co-ordinated by Marc Noy.

Curs avançat

Advanced Course on Analytic and Probabilistic Techniques in Combinatorics, from January 15 to 26, co-ordinated by Marc Noy and Dominic Welsh.

6.1.6 RESEARCH PROGRAMME ON MATHEMATICS AND DIGITAL CONTENT SECURITY

Period

From September 1, 2006 to October 31, 2007

Scientists in charge

Enric Nart (UAB)

Enric Ventura (UPC)

Main research topic

Group-based cryptography

Other research topics

• Complexity of algorithms

• Combinatorial and algorithmic group theory

Visiting researchers

Laura Ciobanu
Centre de Recerca Matemàtica

Sean Cleary
City College of New York

Volker Diekert
Universität Stuttgart

Andrew Duncan
Newcastle University

Benjamin Fine
Fairfield University

Robert Gilman
Stevens Institute of Technology

Alexei Miasnikov
McGill University

Sasa Radomirovic
Norwegian University of Science and Technology

Vladimir Shpilrain
City College of New York

Katherine St. John
Lehman College

Enric Ventura
Universitat Politècnica de Catalunya

Asli Yaman
Centre de Recerca Matemàtica

Activities

Workshop

Practical Aspects of Cryptography, April 2007, organized by the Universidad de Oviedo and co-ordinated by Consuelo Martínez.

Conference

Conference on Cryptography and Digital Content Security, from May 14 to 18, 2007, co-ordinated by Enric Nart and Jorge Luis Villar.

Advanced course

Advanced Course on Group-Based Cryptography, from May 28 to June 2, 2007, co-ordinated by Enric Ventura.

6.2 SPECIALISED QUARTERS

6.2.1 FOURIER ANALYSIS, GEOMETRIC MEASURE THEORY, AND APPLICATIONS

Period

This thematic research trimester, from April 15 to July 15, 2006, was organised by the CRM in collaboration with the Universidad Autónoma de Madrid and the Universitat Autònoma de Barcelona. The activity of the researchers participating in the trimester was carried out at the UAM from April 15 to May 31, and at the CRM, Bellaterra, from June 1 to July 15.

Scientists in charge

José M. Martell (UAM)

Joan Mateu (UAB)

Alberto Ruiz (UAM)

Xavier Tolsa (ICREA - UAB)

Ana Vargas (UAM)

Joan Verdera (UAB)

Temes de recerca

- Calderón-Zygmund operators and rectifiability
- Analytic capacity
- Removable sets for elliptic PDE's
- Projections and Favard length
- Restriction problems for the Fourier transform
- The Kakeya problem
- Fourier analysis techniques for PDE's and inverse problems

Visiting researchers

Pascal Auscher
Université de Paris XI

Jonathan Bennett
University of Birmingham

Russell Brown
University of Kentucky

Tony Carbery
University of Edinburgh

Marianna Csornyei
University College London

Galia Dafni
Concordia University

Guy David
Université de Paris Sud

Daniel Faraco
Universidad Autónoma de Madrid

John B. Garnett
University of California at Los Angeles

Maria José González
Universidad de Cádiz

Loukas Grafakos
University of Missouri-Columbia

Steve Hofmann
University of Missouri-Columbia

Pekka Koskela
Jyväskylä Universitet

Slava Kurylev
Loughborough University

Sanghyuk Lee
Seoul National University

Pertti Mattila
University of Helsinki

Joan Orobitg
Universitat Autònoma de Barcelona

Hervé Pajot
Université de Grenoble 1

Carlos Pérez
Universidad de Sevilla

Raanan Schul
University of California at Los Angeles

Sergei Treil
Brown University

Ignacio Uriarte
University of Helsinki

Luis Vega González
Universidad del País Vasco

Alexander Volberg
Michigan State University

Activities

Seminari

A weekly seminar at the UAM and the CRM.

Workshop

Workshop on Fourier Analysis, Geometric Measure Theory, and Applications, from June 5 to 9, 2006 at the CRM.

Final report

During three months, 32 researchers from many different countries, mainly European, met for periods lasting from 1 to 12 weeks at the Universidad Autónoma de Madrid and at the Centre de Recerca Matemàtica, to jointly work on the above mentioned research topics. These were altogether 130 weeks of research visitors, additionally to the local researchers in the field of this thematic term.

In the last years, an increasing interest appeared and a substantial development has been realised in numerous problems arising in the intersection of Fourier analysis and geometric neasure theory. These have been the most important research topics undertaken during the term, from the different points of view of the schools represented by the research visitors: complex analysis and real analysis.

Setting out from complex analysis, the participants considered in particular the geometric characterisation of removable sets for analytic and bounded functions, that leads to the study of the analytic capacity and L^2 bounds of various Calderón-Zygmund operators, as the Cauchy transform, with respect to nondoubling measures.

On the other side, the application of techniques coming from real analysis (Carleson measures, theorems $T(b)$) has been essential in the progress made in Kato's conjecture or in the resolution of Calderón's problem on the inverse conductivity in the plane, using Beltrami operators and quasiconformal maps.

6.3 CONFERENCES

6.3.1 BARCELONA CONFERENCE IN PLANAR VECTOR FIELDS

From February 13 to 17, the CRM organised a congress entitled *Barcelona Conference in Planar Vector Fields*, the main area of interest of which was the qualitative theory of planar polynomial vector fields. The main tendencies in this field of research are represented by the analysis of bifurcations of limit cycles of sets, graphs, centres, singularities, etc.; periodic limits; the existence of algebraic invariant curves; the problem of distinguishing between centres and foci; isochronic centres; periodic functions; desingularisation; finite cyclicity; integrability; global attraction, etc. The congress, which dealt with a wide variety of these problems, emphasised the two following aspects: a review of the progress made recently in this field and the exploration of new directions for future research.

The co-ordinators were Armengol Gasull and Jaume Llibre, professors at the UAB. The congress welcomed 77 participants. The speakers and titles were:

Marcin Bobienski
A counterexample to a multidimensional linearized Hilbert 16th Problem

Valerii Dryuma
Riemann extensions in the theory of first order differential equations

Freddy Dumortier
Compactification and desingularization of spaces of polynomial Liénard equations

Isaac García Rodríguez
Limit sets of planar vector fields via integral invariants

Lubomir Gavrilov
Higher order Poincaré-Pontryagin function and iterated path integrals

Jaume Giné Mesa
Linearizability and integrability of vector fields via commutation

Yu Ilyashenko
A restricted version of Hilbert's 16th problem for quadratic vector fields

Xavier Jarque
A criterion for at most one critical point of the period function for planar vector fields

Víctor Jiménez
A topological characterization of the ϖ-limit sets for analytic flows on the plane, the sphere and the projective plane

Chengzhi Li
The period function of quadratic reversible systems

Oleg Makarenkov
New subharmonic solutions for a class of periodically perturbed integrable systems

Francesc Mañosas
An inverse problem for analytic potential systems with applications

Pavao Mardesic
On the principal Poincaré-Pontryagin function

Marcelo Messias
Periodic perturbations of planar polynomial vector fields

James Muldowney
Evolution of exterior products in dynamics

Dmitry Novikov
The Maxwell conjecture about equilibria of point-charges potential

Daniel Panazzolo
Dulac maps and the bifurcation of degenerate graphics

Daniel Peralta Salas
Inverse problems for limit cycles and polynomial vector fields

Jesús S. Pérez del Río
Polynomial first integrals of quadratic vector fields

Eduardo Piña
Dynamical systems and alternate knots

Enrique Ponce Nuñez
Global asymptotic stability issues in engineering applications

Rafael Prohens
A criterion to bound the number of limit cycles on the cylinder

Marco Sabatini
Studying the period function monotonicity and limit cycle stability without normalizers

Jorge Sotomayor
Bifurcations in the Watt governor differential system

Gregorz Swirszcz
Relationships between limit cycles and algebraic invariant curves for quadratic systems

Marco Antonio Teixeira
Degenerate resonances for reversible systems

Jordi Villadelprat
On quadratic centers with monotonic period function

Massimo Villarini
Normalization of Poincaré singularities via variation of constants

Jiazhong Yang
Limit cycles bifurcating from the period annulus of certain kinds of centers

Michal Zhitomirskii
Curves in foliated plane

Henryk Zoladek
Small amplitude limit cycles for the polynomial Liénard equation

Vesna Zupanovic
Fractal analysis of spiral trajectories of some planar vector fields

6.3.2 CONFERENCE ON RECENT DEVELOPMENTS IN THE ARITHMETIC OF SHIMURA VARIETIES AND ARAKELOV GEOMETRY

From July 10 to 15, the Centre de Recerca Matemàtica hosted a congress entitled *Recent Developments in the Arithmetic of Shimura Varieties and Arakelov Geometry* (SVAG), organised by the CRM and coordinated by professor José Ignacio Burgos (UB) and Jörg Wildeshaus (Université de Paris XIII).

The scientific committee, made up of Jean-Benoît Bost, Université de Paris XI, Michael Harris, Université de Paris VII, and Stephen Kudla, University of Toronto, structured the congress into a series of 23 plenary conferences plus a specific seminary called *Work in Progress.*

The plenary conferences held were the following:

David Blottière
The polylogarithm of Hilbert-Blumenthal modular families

Pascal Boyer
Monodromy of the perverse sheaf of vanishing cycles of some simple Shimura varieties

Jan H. Bruinier
Geometric theta lifts

Henri Darmon
Shimura lifts and p-adic families of modular forms

Frederic Deglise
Mixed motives and the six functor formalism

L. Houssain El Fadil
An algorithm to compute an integral basis and a power integral basis

Carlo Gasbarri
The canonical subgroup for families of abelian varieties

Jayce Getz
Hilbert modular forms with coefficients in intersection homology and quadratic base change

Henri Gillet
Motivic weight complexes for schemes and stacks

Eyal Goren
Bad reduction of CM curves and special values of Siegel modular functions

Jürg Kramer
Estimates for Faltings' delta function and arithmetic implications

Meimei Lin
Statistical geometry in econometrics and the exact geometry of explosive autoregressive models

Elena Mantovan
Integral models for toroidal compactifications of Shimura varieties

Alberto Mínguez
Correspondencia de Howe local

Sophie Morel
Intersection complex on the Baily-Borel compactification of a Siegel modular variety

Bao Chau Ngo
Counting G-shtukas

Marc-Hubert Nicole
Traverso's truncation conjectures for p-divisible groups

Abedallah Rababah
Degree reduction and elevation of bezier surfaces

Michael Rapoport
Some remarks on special cycles on Shimura curves

Damian Rössler
A conjectural relative fixed point formula

Christophe Soulé
Successive minima on arithmetic surfaces

Andrei Yafaev
The André-Oort conjecture

Chia-Fu Yu
Irreducibility of Hilbert-Blumenthal moduli spaces with parahoric level structure

The objective of the *Work in Progress* seminar, co-ordinated by David Blottière and Gerard Freixas, was to encourage interaction between young researchers taking part in the congress, through discussion of the conference subjects, the research projects themselves, and recent results.

The congress was attended by 69 researchers and PhD students, mainly from Europe, who in the activity evaluation questionnaire considered both the scientific content of the activity and its organisation to have been highly positive.

This congress was organised as one of the activities of the European Mathematical Society financed by the European Commission, as part of the Marie Curie programme, which made it possible to award travel, accommodation and registration grants to most of the participants. The financing of the congress was completed by respective subsidies from MEC and DURSI.

It is worth mentioning two especially interesting social activities that were of-

fered to all of the students at the congress, namely a guided visit to the modernist Sagrada Família temple, followed by a collective supper, and a piano concert given by Harry Tamvakis, one of the participants in the congress, performing pieces by Granados, Beethoven and Mompou.

6.3.3 BARCELONA ANALYSIS CONFERENCE

From September 4 to 8, 2006, the historic building of the Universitat de Barcelona was the venue for a satellite congress of the International Congress of Mathematicians (ICM 2006) called *Barcelona Analysis Conference* (BAC06). The BAC06 was organised by the Analysis Seminar of Barcelona, in collaboration with a number of Catalan institutions and universities, which included the Centre de Recerca Matemàtica.

The BAC06 focused on a wide spectrum of issues of mathematical analysis (harmonic analysis, geometric measure theory, real and functional analysis, complex analysis, signal theory and PDE's). The high level of the 23 speakers, who were invited directly by the scientific committee, meant that despite being held on the same dates as several scientific congresses and meetings, the BAC06 was able to attract a good number of the finest specialists in the world in the different areas covered. In total, more than one hundred specialists from 21 different countries took part in the event.

The invited speakers were:

K. Astala
University of Helsinki

P. Auscher
Université de Paris Sud

R. Bañuelos
Purdue University

B. Berndtsson
Chalmers University and University of Göteborg

A. Borichev
Université de Bordeaux 1

X. Cabré
ICREA - Universitat Politècnica de Catalunya

E. Candes
California Institute of Technology

A. Carbery
University of Edinburgh

A. Córdoba
Universidad Autónoma de Madrid

M. Cwikel
Technion, Israel Institute of Technology

P. Hajlasz
University of Pittsburgh

M. Lacey
Georgia Institute of Technology

N. Makarov
California Institute of Technology

J. Malý
Univerzita Karlova

J. Mateu
Universitat Autònoma de Barcelona

J. McCarthy
Washington University, St. Louis

A. Nagel
University of Wisconsin, Madison

J. Ortega-Cerdà
Universitat de Barcelona

M. Sodin
Tel Aviv University

S. Treil
Brown University

A. Vargas
Universidad Autónoma de Madrid

I. Verbitsky
University of Missouri, Columbia

J. M. Wu
University of Illinois, Urbana-Champaign

6.3.4 CONFERENCE ON MATHEMA-TICAL NEUROSCIENCE

The *Conference on Mathematical Neuroscience* (Neuromath '06) was held in Andorra from September 1 to 4, 2006. It was a satellite event of the ICM 2006 and formed part of the actions of the NEST project entitled *Shaping New Directions in Mathematics for Science and Society* (MATHFSS). The mathematical side of neuroscience is still very much virgin territory and offers many challenges for exploration. This congress was created in order to encourage the mathematical community to work on matters of neuroscientific interest. It was designed to guarantee the presence of specialists covering a spectrum from the mathematical research of neuroscience to experimentation, passing through computational treatment. The aim of such a broad scope was for the experimentalists to propose neuroscientific problems to which Mathematics is able to make a contribution; for computationalists to show what models they work with, which mathematical formulations are useful to them and provide guidance on what interesting simplifications could be approached on a mathematical level; and, finally, for mathematicians working in the area, to provide guidance on what areas of their specialty and what elements of knowledge are useful to them in order to be able to contribute to this field of application. Apart from the specialists in mathematical and computational neuroscience, the congress was also particularly addressed at members of the mathematical community that felt a curiosity to learn about research in this area.

The CRM assumed the main responsibility for the organisation of Neuromath '06 (invitation letters to speakers, registration, travel, accommodation, receipt of communications), while the Universitat d'Andorra took care of local aspects (coffee breaks, conference rooms, computer equipment).

The scientific committee was made up of the following people:

D. Terman, Ohio State University (chair)

A. Compte, Universitat Miguel Hernández

A. Guillamon, Universitat Politècnica de Catalunya (co-ordinator)

H. G. Rotstein, Boston University

The plenary speakers were:

Bard Ermentrout
University of Pittsburgh

What makes a neuron spike? Reliability and dynamics

Nancy Kopell
Boston University

Multiple interacting rhythms in the nervous system

John Rinzel
New York University

Dynamics of perceptual bistability

Other invited speakers:

Ad Aersten
Universität Freiburg

Cortical network dynamics-precision in a noisy environment?

Jane Best
Ohio State University

A mathematical model for the development of sleep regulation

Alla Borisyuk
University of Utah

The dynamic range of bursting in a network of respiratory pacemaker cells

Amit Bose
New Jersey Institute of Technology

Multistability and reduction to one-dimensional maps

Eric Shea-Brown
New York University

Network architecture and spiking dynamics of coupled phase oscillators

Nicolas Brunel
Université de Paris V

Statistical properties of excitatory synaptic connectivity optimizing information storage

Stephen Coombes
University of Nottingham

On the dynamics of dendritic trees: morphology, resonant membrane and active spines

Gustavo Deco
Universitat Pompeu Fabra

The role of statistical fluctuations in probabilistic decision-making

Jean-Pierre Françoise
Université de Paris VI

Attractive periodic orbits of weakly coupled oscillators

Boris Gutkin
Institut Pasteur

GABA reversal pontetial control synchronization of neuronal oscillators

David Hansel
Université de Paris V

The ring model of cortical dynamics: delayed insights

John Hertz
Nordita

Cross-correlations in cortical networks

Kresimir Josic
University of Houston

Co-variation of output rate and correlation

Peter Latham
Gatsby Computational Neuroscience Unit

Requiem for the spike

Tim Lewis
University of California at Davis

Firing dynamics of electrically coupled pairs of inhibitory interneurons in the neocortex

Georgy Medvedev
Drexel University

Multimodal oscillations: from dopamine neurons to solid fuel combustion

Jonathan Rubin
University of Pittsburgh

Giant squid, hidden canard: the 3D geometry of the Hodgkin-Huxley model

Michelle Rudolph
Centre National de la Recherche Scientifique

Neuronal dynamics in the active brain: Some insights from intracellular and theoretical studies

María-Victoria Sánchez-Vives
Universitat Miguel Hernández

Bistability and rhythmicity in the cortical network: mechanisms of generation and control

Walter Senn
Universität Bern

Towards a theory of stochastic learning with binary synapses

Brian Smith
Ohio State University

Spatiotemporal codes and plasticity: How the olfactory system may detect, identify and interpret odors

Jeff Smith
National Institute of Health

Models of respiratory neurons and networks in the central nervous system

Louis Tao
New Jersey Institute of Technology

Reverse correlation and network architecture

Mina Teicher
Bar-Ilan University

Synchronization

J. L. van Hemmen
Technische Universität München

How lateral line hydrodynamics allows fish to localize both predator and prey

Forty-one posters were presented, divided into two sessions and featuring very lively debates. The titles and main contents of all the presentations can be found in the congress brochure. The evaluation of the congress was highly positive, and was based on the following facts:

• The high scientific quality of the communications. In most of these, articles were presented that have appeared in prestigious journals in recent years (Nature, PNAS, Nature Neuroscience, Science, SIAM journals, etc.).

• Acceptance of invited experts to participate was 90%, which made the congress highly attractive and facilitated the overall participation: 93 participants from 17 different countries.

• Both the plenary speakers and guests were highly renowned in the field of computational neuroscience, and it can doubtlessly be declared that they represented the very highest level of research in the area.

• Debate and discussion featured very highly in all of the Neuromath '06 communications. This helped create the ideal atmosphere for the exchange of ideas and the educational nature of the congress.

• The election of three experimentalist speakers introduced considerable added value, as these were people who, as well as working in experimental laboratories, permanently collaborate with scientific theories.

• Participation was well divided between specialists in mathematical and computational neuroscience (50%), doctorate students (30%), and specialists from other branches of Mathematics (20%).

• The destination of a major share of the budget to the promotion of grants for young researchers gave the congress a perfect balance between the diffusion of knowledge and learning.

• The participants expressed extremely high satisfaction, as shown by the questionnaires returned.

• The professionalism of the CRM's management meant the organisation was extremely fluid and helped create a pleasant atmosphere among the participants.

6.4   ADVANCED COURSES

This year brought the eleventh edition of the advanced courses organised by the CRM on specific mathematical subjects that are topical in terms of its research activity. These intensive courses are aimed at advanced doctorate students and doctors, and are given by experts of especially prestigious renown.

6.4.1   ARAKELOV GEOMETRY AND SHIMURA VARIETIES

Held from February 20 to 25, 2006, co-ordinated by José Ignacio Burgos (UPC) and Jörg Wildeshaus (Université de Paris XIII), with the following programme:

• Ching-Li Chai, University of Pennsylvania. *Integral models of Shimura varieties*

The essence of Arakelov geometry is the relationship between the algebraic geometry of an integral model of a variety with the hermitian differential geometry of the corresponding complex variety. Therefore the study of integral models is central in this theory. The objective of this course was to give an introduction to the construction and pro-

perties of integral models of Shimura varieties. After introducing the basic concepts, like a review of the integral model of the moduli space of abelian varieties and the existence of good reduction in the PEL case, the course treated more advanced topics, like a study of the singularities that come from the conductor (not the level) or the fine structures of the reduction modulo p (Hecke symmetry, leaves, etc.). This phenomenon is very recent, but has potential applications to Arakelov theory in zero characteristic.

• Henri Darmon, McGill University, Montréal. *Heegner points, Stark-Heegner points, and values of L-series*

Any (modular) elliptic curve over $\mathbf{Q}$ is equipped with a large collection of algebraic points defined over abelian extensions of imaginary quadratic fields: the so-called Heegner points arising from the theory of complex multiplication. This has been the key to the most decisive progress in the last decades on the Birch and Swinnerton-Dyer conjecture, arising from the work of Gross-Zagier and Kolyvagin. More recently, it was discovered that Heegner points admit a host of conjectural generalizations, referred to as Stark-Heegner points because they occupy relative to classical Heegner points a position somewhat analogous to Stark units relative to elliptic or circular units. The goal of this lecture series was to review and discuss Heegner points, Stark-Heegner points, their arithmetic applications and their relations (proved or conjectured) with special values of certain Rankin L-series.

• Damian Roessler, Université Denis Diderot, Paris 7. *Riemann-Roch formulae in Arakelov geometry and applications*

The arithmetic Grothendieck-Riemann-Roch formula, together with its equivariant version, the arithmetic relative Lefschetz fixed point formula, are important theorems in Arakelov theory. In the first part of the course, the work of Bismut-Gillet-Soulé and

Bismut-Koehler-Roessler was described on the analogues of the Grothendieck-Riemann-Roch formula and equivariant versions thereof in the context of Arakelov theory. In the second part, various applications were described, including a residue formula à la Bott, the computation of the height of some flag varieties, the computation of the arithmetic degree of certain modular line bundles and the proof of the Gross-Deligne conjecture for a certain class of varieties.

6.4.2 LIMIT CYCLES OF DIFFERENTIAL EQUATIONS

The course took place at the CRM from June 26 to July 7, co-ordinated by Armengol Gasull and Jaume Llibre from the UAB and with the following programme. The material from the two first parts of this course gave rise to a volume of the *Advanced Courses in Mathematics CRM Barcelona* series, which will be published by Birkhäuser in 2007.

• Colin Christopher, University of Plymouth. *Around the center-focus problem*

The aim of this course is to consider some of the topics which surround the Poincaré center-focus problem for polynomial differential systems. Clearly, the subject is closely tied with what mechanisms underlie the local integrability of polynomial differential systems, since the existence of a center implies the existence of a local analytic first integral.

Because these systems are defined algebraically, we expect these mechanisms to be algebraic too in some sense. This indeed seems to be the case, but the situation is far from being understood except for a growing number of explicit examples. The first part of the course considers the two main mechanisms known to produce centers in polynomial differential systems, mainly Darboux in-

tegrability and algebraic symmetries. The second part considers several topics loosely associated with the idea of monodromy.

• Chengzhi Li, Peking University. *Abelian integrals and application to the weak Hilbert 16th problem*

The second part of Hilbert's 16th problem, asking for the maximum number $H(n)$ and position of limit cycles for all planar polynomial differential systems of degree n, is still open even for $n = 2$. A weak form of this problem, proposed by Arnold, asking for the maximum number $Z(m; n)$ of isolated zeros of Abelian integrals of all polynomial 1-form of degree n over algebraic ovals of degree m, is also extremely hard to study, though the "uniform finiteness" was proved by Khovansky and Varchenko.

This course is devoted to introduce some basic concepts and methods about the application of Abelian integrals to the weak Hilbert's 16th problem. The relation between the study of Abelian integrals and the study of limit cycles is analyzed. Several methods are provided for computing the Abelian integrals and their zeros. Finally a unified study of the weak Hilbert's 16th problem in the quadratic case is given.

• Sergei Yakovenko, Weizmann Institute of Science. *Algebraic solutions of polynomial vector fields*

In this course the notion of degree of a polynomial foliation on $\mathbb{C}P^2$ is introduced, and two natural classes of "foliations of the given degree" are considered. The generic foliations from these two classes have different, though in some sense similar, properties. Then the course switches to the study of algebraic leaves of polynomial foliations, focusing on determination of their degrees: the problem goes back to Poincaré. Its resent solution is the central result of this part of the course. After it is shown that generically polynomial foliations have no algebraic leaves. On the other hand, abundance of alge-

braic leaves implies integrability. Finally the blow up techniques in complex variables was introduced. Later on the classical Poincaré-Lyapunov Theorem about the existente of an analytic first integral in a neighborhood of a center whose linear part is not degenerate was proved. The course ended with a proof of the Mattei-Moussu Theorem showing that topologically simple holomorphic foliations are analytically integrable.

6.4.3   COMBINATORIAL AND COMPUTATIONAL GEOMETRY: TRENDS AND TOPICS FOR THE FUTURE

The course was held from August 31 to September 5, 2006 in the historic building of the Universidad de Alcalá. On the same day and at the same place, the *Workshop on Geometric and Topological Combinatorics* was held, organised by the Universidad de Cantabria. The times were scheduled so that parti-

cipants interested in taking part in both activities in their entirety could do so. Both events were satellite events related to the International Congress of Mathematicians, ICM 2006, which was held in Madrid in August of the same year. As well as organising this advanced course, the CRM collaborated with the workshop in various aspects of its management and operation, which are also briefly summarised here.

The course was co-ordinated by Professors Manuel Abellanas (UPM) and Ferran Hurtado (UPC), with the assistance of Professors David Orden and Pedro Ramos (UAH). It was structured as a double magister dissertation, and was conducted by two lecturers of major international renown and authority. The main aim was to analyse and predictively explore research into computational, combinatorial and discrete geometry, a discipline that studies the combinatorial complexity and structure of discrete geometric objects, as well as the development of efficient algorithms for their computational treat-

ment. This is a highly interdisciplinary area and is related to several vital mathematical fields, such as algebraic geometry, topology, combinatorics, and probability theory, as well as using modern technological applications such as geographical information systems, graphic information, robotics, and structural computational biology.

The lecturers were Professor János Pach, of the Courant Institute at New York University, and Alfréd Rényi Institute of Mathematics of the Hungarian Academy of Sciences, and Professor Micha Sharir of the School of Computer Science at Tel Aviv University, and also a Research Professor at the Courant Institute.

The programme consisted of five rounds of daily conferences, each lasting two hours with the following programme:

• János Pach:

Sylvester-Gallai problem: The beginnings of combinatorial geometry

Crossing numbers of graphs: Graph drawing and its applications

Extremal combinatorics: Repeated patterns and pattern recognition

Geometric coloring problems: Sphere packings and frequency allocation

From Sam Loyd to Laszlo Fejes Toth: The fifteen puzzle and discrete motion planning

• Micha Sharir:

Geometric arrangements: The evolution of the basic theory

Arrangements in motion: Union of geometric objects and Voronoi diagrams

Incidences and their relatives

Lines in space: Geometry, combinatorics, and algorithms

Putting arrangements to work: Geometric optimization

As the list shows, the course was mainly focused on the theory of arrangements, but with the emphasis always on the prospective analysis of the global evolution of the discipline. The course notes were published as a single volume and distributed among the students, who were also provided with copies of all the visual materials.

As for the *Workshop on Geometric and Topological Combinatorics*, this dealt with the discrete structures that arise in a variety of mathematical contexts, from enumerative questions to polytopes and other constructions from lineal algebra to the topology of varieties. It was co-ordinated by Professor Francisco Santos (UdC), with the assistance of Professors Manuel Abellanas (UPM), David Orden (UAH), Julian Pfeifle (UPC) and Pedro Ramos (UAH). It consisted of five one-hour lectures, given by Professors Alexander Barvinok, Stefan Felsner, Sergei Fomin, Victor Reiner, and Ileana Streinu, with nine guest talks given by Professors Eric Babson, Richard Ehrenborg, Dmitry Feichtner-Kozlov, Christian Haase, M. Ángeles Hernández-Cifre, Roy Meshulam, Ed Swartz, Thorsten Theobald, and Afra Zomorodian, and one poster session in which those present were able to present their recent works.

All in all, the events were attended by 114 people, of which 87 attended the advanced course. In terms of origin, 28 were Spanish nationals and the others came from 30 different countries from every continent. Of the 114 participants, 27 were women and 87 were men, while 90 participants were aged 35 years or less.

6.5   WORKSHOPS

6.5.1   FOURIER ANALYSIS, GEOMETRIC MEASURE THEORY AND APPLICATIONS

This workshop, limited to local researchers and participating visitors involved in the specialised research trimester of the same name, was attended by 25 people at the CRM from June 5 to 9, 2006.

The conferences given were:

K. Astala
Topics in mappings of finite distortion

T. Carbery
The multilinear Kakeya maximal function

D. Faraco
Stability of Calderón's inverse problem in 2D

M. J. González
Exceptional sets and composition operators

L. Grafakos
Convergence of multilinear Fourier series

P. Koskela
Hardy-Sobolev spaces in homogeneous spaces

P. Mattila
Fourier transform and Hausdorff dimension

6.5.2   TWENTY YEARS OF POST-DOCS AT THE CRM

On the occasion of the 20th anniversary of the first post-doctoral fellowships at the Centre de Recerca Matemàtica, on September 22 and 23 a meeting of former CRM post-docs was held, at which participants exposed the research subjects of their specialty, whether that was in terms of their studies in the academic field, or the types of work in which Mathematics are applied, linked to the business world.

The reunion was organised by Vladimir Zaiats, a Ukrainian post-doc back in 1991-

1992, and currently a professor at the Universitat de Vic, 60 km away from Barcelona.

Over 20 years, 76 young post-doctorate level researchers have been or still are interns at the CRM, having come from 27 different countries, with scholarships from the European Union, the Spanish Government, the Generalitat de Catalunya, the governments of other countries, or from the CRM itself. The attached table shows each intern's nationality, scientific field and present place of employment.

It was hugely satisfying to see how their time at the CRM had, for most of these interns, been a source of scientific enrichment and one that has helped them to consolidate their positions in the academic or business worlds.

On this subject, we would like to thank all of those researchers that have helped the CRM to grow over the years. At the same time, we also wish to express our greatest sorrow as we remember Michimasa Tanabe, who was at the CRM in 1994, but died a few years later in his native Japan.

The following table contains information about countries of origin, thesis oral presentations, and present countries of residence of the 76 expostdocs at the end of 2006.

	Citizenship	PhD	Present	
Australia			1	
Belgium	3	3	2	
Canada	1	1	1	
China	6	5	5	
Czechia	1	1		
Denmark	1	1	1	
Finland	1	1	1	
France	15	14	12	
Germany	3	3	2	
Greece	1			
Guatemala	1			
Hungary	1			
Israel	1	1		
Italy	1			
Japan	2	2	3	
Morocco	2	2	2	
Poland	6	6	5	
Portugal	2		2	
Romania	3	2	1	
Russia	2	2	2	
South Korea	1			
Spain	7	8	16	7 at CRM
Switzerland	3	4	1	
Turkey	1		1	
Ukraine	2	2	1	
United Kingdom	5	7	3	
USA	3	11	10	
Vietnam	1		1	
Total	**76**	**76**	**73**	

6.6   ROUND TABLES

6.6.1.   SHAPING NEW DIRECTIONS IN MATHEMATICS FOR SCIENCE AND SOCIETY

A round table was organised by the CRM at the Madrid Congress Palace on August 24, 2006, within the scientific programme of the International Congress of Mathematicians, ICM 2006. This was also one of the activities of the project entitled *Shaping New Directions in Mathematics for Science and Society* (MATHFSS), a support action of the NEST Programme of the European Commission, which the CRM is leading together with the Emmy Noether Institute, EURANDOM, and the IHÉS from 2005 to 2007.

Moderator:

Mina Teicher (Bar-Ilan University)

Panelists:

Touradj Ebrahimi
(École Polytechnique Fédérale de Lausanne)

Francisco Marcellán (MEC)

David Terman
(Mathematical Biosciences Institute, Ohio)

Henry Wynn
(London School of Economics)

Co-ordinator:

Carles Casacuberta (CRM)

The goal of the Round Table was to enhance visibility of the MATHFSS project both in Spain and at the international arena, taking advantage of the exceptional scenario offered by the ICM 2006. At the same time, the organisers aimed at obtaining material and opinions for the final report of the project.

The scientific topics addressed in the presentations were Digital Content Security, Mathematical Neuroscience, and Risk Assess-ment. For each of these themes, the panelists answered the following questions:

   • What is the current impact of Mathematics on your project topic?

   • To what extent is the development of Mathematics influenced by advances in this topic?

   • How can Mathematics achieve a stronger presence in multidisciplinary funded programmes?

One of the participants at the Round Table was the Secretary General of Scientific and Technological Policy of the Spanish Ministry of Education and Science, Francisco Marcellán. In his speech, he emphasised the efforts currently being made by Spanish scientific authorities in order to foster emerging directions in science, and to support mathematicians in particular. He also spoke about the CRM's energetic contribution towards these goals. Further details about the Round Table can be found at the MATHFSS website (www.mathfss.org), together with additional information about the project.

6.7   MASTER'S COURSE IN MATHEMATICAL FINANCE

The Master's course *Matemàtiques per als instruments financers* was developed for the 9th time in 2006 thanks to the collaboration of the Mathematics Department of the UAB, the CRM, and several financial companies such as the Barcelona Stock Exchange, which is the sponsoring institution. Other collaborating institutions are the departments of Economics and Economics History, Applied Economics, and Business Economics of the UAB, the Statistics Department of the UB and several outstanding specialists who work in direct contact with the markets.

The collaborating companies offer

practical training opportunities to the students by offering them grants. This allows a direct contact between the academic community and the professional world, allowing to develop and teach innovative techniques about valuation of derived financial products, calculation of coverage strategies, risk assessment and risk control.

The goal of the Master's course is to train specialists capable of developing new financial products, according to the current needs, and prepare them to understand and critically discuss the hypotheses and limitations of the existing models. The Master's course was designed for young students with

a mathematical talent, regardless of their previous training. Thus it is open to students with a degree in Mathematics, Physics, Economy, Engineering or similar disciplines. Job opportunities after the course are excellent at present.

In the 2005-2006 academic year, 12 students were enrolled. Of these, four were from the Universitat Autònoma de Barcelona, three from the Universitat de Barcelona, two from the UNAM (Mexico), one from the Universitat Poliècnica de Catalunya, one from the Universidad de la Laguna, and one from the Escuela Superior Politécnica del Litoral (Ecuador).

The Master's course is structured in three terms, two theoretical, each with 120 hours of teaching, and a third practical in a financial company. The Master's responsability lies on the Academic Commission, consisting of professors Joan del Castillo, Jaume Llibre, Frederic Utzet, Xavier Xarles, and Josep Vives (who has been the co-ordinator), and the Advisory Council, consisting of Xavier Auguets (Caixa Catalunya), Antoni Giralt (Barcelona Stock Exchange), Pere Guinjoan (Caixa d'Estalvis i Pensions de Barcelona), Albert Cortés (Banc Sabadell), and Victòria Castellot (Caifor). The Executive Committee consists of Manuel Castellet (CRM Director), Jaume Aguadé (Chairman of the UAB Mathematics Department), and Josep Vives (Master's Co-ordinator).

Every year a maximum of twenty students are admitted to the course, and they have access at the premises of the CRM to the most advanced technology in order to follow the financial markets.

6.8 SEMINARS AND TALKS

The CRM promotes seminars and talks that are the result of the work undertaken by visiting researchers at the Centre, and gives both support and welcome to various periodical seminars organised by research groups from the Barcelona universities. Diffusion of these activities is made through the weekly Newsheet distributed by e-mail and published on the CRM website.

A good many of these lectures take place on the CRM premises; others are held in the Mathematics Departments at the UAB, UB and UPC. In 2006, 248 talks were given, of which 196 in the following seminars:

ANALYSIS SEMINAR

Organised by the Universitat Autònoma de Barcelona and the Universitat de Barcelona.

Co-ordinated by Joan Orobitg and Xavier Tolsa.

SEMINAR ON PDE'S AND APPLICATIONS

Organised by the Universitat Autònoma de Barcelona.

Co-ordinated bt Albert Avinyó.

Web: www-ma2.upc.es/~edps

GEOMETRY SEMINAR

Organised by the Universitat Autònoma de Barcelona.

Co-ordinated by Marcel Nicolau.

UAB DYNAMICAL SYSTEMS GROUP SEMINAR

Organised by the Universitat Autònoma de Barcelona.

Co-ordinated by Armengol Gasull.

Web: www.gsd.uab.es

STATISTICS SERVICE SEMINAR

Organised by the Statistics Service of the UAB.

Co-ordinated by Pere Puig.

Web: www.uab.es/s-estadistica

RING THEORY SEMINAR

Organised by the Universitat Autònoma de Barcelona.

Co-ordinated by Francesc Perera.

TOPOLOGY SEMINAR

Organised by the Universitat Autònoma de Barcelona and the Universitat de Barcelona.

Co-ordinated by C. Broto, W. Pitsch and J. Scherer.

Web: mat.uab.es/~topalg

ON HILBERT'S 16TH PROBLEM

Organised by the Centre de Recerca Matemàtica.

Co-ordinated by A. Gasull and J. Llibre

ARAKELOV GEOMETRY AND SHIMURA VARIETIES

Organised by the Centre de Recerca Matemàtica.

Co-ordinated by J. I. Burgos and J. Wildeshaus

7. PUBLICATIONS

During 2006, work has continued on the Centre's series of publications: *Advanced Courses in Mathematics CRM Barcelona, Quaderns, and Preprints.*

▌7.1   ADVANCED COURSES IN MATHEMATICS CRM BARCELONA

The volumes of this series, published by the Swiss publishing company Birkhäuser, cover the content of some of the advanced courses taught by distinguished specialists at the CRM, based on the notes handed out to the students at the beginning of the course, which are later reworked by the authors. They are especially addressed to advanced doctoral and young post-doctoral students, and completely elucidate their content, with the necessary preliminaries, definitions and detailed proofs.
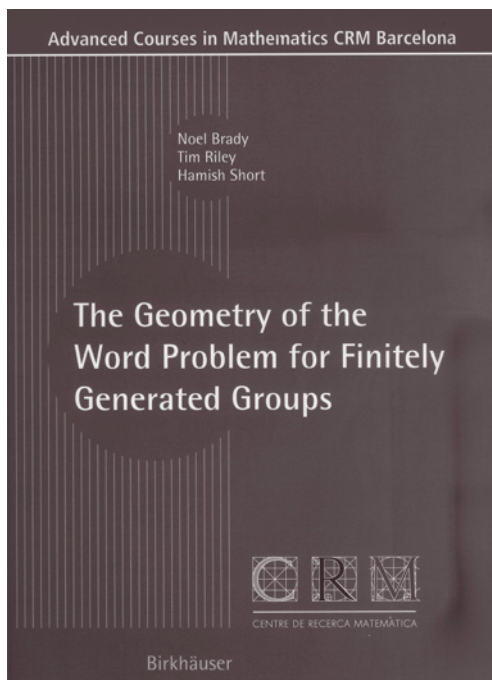
The following two volumes were published in 2006:

String Topology and Cyclic Homology, by R. L. Cohen, K. Hess and A. A. Voronov, emanating from an advanced course with the same title held in September 2003 at the Universidad de Almería.

The Geometry of the Word Problem for Finitely Generated Groups, by Noel Brady, Tim Riley and Hamish Short, emanating from an advanced course with the same title held in July 2005 at the CRM.

▌7.2   QUADERNS

The Quaderns compile the content of specialised activities. The following issues have been published in 2006:

Advanced Course on Arakelov Geometry and Shimura Varieties

Editors: J. I. Burgos, J. Wildeshaus (no. 36)

Análisis armónico no conmutativo, probabilidad cuántica y espacios de operadores

Editor: J. Parcet (no. 37)

Advanced Course on Limit Cycles of Differential Equations

Editors: A. Gasull, J. Llibre (no. 38)

Advanced Course on Combinatorial and Computational Geometry: Trends and Topics for the Future

Editors: M. Abellanas, F. Hurtado (no. 39)

7.3 PREPRINTS

The following 69 preprints were published by the CRM in 2006:

Internal consistency and the inner model hypothesis
S. D. Friedman (no. 661)

Recasting the Elliott conjecture
Perera, A. S. Toms (no. 662)

Periodic solutions for nonautonomous second order differential inclusions systems with p-Laplacian
D. Pasca (no. 663)

Periodic orbits near a heteroclinic loop formed by one dimensional orbit and a 2-dimensional manifold: application to the charged collinear 3-body problem
J. Llibre, D. Pasca (no. 664)

Absolute type shaft encoding using LFSR sequences with prescribed length
E. Ventura, J. M. Fuertes, B. Balle (no. 665)

Testing Cayley graph densities
G. N. Arzhantseva, V. S Guba, M. Lustig, J.-P. Préaux (no. 666)

Pure braid subgroups of braided Thompson's groups
T. Brady, J. Burillo, S. Cleary, M. Stein (no. 667)

Generalized property R and the Schoenflies Conjecture
M. Scharlemann (no. 668)

Approximating subtree distances between phylogenies
M. L. Bonet, K. St. John, R. Mahindru, N. Amenta (no. 669)

Generalized backward doubly stochastic differential equations and SPDEs with nonlinear Neumann boundary conditions
B. Boufoussi, J. Van Casteren, N. Mrhardy (no. 670)

Inverse problems for multiple invariant curves
C. Christopher, J. Llibre, C. Pantazi, S. Walcher (no. 671)

Minimal truncations of supersingular p-divisible groups
M.-H. Nicole, A. Vasiu (no. 672)

Lower bounds for the number of limit cycles of trigonometric Abel equations
M. J. Álvarez, A. Gasull, J. Yu (no. 673)

Limit cycles for cubic systems with a symmetry of order 4 and without infinite critical points
M. J. Álvarez, A. Gasull, R. Prohens (no. 674)

Refilling meridians in a genus 2 handlebody complement
M. Scharlemann (no. 675)

Intersection pairing and intersection motive of surfaces
J. Wildeshaus (no. 676)

Limit cycles for a class of three dimensional polynomial differential systems
J. Llibre, J. Yu (no. 677)

On the upper bound of the number of limit cycles obtained by the second order averaging method I
J. Llibre, J. Yu (no. 678)

On the upper bound of the number of limit cycles obtained by the second order averaging method II
J. Llibre, J. Yu (no. 679)

Geometric tools to determine the hyperbolicity of limit cycles
A. Guillamon, M. Sabatini (no. 680)

Algebraic extensions in free groups
A. Miasnikov, E. Ventura, P. Weil (no. 681)

L^p-solutions to BSDEs with super-linear growth coefficient. Application to degenerate semilinear PDEs
K. Bahlali, E. Essaky, M. Hassani, E. Pardoux (no. 682)

Reflected backward stochastic differential equations with jumps and RCLL obstacle
E. H. Essaky (no. 683)

Normal forms for rational difference equations with applications to the global periodicity problem
J. Rubió-Massegú, V. Mañyosa (no. 684)

The density of injective endomorphisms of a free group
A. Martino, E. C. Turner, E. Ventura
(no. 685)

Periodic orbits in complex Abel equation
A. Cima, A. Gasull, F. Mañosas (no. 686)

Restricted walks in regular trees
L. Ciobanu, S. Radomirovic (no. 687)

The third order Melnikov function of a quadratic center under quadratic perturbation
A. Buica, A. Gasull, J. Yang (no. 688)

Asymptotics of orthogonal polynomials via the Koosis theorem
F. Nazarov, A. Volberg, P. Yuditskii (no. 689)

A rotation method which gives linear L^p-estimates for powers of the Ahlfors-Beurling operator
O. Dragicevic, S. Petermichl, A. Volberg
(no. 690)

Quadratic perturbations of a quadratic reversible Lotka-Volterra system
C. Li, J. Llibre (no. 691)

Non compact euclidean cone 3-manifolds with cone angles less than 2π
D. Cooper, J. Porti (no. 692)

Hopf bifurcation of a delay differential equation with two delays
J. Llibre, A. Tarta (no. 693)

The mean Dehn functions of abelian groups
O. Bogopolski, E. Ventura (no. 694)

The word problem distinguishes counter languages
S. Cleary, M. Elder, G. Ostheimer (no. 695)

Traverso's isogeny conjecture for p-divisible groups
M.-H. Nicole, A. Vasiu (no. 696)

Lipschitz harmonic capacity and bilipschitz images of Cantor sets
J. Garnett, L. Prat, X. Tolsa (no. 697)

Two algorithms to find a power integral basis
L. H. El Fadil (no. 698)

Galois extension of CP-graded ring extensions
L. H. El Fadil (no. 699)

Valuations, intersections et fonctions de Belyi
R. Litcanu (no. 700)

Petits points et conjecture de Bogomolov
R. Litcanu (no. 701)

Semigroups of matrices of intermediate growth
F. Cedó, J. Okninski (no. 702)

Polynomial and linearized normal forms for almost periodic differential systems
W. Li, J. Llibre, H. Wu (no. 703)

Hopf bifurcation for degenerate singular points of multiplicity $2n - 1$ in dimension 3
J. Llibre, H. Wu (no. 704)

Reduction of periodic difference systems to linear or autonomous ones
W. Li, J. Llibre, H. Wu (no. 705)

Classes of measures generated by capacities
G. Dafni, G. E. Karadzhov, J. Xiao (no. 706)

Large deviation for BSDE with subdifferential operator
E. H. Essaky (no. 707)

On the injectivity of the Kudla-Millson lift and surjectivity of the Borcherds lift
J. Bruinier, J. Funke (no. 708)

CM points and weight $3 = 2$ modular forms
J. Funke (no. 709)

Stable rank of Leavitt path algebra
P. Ara, E. Pardo (no. 710)

The Cuntz semigroup, the Elliott conjecture, and dimension functions on C*-algebras
N. P. Brown, F. Perera, A. S. Toms (no. 711)

Multiplicity of limit cycles and analytic m-solutions for planar differential systems
A. Gasull, J. Giné, M. Grau (no. 712)

Real rank zero algebras have the corona factorization property
D. Kucerovsky, F. Perera (no. 713)

Stability of periodic solutions obtained via the averaging method for nonsmooth Lipschitz systems
A. Buica, A. Daniilidis (no. 714)

Distortion of Hausdorff measures and improved Painlevé removability for quasiregular mappings
K. Astala, A. Clop, J. Mateu, J. Orobitg, l. Uriarte-Tuero (no. 715)

Mixing invariants of hyperbolic 3-manifolds
C. Lecuire (no. 716)

The Bogomolov conjecture for totally degenerate Abelian varieties
W. Gubler (no. 717)

Tropical varieties for non-archimedean analytic spaces
W. Gubler (no. 718)

On the stability of periodic orbits in $\mathbb{R}^n$
A. Gasull, H. Giacomini, M. Grau (no. 719)

Convergence of singular integrals with general measures
P. Mattila, J. Verdera (no. 720)

On the complexity of the Whitehead minimization problem
A. Roig, E. Ventura, P. Weil (no. 721)

Random graphs on surfaces
C. McDiarmid (no. 722)

The equation $x^p y^q = z^r$ and groups that act freely on Λ-trees
N. Brady, L. Ciobanu, A. Martino, S. O. Rourke (no. 723)

Discriminating groups: a comprehensive overview
B. Fine, A. M. Gaglione, A. Myasnikov, D. Spellman (no. 724)

Number of preprints
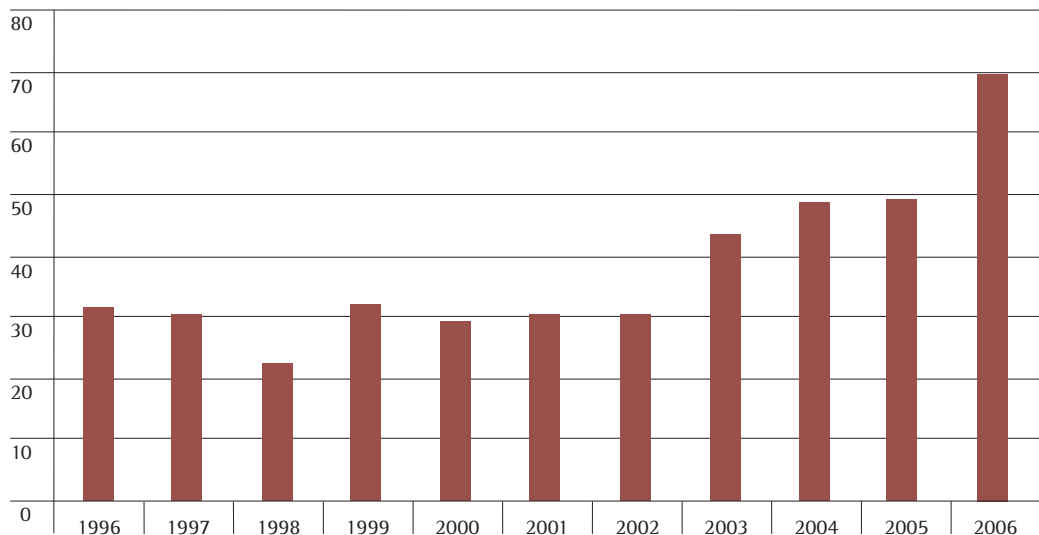
Encryption methods using formal power series rings
G. Baumslag, Y. Brukhov, B. Fine, G. Rosenberger (no. 725)

Dynamics of the third order Lyness' difference equation
A. Cima, A. Gasull, V. Mañosa (no. 726)

On the number of K_3-minor-free and maximal $K_{3,3}$-minor-free graphs
S. Gerke, O. Giménez, M. Noy, A. Weissl (no. 727)

Diophantine approximation on projective varieties I: algebraic distance and metric Bézout theorem
H. Massold (no. 728)

Numerical schemes of diffusion asymptotics and moment closures for kinetic equations
A. Cima, A. Gasull, V. Mañosa (no. 729)

7.4   OTHER PUBLICATIONS

Other than the aforementioned series and as a result of CRM activities, the following book was published:

• *Set Theory*, edited by Joan Bagaria and Stevo Todorcevic, published by Birkhäuser as part of the *Trends in Mathematics* series.

8. THE EUROPEAN FRAMEWORK

8.1 ERCOM

ERCOM (European Research Centres on Mathematics) is a committee under the European Mathematical Society (EMS) consisting of the scientific directors of European research centres in the Mathematical Sciences. Only centres for which the number of visiting staff substantially exceeds the number of permanent and long-term staff, and which cover mathematical sciences broadly, are eligible for representation in ERCOM.

The purposes of ERCOM are:

• to constitute a forum for communication and exchange of information and to foster collaboration and co-ordination among the centres themselves and between the centres and the EMS;

• to promote advanced research training on a European level;

• to advise the Executive Committee of the EMS on matters related to activities of the centres;

• to contribute to make the EMS more visible;

• to cultivate contacts with similar research centres within and outside Europe.

The CRM is a member of ERCOM from its foundation.

The Chairman of ERCOM is named for a period of four years (renewable for two further years) by the EMS Executive Committee by proposal of ERCOM, and is to be Jan Karel Lenstra, Director of the Centrum voor Wiskunde en Informatica for the 2006-2009 period.

The ERCOM annual meeting for 2006 was held at the Institut des Hautes Études Scientifiques, in Bures-sur-Yvette, on March 24 and 25. Jan Karel Lenstra of the Centrum voor Wiskunde en Informatica has taken over as president of ERCOM. At the beginning of the meeting he thanked the former president, Manuel Castellet, for all the work he had done for his team and took advantage of the occasion to introduce John Toland of the International Centre for Mathematical Sciences, as Vice-Chairman and Herman te Riele, also of the Centrum voor Wiskunde en Informatica, as Scientific Secretary.

The ERCOM centres explained their fundraising policies and their objectives in this field, in which the work of the Institute des Hautes Études Scientifiques was singled out for particular praise. The ERCOM member discussed about the guidelines of the European Research Council (ERC), a new European Union initiative, as part of its seventh framework programme, and whose aim is to finance fundamental research (including life sciences) by the strict criteria of excellence.

The next ERCOM meeting will be held on March 16 and 17, 2007 at the Abdus Salam International Centre for Theoretical Physics in Trieste.

Web: www.ercom.org

8.2 EPDI

Since December 2000, the CRM has been a member of the EPDI (European Post-Doctoral Institute for the Mathematical Sciences), which groups nine European research institutes: the Institut des Hautes Études Scientifiques (IHÉS) in Bures-sur-Yvette (which was the promoter and the Director of which, J.-P. Bourguignon, is still the Co-ordinator), the Max-Planck-Institut für Mathematik in Bonn, the Isaac Newton Institute for

the Mathematical Sciences in Cambridge, the Max-Planck-Institut für Mathematik in den Naturwissenschaften in Leipzig, the Institute Mittag-Leffler in Djursholm, the Banach Center in Warsaw, the Erwin Schrödinger Institut in Vienna, the Forschungsinstitut für Mathematik (FIM) in Zürich, and the CRM.

The EPDI annually awards two-year long post-doctorate grants in the field of Mathematics (pure and applied) and Mathematical Physics, which are offered to young researchers in European countries.

This year a grant was awarded to Carlo Marinelli, who came on a post-doctorate visit to the CRM from 2007 to April 2008, under the scientific direction of Marta Sanz, a professor at the Universitat de Barcelona. Doctor Marinelli works on stochastic analysis and its applications to financial mathematics, in particular on stochastic and deterministic optimal control for distributed systems, differential equations and stochastic partial derivatives with jumps and stable modelling of phenomena with heavy tails.

There were 38 candidates for grants in 2006, of which 37 mentioned the CRM in their itinerary. The competition period was resolved in two phases; in the first, at a meeting held at the IHÉS on December 18, a pre-selection of 16 candidates was made, three of whom were linked to the CRM. At the meeting of the Scientific Committee held in January 2007 in Stockholm, these 16 pre-selected candidates were ordered; the candidates that mentioned the CRM in their itineraries were placed in three of the leading positions. These were, respectively, Victor Kleptsyn (who proposed a collaboration with Jaume Llibre from April to September 2008), Julie Deserti (who proposed a collaboration with Marcel Nicolau and Maria Alberich from October 2008 to September 2009), and Anne Pichereau (who proposed a collaboration with Eva Miranda from October 2007 to September 2008 and will participate in the research pro-

gramme on Geometric Flows and Equivariant Problems in Symplectic Geometry). The withdrawal of two of the first five candidates meant that J. Deserti and A. Pichereau finally obtained the grant.

Web: seven.ihes.fr/EPDI/index.html

8.3 SHAPING NEW DIRECTIONS IN MATHEMATICS FOR SCIENCE AND SOCIETY

8.3.1 PROJECT OUTLINE

The NEST programme (New and Emerging Science and Technology) is an activity of the 6th Framework Programme of the European Commission, whose aim is to promote highly innovative research, possibly opening new directions for science and technology. Besides stimulating research aimed to the development of new techniques and supporting multidisciplinary scientific knowledge, the NEST programme aims to consolidate efforts made in emerging research fields. It also aims to help planning support activities for the European Research Area. The programme includes several complementary lines of action and also foresees support actions. These can be methodological studies or activities that promote links within the research community about important scientific and technological advances.

The project entitled Shaping New Directions in Mathematics for Science and Society (MATHFSS) is one of the Support Actions that were approved in 2005 within the NEST programme. It will last two years since December 1, 2005. It has been made possible by the collaboration of the following ERCOM centres:

• Centre de Recerca Matemàtica, project co-ordinator

• Emmy Noether Research Institute for Mathematics, Israel

• European Institute for Statistics, Probability and Operations Research (EURANDOM), The Netherlands

• Institut des Hautes Études Scientifiques (IHÉS), France

The goal of the project is to foster international contacts and draw training contents in Mathematics around the following emerging research topics:

- Systems Biology

- Risk Assessment

- Mathematical Neuroscience

- Digital Content Security

For each one of these topics, a group of experts will write a report on the current state of research, including proposals for training strategies aimed at young investigators and opinions about possible scientific developments in the coming years. The resulting reports will be the main content of a booklet that will be edited by the CRM upon termination of the project in December 2007. This booklet will also include policy recommendations to the European Commission.

8.3.2   ACTIVITIES DURING 2006

Several activities have been planned within the MATHFSS project, mainly workshops and round tables, addressed to cutting-edge researchers and scientific policy makers from European countries. The following events took place during 2006:

• *Risk Measures and Risk Management for High-Frequency Data*, workshop and round table held at EURANDOM, Eindhoven, from March 6 to 8, 2006. Organising Committee: O. E. Barndorff-Nielsen (Aarhus), W. Polasek (Wien), J. L. Teugels (Leuven), H. Wynn (London).

• *Shaping New Directions in Mathematics for Science and Society*, round table held on August 24, 2006 in Madrid, within the scientific programme of the International Congress of Mathematicians, ICM 2006. Co-ordinator: C. Casacuberta (CRM). Moderator: M. Teicher (Bar-Ilan). Panelists: T. Ebrahimi (Lausanne), F. Marcellán (MEC), D. Terman (Ohio), H. Wynn (London).

• *Mathematical Neuroscience,* a conference organised by the CRM at the Universitat d'Andorra from September 1 to 4, 2006. Co-ordinator: A. Guillamon (UPC). Scientific Committee: D. Terman (Ohio), A. Compte (Alacant), A. Guillamon (UPC), H. G. Rotstein (Boston).

• *Mathematical Aspects of Brain Functions: Compositionality and Synchronization*, a workshop organised by the Emmy Noether Institute at the Accademia dei Lincei, Roma, from October 9 to 11, 2006. Organising Committee: E. Arbarello (Roma), M. Teicher (Bar-Ilan), A. Treves (Trieste).

On February 4, 2006, a meeting of the MATHFSS Advisory Committe took place at the CRM, with the goal of devising lines of action of participating centres and planning activities for 2006. The meeting was attended by Jean-Pierre Bourguignon (IHÉS), Carles Casacuberta (CRM), Manuel Castellet (CRM), Enric Nart (UAB), Mina Teicher (Bar-Ilan), and Henry Wynn (EURANDOM). It was chaired by Mina Teicher. The meeting allowed to fix a calendar of activites for the whole project, together with a list of priority scientific topics within each of the four main themes of the project. The membership of the four Expert Groups was advised. Guidelines were given for the Round Table at the ICM 2006, and other possible actions around the project were discussed. Shortly after this meeting, the CRM printed and distributed Catalan and English versions of an informative leaflet.

The project was co-ordinated by Manuel Castellet until June 2006. Carles Casacuberta has acted as co-ordinator since then. The first report, covering activities carried out between December 2005 and June 2006, was submitted to the European Commission on June 15, 2006. This report and other material can be downloaded from the project website www.mathfss.org, which is hosted and managed by the CRM.

8.4   IMSI MEETING

On the occasion of the International Congress of Mathematicians held in Madrid, on August 24, the IMSI held its four-yearly meeting, co-ordinated on this occasion by Douglas Arnold, Director of the IMA, and Manuel Castellet, Director of the CRM.

The IMSI has the following main objectives:

• For all of the different communities of mathematicians, to help promote the offer available at different mathematical sciences institutes around the world.

• To promote communication between mathematical sciences institutes in order to exchange knowledge about the best methods, improve coordination and cooperation and, if necessary, unify resources.

• To co-operate in projects that mathematical sciences institutes are able to contribute to in an exceptional manner, such as helping to make mathematical research companies more visible, increasing the opportunities for mathematicians in developing countries, etc.

9. THE INGENIO MATHEMATICA PROJECT

The CRM is one of the promotors, and currently a node, of a project entitled *Ingenio Mathematica*, which is being funded by the Spanish Ministry of Education and Science (MEC) with 1.5 million euros per year during the period 2006-2011. This project was awarded to a large coalition of mathematical research groups in Spain on the first call of the *Consolider-Ingenio 2010* programme of the MEC. The official starting date was October 3, 2006. The research co-ordinator of the project is Enrique Zuazua (UAM) and the management center is located at the Universidad de Cantabria.

The main goal of the project is to improve the role of mathematical research in the Spanish system of science, technology and innovation. More specific goals are to promote the use of computational methods both inside and outside mathematical research; to achieve greater recognition for Spanish research groups at an international level and to increase the presence of Spanish mathematicians in strategic areas, to create a Doctorate School of international status; to use research and innovation to improve education and mathematical training at all levels; and to make the results of mathematical research more accessible, both from within and from outside Mathematics.

The scientific direction of the project lies under the responsibility of a Board of Directors, formed by Alfredo Bermúdez de Castro, Joaquim Bruna, Eduardo Casas, Antonio Durán, Laureano González-Vega, Manuel de León, Marco Antonio López-Cerdá, Ignacio Luengo, Consuelo Martínez, Marta Sanz-Solé, Oriol Serra, Carles Simó, Luis Vega, and Enrique Zuazua. The nodes of the project are the CRM, the CESGA (Centro de Supercomputación de Galicia), the CIEM (Centro Internacional de Encuentros Matemáticos, Castro Urdiales), the ICM (Instituto de Ciencias Matemáticas, to be created soon in Madrid), and the IMUB (Institut de Matemàtiques de la Universitat de Barcelona).

Four platforms, named *Future, Consulting, Computing*, and *EDU*, provide a frame for the actions of *Ingenio Mathematica*, running in parallel with two instruments, the International Graduate School and the Programmes of Intensive Research.

The CRM, thanks to its wide experience and suitable equipment, is defined within the project as a particularly well-suited node for the management of Programmes of Intensive Research. Using a part of its 2006 budget, Ingenio Mathematica will partially support the following CRM programmes:

• Enumerative Combinatorics and Random Structures;

• Mathematics and Digital Content Security.

The CRM has sent an open invitation to research groups participating in *Ingenio Mathematica* for the organisation of other Programmes of Intensive Research, or any other activity that is in accordance with the CRM general objectives.

10. CRM DOCTORATE SCHOLARSHIPS

In 2003, the CRM initiated a new policy to stimulate mathematical research in lines of investigation linked to the different priority thematic areas of the European Union's Sixth Framework Programme, with different initiatives reflected in the Report of Activities for the year 2005.

In order to promote impetus for this new line of action, this year the CRM has announced and awarded three scholarships of a duration of four years each, for a doctoral thesis at a university in Catalonia in one of the following areas:

- Digital Content Security
- Mathematical Neuroscience
- Mathematical Finance

The scholarships were opened to recent graduates from any institution in the world. Eighteen candidates from nine different countries (15 men and 3 women) applied. The applications were distributed across the three areas as follows: Digital Content Security, 5; Mathematical Neuroscience, 5; Mathematical Finance, 8.

A committee formed by professors Antoni Guillamon (UPC), Jorge Luis Villar (UPC), Enric Nart (UAB), Frederic Utzet (UAB) and Josep Vives (UB) analysed the documentation presented by these 18 candidates and submitted its proposal to the CRM Directorate Team, who accepted it.

The three candidates to receive a CRM doctorate scholarship were:

- Mrs. Somayeh Heidarvand, graduate of Arak University, Iran, for a doctoral thesis on Digital Content Security under the supervision of Jorge Luis Villar, at the Universitat Politècnica de Catalunya.

- Mr. Pedro Ernesto García Rodríguez, graduate of Universidad de Oriente, Santiago de Cuba, for a doctoral thesis on Mathematical Neuroscience under the supervision of Antoni Guillamon and Gustavo Deco, at Universitat Pompeu Fabra.

- Mr. Albert Ferreiro, graduated at the Universitat Autònoma de Barcelona, for a doctoral thesis on Mathematical Finance under the supervision of Frederic Utzet, at the Universitat Autònoma de Barcelona.

11. SOCIAL ACTIVITIES

Since its beginnings, the CRM has not only attempted to provide its visiting researchers with the finest working conditions, but has also helped them to learn about the social and cultural situation in Catalonia, the country that is their temporary home. Every year a certain number of social activities, museum visits, countryside excursions, festive celebrations and so on also take place, which help to stimulate conversation between local and visiting researchers.

Several social events and informal activities were held in 2006, which include the following:

- Visit to the Cistercian monasteries of Poblet and Santes Creus, with *calçotada* feast, February 4.
- Conference on Catalan culture, March 23.
- Excursion to Cabrera, May 6.
- Excursion to Montserrat, October 22.
- Celebration of All Saints Day, October 31.
- Celebration of Christmas, with *torrons*, December 19.
- Celebration of the birth of Anna Maria, daughter of Sergey Tikhonov, born November 13, 2006.
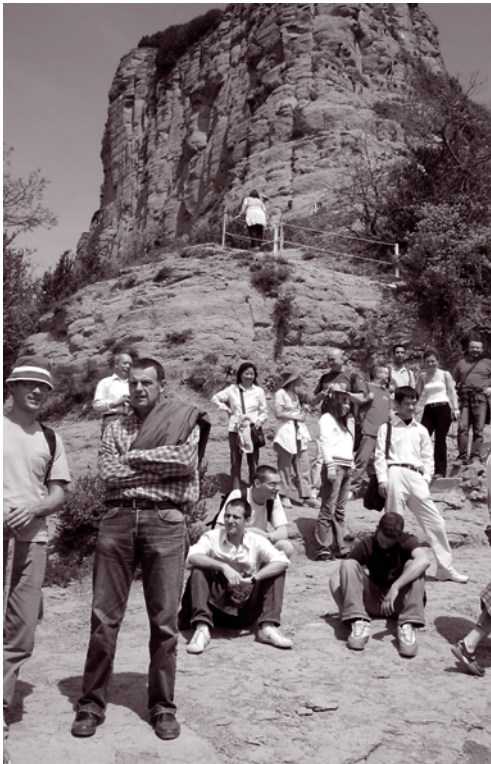
12. DISTINCTIONS

12.1 CREU DE SANT JORDI PRIZE

For 2006, the Catalan Government awarded the Director of the CRM, Manuel Castellet, with the *Creu de Sant Jordi* in recognition of his invaluable career in the university environment and his contribution to research through the creation of the internationally prestigious Barcelona Algebraic Topology Group, affiliated to the Universitat Autònoma, and also for his long-standing links with the Institut d'Estudis Catalans, of which he is a former President, and for founding and managing the Centre de Recerca Matemàtica.

The *Creu de Sant Jordi* is the greatest honour bestowed by the Generalitat de Catalunya. It was created in 1981 to honour those people who have been of particularly special service to Catalonia in the defence of its identity and the restoration of its personality, or more generally in both the civic and cultural areas.

This was the second time that this distinction has been awarded to a mathematician. In 1994 it was awarded to Lluís Santaló, a Catalan mathematician who emigrated to Argentina.

In 1991 Manuel Castellet had previously been honoured by the Generalitat de Catalunya when he received the Narcís Monturiol Medal in recognition of scientific and technological merit.

12.2 JOSÉ LUIS RUBIO DE FRANCIA PRIZE

The Real Sociedad Matemática Española's José Luis Rubio de Francia Award for young researchers that have distinguished themselves through the quality of their work was presented to Doctor Javier Parcet, a researcher at the Centre de Recerca Matemàtica.

Javier Parcet, a young 30 year old who studied at the Universidad Autónoma de Madrid, at Texas A&M University, and at Illinois University, performed research at the CRM in 2006 as part of a Ramón y Cajal contract.

The Scientific Committee was notably impressed by the results of Parcet's recent study of non-commutative analysis, as well as the development of a new theory for hypergeometric polynomials.
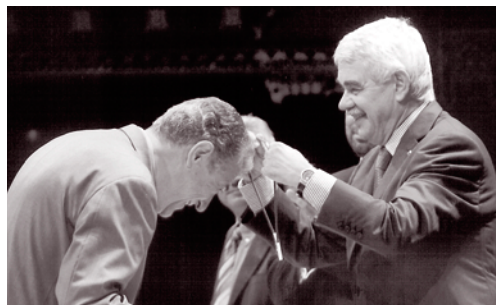
13. FERRAN SUNYER I BALAGUER FUNDATION AWARD

In 2006 the Institut d'Estudis Catalans and the Ferran Sunyer i Balaguer Foundation presented the fifteenth edition of the Premi Internacional Ferran Sunyer i Balaguer. The award is presented to a monograph that explains the progress made in research of the most recently developed areas of Mathematics. The winner receives 12,000 euros and the winning work is published by Birkhäuser as part of its Progress in Mathematics series.

For the 2005 call, the Scientific Committee, made up of Antonio Córdoba (UAM), Oriol Serra (UPC), Paul Malliavin (Université de Paris VI), Joseph Oesterlé (Institut de Mathématiques de Jussieu) and A. Weinstein (University of California at Berkeley) recommended that the Foundation should present the award to the following monograph:

Holomorphic Morse inequalities and Bergman kernels

by Xiaonan Ma, École Polytechnique Palaiseau, and George Marinescu, Johann-Wolfgang-Goethe Universität

Ma and Marinescu's book presents a self-contained and unifying approach, from the perspective of the theory of local index, to holomorphic Morse inequalities and asymptotic expansions of Bergman kernels. The authors' work opens several lines of study of highly active areas of the research of complex, Kählerian and symplectic geometry. The authors also present several applications, such as an analytical test of the Kodaira vanishing theorem, a solution of the Grauert-Riemenschneider and Shiffman conjectures, compactification of integral Kählerian varieties of pinched negative curvature, Berezin-Toeplitz quantisation, weak Lefschetz theorems, the asymptotic study of Ray-Singer analytical torsion, etc.

Since 2003, the Director of the Foundation has been Pere Pascual, professor at the Universitat Politècnica de Catalunya.

Web: www.crm.cat/info/ffsb.htm
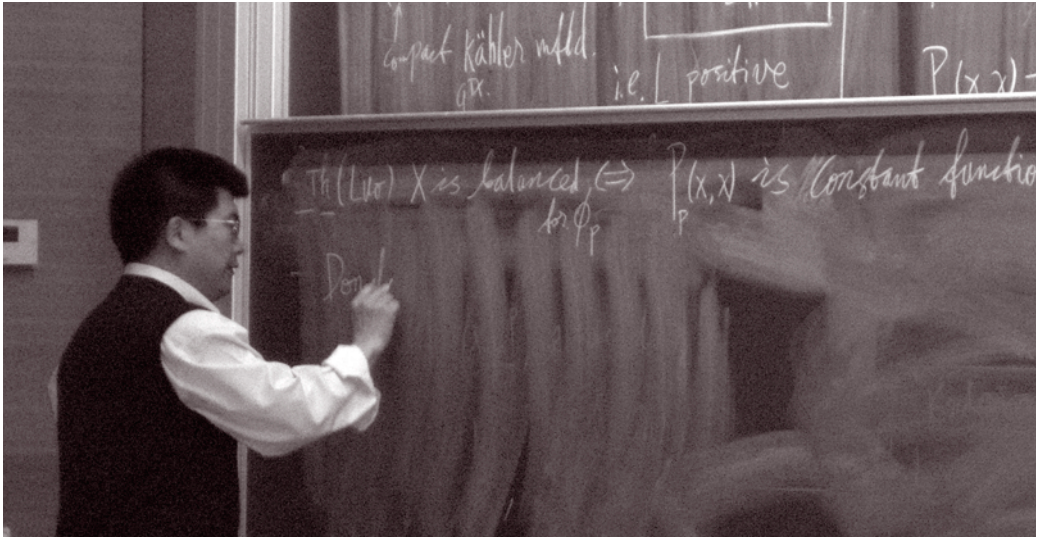
14. INSTITUTIONAL FUNDING

14.1 VISITING PROFESSORS (MEC, DURSI, UAB)

J. Wildeshaus	01.09.2005 – 31.07.2006
Z. Zhang	01.10.2005 – 31.07.2006
A. Poltoratski	15.01.2006 – 15.03.2006
J. Kramer	01.02.2006 – 30.04.2006
J. Garnett	20.04.2006 – 20.07.2006
M. Ferrante	01.06.2006 – 31.08.2006
S. Bazzoni	01.09.2006 – 28.02.2007
D. Welsh	01.09.2006 – 31.08.2007

14.2 POST–DOCTORAL FELLOWSHIPS (MEC, DURSI)

C. Lecuire	01.01.2005 – 30.09.2006
D. Pasca	01.03.2005 – 31.08.2006
E. H. Essaky	01.05.2005 – 30.09.2006
B. Deroin	01.09.2005 – 31.08.2006
A. Yaman	01.09.2005 – 30.11.2006
J. Yu	01.10.2005 – 31.03.2007
Y. Ding	01.11.2005 – 31.10.2006
P. Prihoda	01.09.2006 – 19.08.2008
S. Elizalde	01.10.2006 – 30.09.2008

14.3 MARIE CURIE FELLOWSHIPS (UE)

|	
O. Penacchio	01.10.2003 – 31.01.2006
S. Tikhonov	01.09.2004 – 31.08.2006
L. Ciobanu	01.01.2005 – 31.12.2006
J. Dubois	01.09.2006 – 31.08.2008
A. Yaman	01.12.2006 – 30.11.2008

14.4 CONFERENCES AND ADVANCED COURSES

• Barcelona Conference in Planar Vector Fields (AGAUR, UAB, MEC)

• Advanced Course on Arakelov Geometry and Shimura Varieties (MEC, UAB)

• Workshop on Fourier Analysis (AGAUR)

• Conference on Recent Developments in the Arithmetic of Shimura Varieties, a conference of the European Mathematical Society, funded by the European Commission (AGAUR, UE, MEC)

• Conference on Mathematical Neuroscience, with the collaboration of the Universitat d'Andorra (MEC, NEST, UPC)

• Advanced Course on Combinatorial and Computational Geometry, with the collaboration of the Universidad de Alcalá (MEC)
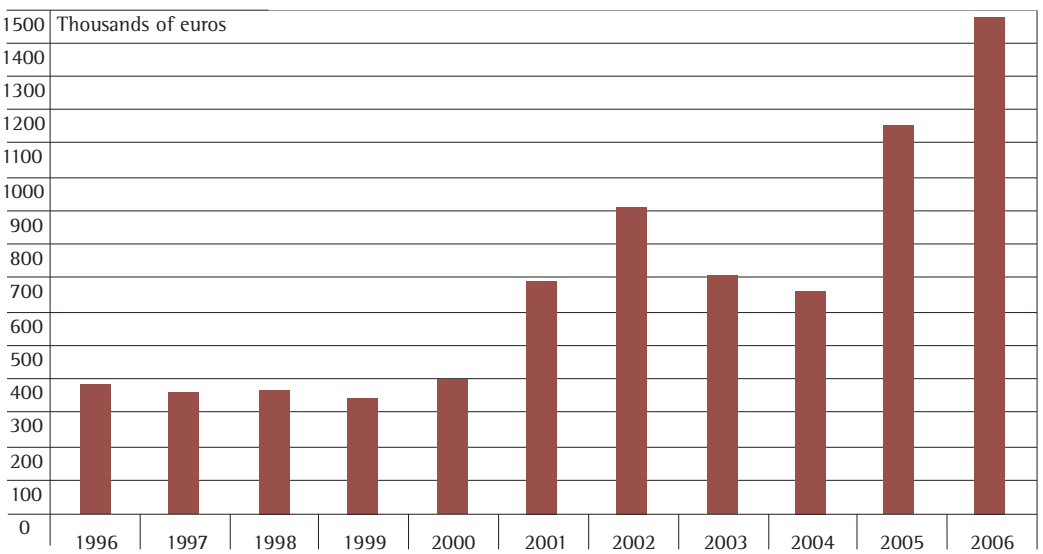
14.5 OTHER FUNDS

• Participation in ERCOM (MEC)

• Shaping New Directions in Mathematics for Science and Society (UE)

• Research Programme on Arakelov Geometry and Shimura Varieties (MEC)

• Research Programme on Hilbert's 16th Problem (MEC)

Institutional funding
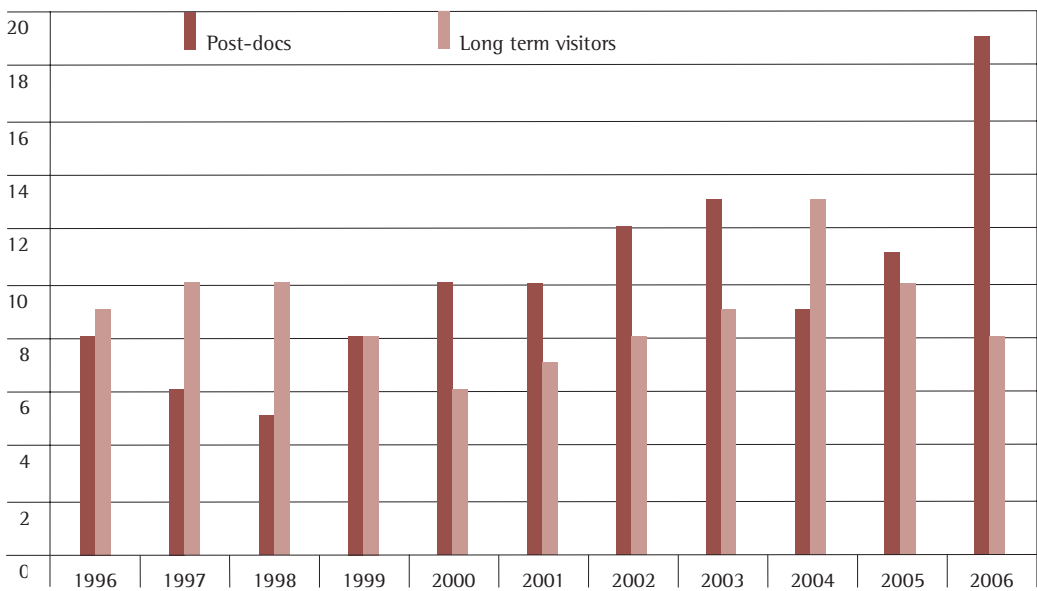
CRM's budget

15. FINANCIAL ACTIVITY

15.1 REVENUE

DURSI (subsidy)	500.135,04 €
DURSI (calls)	33.605,00 €
Ingenio Mathematica	50.000,00 €
MEC	363.165,04 €
UE	300.268,83 €
UAB (facilities)	97.480,13 €
UAB (activities)	9.374,54 €
UPC	1.000,00 €
SCM	1.400,00 €
Registration fees	31.216,38 €
Remainder year 2005	88.569,33 €
Other income	843,05 €
Total	**1.477.057,34 €**

15.2 EXPENDITURE

Visitors	377.485,76 €
Post-doctoral fellows	313.395,84 €
Graduate students	11.200,00 €
Conferences and courses	203.085,93 €
UAB facilities	97.480,13 €
Long-term material	53.802,43 €
Day-to-day material	65.492,15 €
Administration	129.265,11 €
Directorate	19.706,43 €
External services	23.532,38 €
Publications	8.616,88 €
Miscellanous	38.235,01 €
Amortisation of debts	50.000,00 €
Applied provision (PhD Grants)	85.759,29 €
Total	**1.477.057,34 €**

FUTURE ACTIVITIES

16. SCHEDULED SCIENTIFIC ACTIVITIES

16.1 RESEARCH PROGRAMMES

16.1.1 RESEARCH PROGRAMME ON HOMOTOPY THEORY AND HIGHER CATEGORIES

Period

From September 1, 2007, to July 31, 2008

Scientists in charge

Local   Carles Casacuberta (UB)
Joachim Kock (UAB)

Visitors   André Joyal
(Université du Québec à Montréal)

Amnon Neeman
(Australian National University)

Frank Neumann
(University of Leicester)

Main research topics

Homotopical structures lie at the heart of important developments in algebra, geometry, topology, and mathematical physics. The present research programme is devoted to categorical expressions of such structures, and in particular to the interplay between derived categories, Quillen model categories, and higher categories, with emphasis on applications. Leading experts in the fields of homotopy theory and higher category theory will be gathered together to explore the latest developments in these topics and stimulate further advances.

Visiting researchers

Michael Batanin
Macquarie University

Clemens Berger
Université de Nice – Sophia Antipolis

Julia Bergner
Kansas State University

Carles Casacuberta
Universitat de Barcelona

Denis-Charles Cisinski
Université de Paris XIII

Emmanuel Dror Farjoun
Hebrew University of Jerusalem

Vincent Franjou
Université de Nantes

Nicola Gambino
Université du Québec à Montréal

André Joyal
Université du Québec à Montréal

Bernhard Keller
Université de Paris VII

Joachim Kock
Universitat Autònoma de Barcelona

Henning Krause
Universität Paderborn

Tom Leinster
University of Glasgow

Georges Maltsiniotis
Université de Paris VII

Ieke Moerdijk
Universiteit Utrecht

Amnon Neeman
Australian National University

Dmitry Orlov
Russian Academy of Sciences

Jiri Rosický
Masarykova Univerzita

Brooke Shipley
University of Illinois at Chicago

Jeff Smith
University of British Columbia

Bertrand Toën
Université Paul Sabatier

Activities
Seminars

A weekly seminar on Homotopy Theory and Higher Categories, co-ordinated by Carles Casacuberta and Joachim Kock.

Workshops

Thematic weeks will be devoted to the following topics:

- Derived categories
- Categorical groups
- Groups and classifying spaces
- Homotopical localization
- Differential and topological *stacks*

Advanced course

Simplicial Methods in Higher Categories, February 4 to 14, 2008.

Conference

Higher Homotopy Structures and Derived Categories, June 30 to July 5, 2008.

16.1.2. RESEARCH PROGRAMME ON GEOMETRIC FLOWS AND EQUIVARIANT PROBLEMS IN SYMPLETIC GEOMETRY

Period

From January 1, 2008, to July 31, 2008

Scientists in charge

Local   Eva Miranda (UAB)

Joan Porti (UAB)

Visitors Rui Loja Fernandes
(Instituto Superior Técnico, Lisboa)

Vicente Miquel
(Universitat de València)

Research topics

• **Geometric Flows** (from January to March): Mean curvature flow, convexity in constant curvature, and Ricci flow. Renewed interest in the field has developed those recent years, thanks to the results of Perelman on the Ricci flow and Huisken and Sinestrari on the mean curvature flow among others.

• **Symplectic Geometry** (from April to July): Current problems in symplectic and Poisson Geometry. Special emphasis will be given to geometrical aspects of group actions on these manifolds such as moment maps, integrable systems and symplectic groupoids.

Visiting researchers

Jaume Amorós
Universitat Politècnica de Catalunya

Huai-Dong Cao
Lehigh University

Marius Crainic
Universiteit Utrecht

Carles Currás Bosch
Universitat de Barcelona

Rui Loja Fernandes
Instituto Superior Técnico

John Lott
Ann Arbor

Sylvain Maillot
Université Louis Pasteur

Carlo Mantegazza
Scuola Normale Superiore di Pisa

Vicente Miquel
Universitat de València

Eva Miranda
Université Paul Sabatier

Philippe Monnier
Université Paul Sabatier

San Vu Ngoc
Université de Grenoble I

Juan-Pablo Ortega
Université de Franche-Comté

Duong Phong
Columbia University

Joan Porti
Universitat Autònoma de Barcelona

Manuel Ritoré
Universidad de Granada

Eberhard Teufel
Universität Stuttgart

Gang Tian
Princeton University

Peter Topping
University of Warwick

Pol Vanhaecke
Université de Poitiers

Burkhard Wilking
Universität Münster

Ping Xu
Pennsylvania State University

Marco Zambon
Universität Zürich

Activities

Seminars

Two weekly seminars, one on Geometric Flows and another one on Equivariant Problems in Symplectic Geometry.

Workshops

GESTA 2008 (Symplectic Geometry with Algebraic Techniques) May, 2008.

GAP VI (Geometry and Physics VI, topic: Integrable systems) June 16 to 22, 2008.

Curs avançat

Geometric Flows and Hyperbolic Geometry, March 12 to 19, 2008.

Congresos

Conference on Moment Maps, June 23 to 28, 2008.

16.2 SPECIALISED QUARTERS

16.2.1 COMPLEX NON-SMOOTH DYNAMICAL SYSTEMS

Period

From January 1 to March 31, 2007

Scientists in charge

Local   Enric Fossas
(Universitat Politècnica de Catalunya)

Teresa Martínez-Seara
(Universitat Politècnica de Catalunya)

Visitors   Mario di Bernardo
(University of Bristol)

John Hogan
(University of Bristol)

Gerard Olivar
(Universidad Nacional de Colombia)

Research topics

Non regular systems correspond through dynamics associated to brusque changes in position or velocity or wherever there is a threshold. These systems appear both in nature, as is the case of neuronal destruction in biology or impacts in mechanics, and in engineering, for example in transmission or control mechanisms.

This thematic programme will focus on the five following subjects, all of which are related to the analysis, simulation and control of complex non-regular systems:

- Theoretical analysis
- Bifurcations
- Numerical analysis
- Control
- Applications to Biology and Electronics

Visiting researchers

Ricardo Alzate Castaño
Università di Napoli Federico II

Fabiola Angulo García
Universidad Nacional de Colombia

Víctor Avrutin
Universität Stuttgart

David Barton
University of Bristol

Alan Richard Champneys
University of Bristol

David Chillingworth
University of Southampton

Alessandro Colombo
Politecnico di Milano

Harry Dankowicz
University of Illinois at Urbana-Champaign

Mario di Bernardo
University of Bristol

Stephen J. Hogan
University of Bristol

Martin Homer
University of Bristol

Tamás Insperger
Budapest University of Technology and
Economics

Alain Guy Jacquemard
Institut de Mathématiques de Bourgogne

Joanna Mason
University of Bristol

Gerard Olivar
Universidad Nacional de Colombia

Gustavo-Adolfo Osorio Londoño
Università di Napoli Federico II

Petri Piiroinen
University of Bristol

Athanasios Polynikis
University of Bristol

Stefania Santini
Università di Napoli Federico II

Michael Schanz
Universität Stuttgart

Slobodan Simic
San José State University

Gábor Stépán
Budapest University of Technology and
Economics

Marco Antonio Teixeira
UNICAMP

Francisco Torres
Universidad de Sevilla

Pankaj Wahi
College Station

16.3 OTHER VISITING RESEARCHERS DURING 2007

Alsina, Montserrat	Number Theory	Universitat Politècnica de Catalunya
Blanchet, Adrien	Analysis	Centre de Recerca Matemàtica
Bolte, Jérôme	Analysis	Université de Paris VI
Carlen, Eric	Analysis	Georgia Institute of Technology
Carvalho, Maria	Analysis	Universidade de Lisboa
Di Francesco, Marco	Differential Equations	Università di l'Aquila
Dubois, Jérôme	Geometry	Centre de Recerca Matemàtica
Garnett, John	Analysis	University of California at Los Angeles
Gauthier, Paul M.	Analysis	Centre de Recherches Mathématiques
Kishimoto, Daisuke	Algebraic Topology	Kyoto University
Kono, Akira	Algebraic Topology	Kyoto University
Marinelli, Carlo	Probability and Statistics	Universität Bonn
Marinescu, George	Analysis	Johann-Wolfgang-Goethe-Universität
Morozov, Evsey	Probability and Statistics	Russian Academy of Sciences
Palmer, Vicent	Geometry	Universitat Jaume I
Ponce, Enrique	Dynamical Systems	Universidad de Sevilla
Tan, Jinggang	Equacions Diferencials	Centre de Recerca Matemàtica
Thatte, Bhalchandra	Discrete Mathematics	Universität Bielefeld
Wright, David J.	Number Theory	Oklahoma State University

16.4 OTHER CONFERENCES AND ADVANCED COURSES

X Workshop on Celestial Mechanics

Co-ordinators: Montserrat Corbera, Jaume Llibre, Mercè Ollé

CRM, Bellaterra, September 5 to 7, 2007