

**Master Class**  
2005 > 2006



**FINITE AND INFINITE  
DIMENSIONAL  
DYNAMICAL SYSTEMS**



**Spring school**  
2006

**ABELIAN VARIETIES**



**M**

**R**

**I**  
The Netherlands

**MATHEMATICAL RESEARCH INSTITUTE**



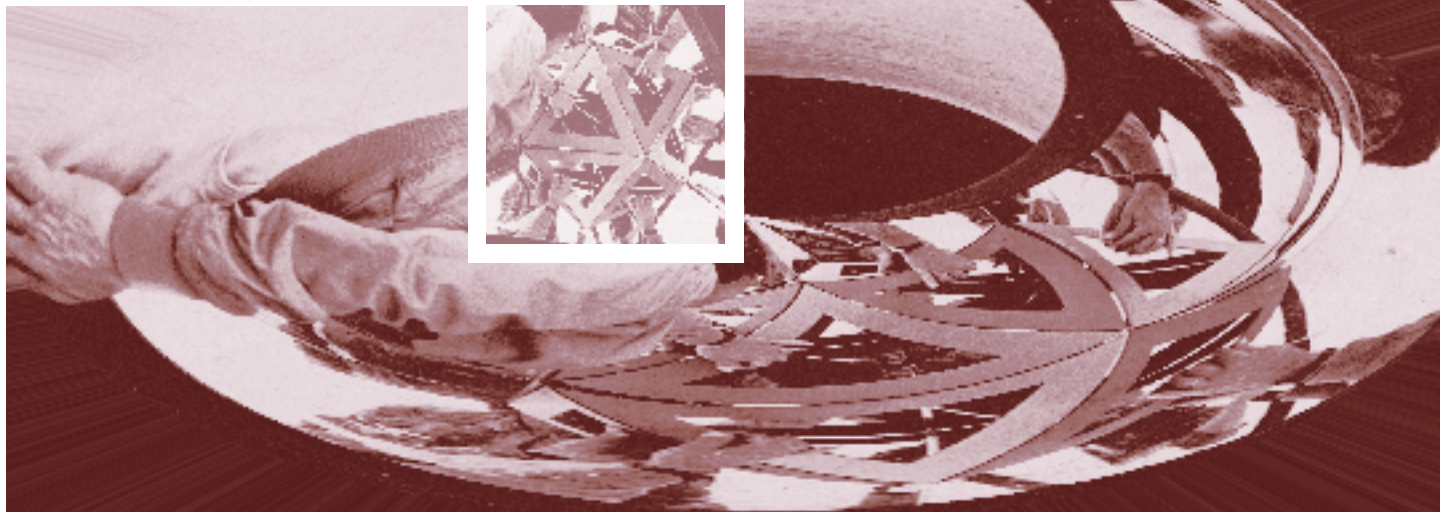
# MATHEMATICAL RESEARCH INSTITUTE

There is something paradoxical about mathematical research. Unraveling a mathematical problem is a highly individual activity, but it is precisely in discussion with colleagues that questions and problems emerge. Interaction is crucial.

In 1994, four of the leading mathematics departments of universities in the Netherlands joined forces to form an inspiring platform for interaction by founding the Mathematical Research Institute (MRI). In doing so, the universities of Groningen, Nijmegen, Twente and Utrecht have further reinforced the position of Dutch mathematical research, the quality and productivity of which is ranked in the European top. The MRI covers a broad range of specializations, with emphasis on five central areas in mathematics: algebra and geometry, analysis, stochastics and operations research. The MRI's research is characterized by its attention to the dynamic relationship between fundamental and applied aspects of mathematics. In order to stimulate the quality and the development of its research, the MRI pays a great deal of attention to education and training of researchers.

The Master Class (one year) and Spring School (one or two months) occupy an important place in the MRI's programme of studies. They are open to anyone in the final years of their undergraduate studies, and also to graduate students. These courses offer a unique opportunity for mathematical talent to develop in the context of current topics that vary annually. Both Master Class and Spring School are specifically aimed at an international audience, and have proved to be successful in bringing together Dutch and foreign students. The language of instruction is English, which makes these schools accessible to foreign students.

All partners of MRI are directly involved with its programs – this guarantees a high level of quality. MRI also has excellent connections in The Netherlands and abroad and regularly invites guest lecturers. This multi-faceted and international atmosphere allows students to get the most out of different visions: an inspiring and challenging situation.

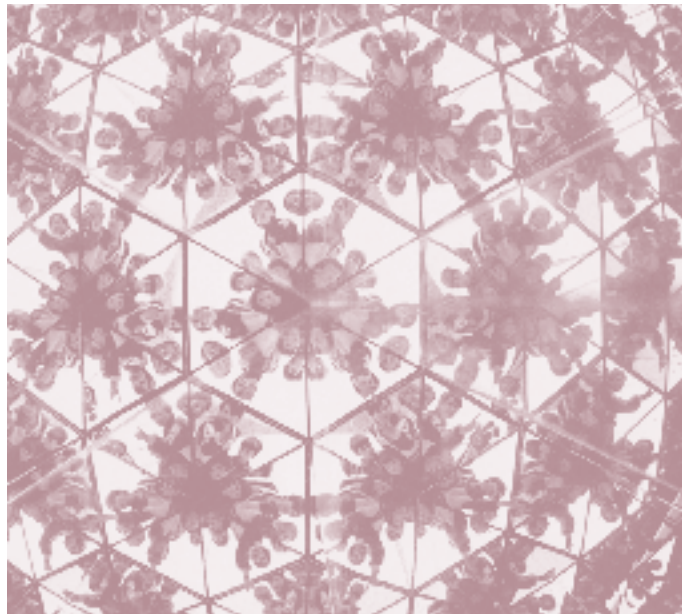
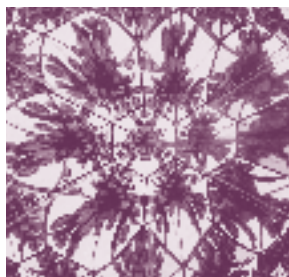
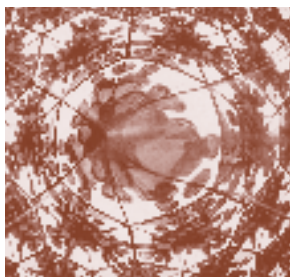


# MASTER CLASS

In the one-year-long Master Class, a current topic is studied intensively and profoundly at an advanced level. The Master Class can form a significant contribution to a PhD programme or preparation for one.

The programme runs from September through June and includes two full days of lectures and seminars per week and individual work on a test problem. The emphasis is on independent, individual effort, but contact with lecturers is personal and intensive. Lecturers give feedback using the work turned in by participants, as well as extensive exercise material. There is a weekly consultation hour for individual questions. Regular evaluation and testing guarantees the quality of the programme. Students who complete the courses successfully will be awarded a Master Class Certificate.

**The final application deadline for the 2005/2006 Master Class is APRIL 1, 2005** (non-EU residents) and MAY 1, 2005 (EU-residents), by which date applications and the necessary documents must have been received by the MRI. Candidates will be selected on the basis of previous academic achievement and references from their home universities. It is preferable to apply before the middle of January 2005, because early acceptance enhances the possibilities for obtaining external scholarships see web-site:  
[www.nuffic.net/Files/huygensform.pdf](http://www.nuffic.net/Files/huygensform.pdf)



Admission and tuition fees for the Master Class are 2269 euro. The cost of a modest but pleasant stay in The Netherlands, including residence and insurance, is approximately 650 euro per month. In addition to the cost of travel to and from The Netherlands, an extra amount of 700 euro will be needed to cover travel expenses in The Netherlands to and from the locations of supplemental educational activities.

Participants needing financial support are requested to approach potential sponsors individually, through their own universities or international institutions, for example. In a few cases, the MRI may be able to help with applications for a stipend. The MRI itself only offers a limited number of stipends.

# FINITE AND INFINITE DIMENSIONAL DYNAMICAL SYSTEMS

The research area “nonlinear dynamical systems” covers all aspects of the evolution of systems that may, or may not, be spatially extended. Many connections exist to various areas of applications, such as life and earth sciences, physics, etcetera. This Master Class aims at presenting a unified view point for the study of finite and infinite dimensional systems, including partial differential equations and functional differential equations.

A central theme in the field of dynamical systems theory concerns the long term behavior of systems, in which the concepts of (finite dimensional) attractor and inertial manifold plays a key role. Attractors may represent orderly dynamics, such as quasi-periodic motion, or a traveling wave, but can also carry (spatio-temporal) chaotic dynamics. A second unifying theme between the study of finite and infinite dimensional systems is bifurcation theory, in which the transitions between various kinds of attractors are studied.

Apart from developing the mathematical theory, significant attention will be paid to the interactions between the theory and applications, and to the usage of numerical tools and methods for detection of bifurcations and the simulation of longtime dynamics. Here is the list of courses we offer.



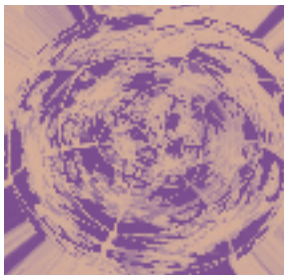
## PROGRAMME 2005/2006

### FIRST SEMESTER

- > **Dissipative Systems and Numerical Methods**  
Yu. A. Kuznetsov, O. Diekmann
- > **Dynamical Systems**  
H. Broer, A.J. Homburg, M. Martens
- > **Infinite Dimensional Dynamical Systems**  
A. Doelman, S. van Gils, J. Hulshof
- > **Seminar: Dynamics and Patterns**  
coordinators H. Broer, A. Doelman, S. van Gils

### SECOND SEMESTER

- > **Variational Methods**  
Van Groessen, M. Peletier
- > **Dynamical Systems**  
H. Broer, A.J. Homburg, M. Martens
- > **Infinite Dimensional Dynamical Systems**  
A.. Doelman, S. van Gils, J. Hulshof
- > **Seminar: Dynamics and Patterns**  
coordinators H. Broer, A. Doelman, S. van Gils



# SPRING SCHOOL 2006

The Spring School offers participants the opportunity to delve intensively, for a brief period, into the chosen current topic. Successful participation in the Spring School can form a part of one's university studies.

The Spring School includes a preparatory period in one's own country and a programme in The Netherlands. The Netherlands programme lasts one or two months (April and May) and includes lectures and seminars for one or more days a week. The lectures are complemented by computer sessions and exercise classes. Background material for the Spring School will be distributed some months before the course starts. In principle, participants can use this to independently prepare for the school. Participants receive help with these preparations at a distance, or in collaboration with the home university. The Spring School concludes with a week-long instructional conference, a series of presentations, seminars and discussions in which international experts participate.

The final date for applications to the 2006 Spring School is October 1, 2005. Applications and the necessary documents must have been received by the MRI secretariat by that date. Candidates will be selected on the basis of previous academic achievement and references from the home university. Admission and tuition fees for the Spring School are 908 euro. Stay in the Netherlands will cost participants approximately 1135 euro, including residence and insurance. Participants needing financial support are requested to approach potential sponsors individually, through their own universities or international institutions, for example. In a few cases, the MRI may be able to help with applications for a stipend. The MRI also offers a limited number of stipends of its own.

# ABELIAN VARIETIES

The 2006 Spring School will deal with Abelian Varieties and their applications. Abelian varieties are projective varieties with the structure of an algebraic group. They play a central role in algebraic geometry and number theory as well as in other fields. We intend to give an advanced introduction to abelian varieties, both stressing the geometric and more arithmetic aspects, the relations with algebraic curves, their moduli and the applications. A basic text on abelian varieties will be distributed. A number of lecturers will discuss the various rather diverse aspects of the topic.

Lecturers include: G. Cornelissen, B. Edixhoven, G. van der Geer, E. Looijenga, B. Moonen, F. Oort and J. Steenbrink.

The Spring School takes place in May 2006 at Utrecht University. It will be followed by a short conference 29-31 May in Amsterdam for which we shall invite a number of specialists in the field. A more detailed programme will be presented later.



# STUDYING IN THE NETHERLANDS

The kingdom by the North Sea with its mild climate has been an international meeting point for scientists and artists for centuries. The well-known wooden shoes and windmills are charming stereotypes, but knowledge and science represent a larger part of The Netherlands' international trade than Dutch cheese and tulips. There is a long tradition of university research and education in The Netherlands. The oldest Dutch universities have their roots in medieval times. Through the centuries, the universities have developed from monks' schools into modern research and educational institutions.

Higher education is a fundamental component of Dutch culture, and studying in The Netherlands has become more than simply following courses: it has become a way of life. The scientific climate in The Netherlands is open and communicative. The relationship between students and lecturers, and among students themselves, is less formal than in many other countries. Student life offers opportunities for culture, sport and recreation. Foreign students will find that a well-organized and lively student life and a tolerant national culture make for a pleasant period of study in The Netherlands. Language need not be a problem, as many Dutch people speak English.

## STUDYING AT THE MRI

The participating universities are located in Groningen, Nijmegen, Twente and Utrecht, each with its own special attractions. This particular Master Class in Noncommutative Geometry is a joint initiative of the University of Utrecht and the University of Amsterdam. The cities of Amsterdam and Utrecht are a half hour train ride apart, and courses will take place at both Universities.

The MRI helps students find housing in one of the four cities, on campus or in a student house. Participants in the Master Class and Spring School have full use of the university facilities, such as excellent libraries and computers with Internet connection (e-mail).



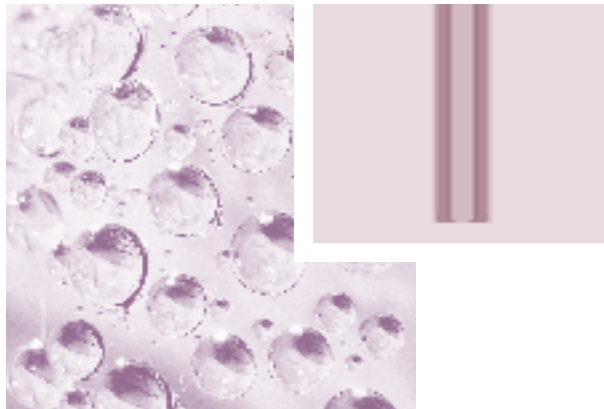
**Camilo Arias Abad (Colombian), starting PhD student in Utrecht, former student in the 2003-2004 Master Class**

"I truly enjoyed the Master Class on Non Commutative Geometry held in Utrecht/Amsterdam in 2003/2004. Since the beginning it was clear that the lecturers would be of the highest level, that the classes would be difficult and that we were expected to work a lot.

I also realized soon that my classmates were all (as I am) genuinely interested in mathematics, and this resulted in many useful discussions and made my stay in Utrecht much more interesting and pleasant.

It was always easy to talk to the professors and ask them the very frequent questions. They were always ready to help me with my doubts and much more than that. I learned a lot from the close contact with them.

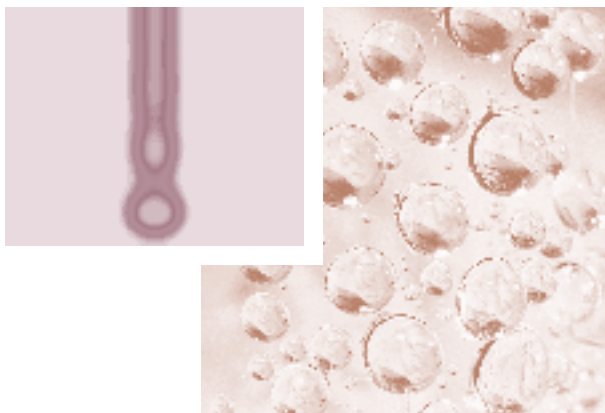
Life in Utrecht was interesting by itself, people at the department were kind and helpful, and a very nice environment to study. Hopefully, I will come back in September."



**Javier Fernandez de Bobadilla de Olazabal (Spanish),  
PostDoc at Utrecht University, former student in the  
1996-1997 Master Class, former PhD student in  
Nijmegen/Utrecht.**

"I participated in 1996/97 Master Class in Complex Geometry and Topology. The quality of the programme was very good. The courses were well selected, broad and deep. The lecturers knew how to go direct to the heart of the matter in each course. Moreover, I found the test problem an excellent way to get immersed into a research topic and make a first contribution. In fact my current research interests are more related with my test problem than with the topic of my Ph.D. thesis.

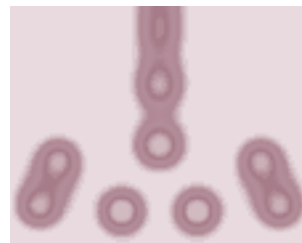
Besides the Master Class itself one can benefit very much from the scientific environment of M.R.I. There are leading experts in many fields of mathematics, and interesting courses, seminars and talks are organized on a regular basis. Actually, like many other Master Class students, I continued my stay in M.R.I. until I finished my Ph.D, and I further continued my stay in The Netherlands on a Post Doc position. I have no doubt that Master Class has been a corner-stone of my career."



**Marius Crainic (Romanian), Master Class coordinator  
(researcher at Utrecht University), former student in the  
1995-1996 Master Class, former PhD student Utrecht}**

“My decision to come to The Netherlands to take part in the Master Class (1995-1996) was one of the most inspired (and difficult) decisions I ever took. It was totally new for me, and later it became part of my normal life. Mathematically (and not only), a new world opened in front of me. Having around excellent mathematicians which are at the same time excellent teachers and friendly persons, is indeed a very good environment for studying and for research.

In the last few years I had the opportunity to see many of the students that took part in the Master Classes, and several of them are now colleagues or (and) friends. Probably the most appropriate label that one can attach with the Master Class is “diversity”. Students come from all over the world, backgrounds are very different, culturally and mathematically, and the paths that the students take after the Master Class are quite various: some go back to their own country, some continue with a PhD project (in The Netherlands or elsewhere), some decide to go and work in industry, etc, etc. But, for one year, they all come here driven by their passion for mathematics, they often spend (working or partying) nights together, become friends. The life in Holland is itself pleasant and interesting. The people are friendly, life is very well organized, and the country is so small that in less than one hour by train you can move between most of the big cities (Amsterdam, Den Hague, Nijmegen, Rotterdam, Utrecht, etc), while in two-three hours you can be in Koln (Germany), Brussels (Belgium), Paris (France), etc.”



**Prof. dr. D. Siersma, director of the MRI.**

“I have experience with the Master Class of the MRI since the beginning (around 1990). I have been teaching several courses and was very often impressed by the efforts from the students. Master Class students come from all over the world. They have different cultural background, which makes teaching in the master class very interesting. Also the mathematical background is different in most cases. First we have to make some efforts to introduce all students to the common prerequisites of the subject. This is mostly done in the first semester. An important ingredient is also the weekly seminar, where the students talk by themselves about mathematics.

During the second semester the lectures discuss new developments. Some of courses are especially designed for this part of the master class. Moreover there is the ‘research problem’. During this period there is a very near contact between student and supervisor and it mostly takes a lot of work to finish the paper in time.

The end of June closes with examinations and graduation. This is mostly the end of a successful year.”



# APPLICATION DEADLINES

## MASTER CLASS

**April 1/May 1, 2005**

## SPRING SCHOOL

**October 1, 2005**

To apply for the Master Class or Spring School send the following documents to the secretariat of the MRI:

- > curriculum vitae (including the following details: first name, surname, date of birth, nationality, address, postal code, city, country, phone number, fax, email address)
- > academic record: list of subjects/classes taken at university, subjects for degree examination, photocopy of diploma (if available)
- > recommendations from members of the academic staff of the home university (at least one)
- > a summary of financial circumstances (if financial support is necessary).



## MATHEMATICAL RESEARCH INSTITUTE

**Jean Arthur** (Spring School)

**Pet Grondman** (Master Class)

**Utrecht University**

**P.O.Box 80010**

**3508 TA Utrecht**

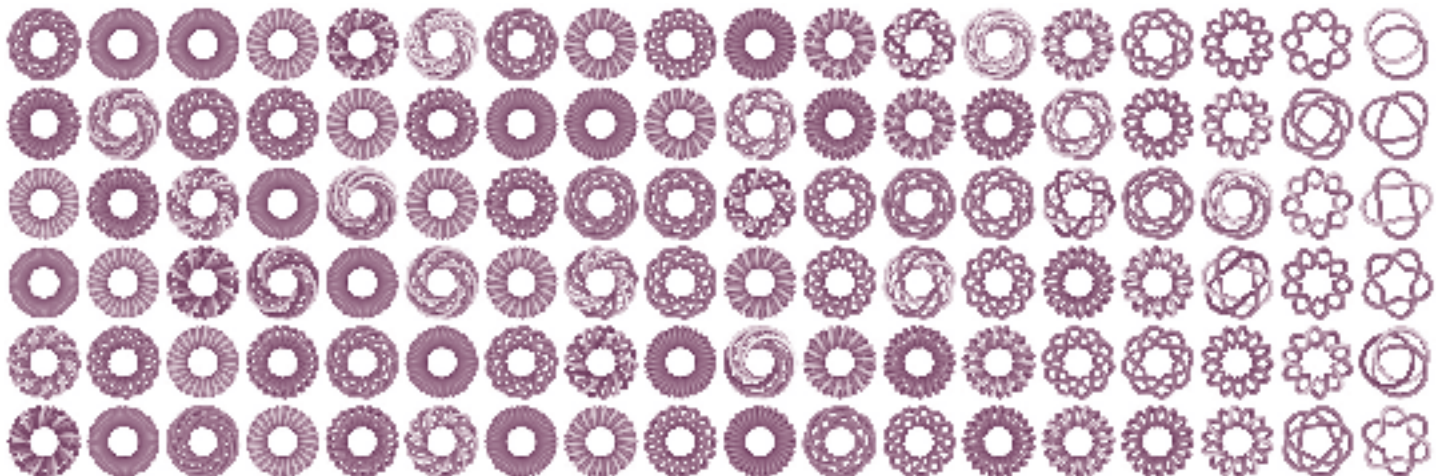
**The Netherlands**

Phone **+31-30-2531430**

Fax **+31-30-2518394**

e-mail **mri@math.uu.nl**

web-site **<http://mri.math.uu.nl>**





**MATHEMATICAL RESEARCH INSTITUTE**

**Jean Arthur** (Spring School)

**Pet Grondman** (Master Class)

**Utrecht University**

**P.O.Box 80010**

**3508 TA Utrecht**

**The Netherlands**

Phone **+31-30-2531430**

Fax **+31-30-2518394**

e-mail **[mri@math.uu.nl](mailto:mri@math.uu.nl)**

web-site **<http://mri.math.uu.nl>**