



Annual Report 1999
Korteweg-de Vries Institute for Mathematics

Faculty of Science, Universiteit van Amsterdam

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Mission statement of the Korteweg-de Vries Institute

The Korteweg-de Vries Institute is the research institute for mathematics of the Universiteit van Amsterdam. The members of the institute share a love for mathematics, both pure and applied, and they feel delight in bringing over this feeling to students: to those who specialize in mathematics as well as those who need math in another discipline, and also those who want to hear about mathematics in its historical development and as a driving force in culture. Our research ambitions are high and cover a wide area, but some choices of topics have to be made. A certain coherence in those choices is important, as well as interaction with other fields such as physics, geoscience, biology, computer science, finance etc. Statistics must be explicitly mentioned as a very vital part of what we see as mathematics. There should be a substantial relationship between our excellence in research and our success in obtaining funding from outside the university. It is the aim of the institute to increase commercial activities in balance with their scientific interest.

Preface

The year 1999 was an important year for the KdV Institute in many respects. First of all there were some important changes in personnel in the area of Algebra and Geometry. Dr. Eric Opdam, coming from Universiteit Leiden, was appointed on the vacant chair of full professor in geometry and algebra. He is an expert in algebraic groups and Hecke algebras. Opdam started his professorship here in August 1999.

It became also known in 1999 that dr. Peter Stevenhagen, who was heading the number theory project, accepted a full professorship at Universiteit Leiden. He is starting there in January 2000. His departure will mean the end of the number theory project at the KdV Institute. We regret the end of a rich tradition in this area in Amsterdam. We thank dr. Stevenhagen for his activities for the KdV Institute. The excellence of his teaching should be mentioned in particular.

Our stochastics programme was strengthened by the appointment of dr. Peter Spreij as a UD. He is coming from the Faculty of Economic Sciences and Econometry of the Vrije Universiteit Amsterdam. He is working in probability theory and he has an interest in financial mathematics.

During 1999, members of the KdV Institute had remarkable successes in obtaining research grants, in particular from NWO. (The full list is included in this annual report.) This causes a steady growth of the number of people working at our institute. We were happy to get allocated to our institute three office rooms at the first floor of the Euclides building. At the second floor, which is the traditional home floor of our institute we had the open space behind the big lecture room rebuilt into a big office room which can house up to six people, mainly graduate students and junior guests.

The scientific advisory board of the KdV Institute, which was constituted in 1998, had its first two meetings on site during one-day visits in January and December 1999. The KdV Institute is happy to have three eminent members in this board. Their advise is of great value to the dean of the faculty and to the institute.

During several months in the spring of 1999 the KdV Institute hosted an exhibition of drawings and other pieces of art inspired by Escher, which were submitted by readers of *Pythagoras*, the math journal aiming at Dutch high school pupils which is sponsored by the KdV Institute joint with the math institutes of Technische Universiteit Delft and Universiteit Leiden. On the occasion of this exhibition we organized an afternoon lecture by prof. Jan van de Craats on “M.C. Escher en de wiskunde”.

The KdV Institute is aware of the importance of a good web presentation. Chris Zaal did a good job in making a facelift of the institute’s home page www.science.uva.nl/research/math. In September 1999 Chris moved to Universiteit Leiden, where he is continuing, among others, his managing editorship of *Pythagoras*. His task as webmaster was taken over by Misja Nuyens.

The number of undergraduate students in mathematics remains too low. This problem we share with most of the other Dutch universities.

The present annual report appears late and does not yet satisfy the criteria of attractive lay-out, meticulous reporting of all necessary details to the board of the Universiteit van Amsterdam, and offering some interesting reading to a wider audience. I apologize for this. I can assure that we will do our utmost to improve this in the annual report over the year 2000.

Tom Koornwinder

General overview and perspective

At the *Korteweg-de Vries Institute for Mathematics* (KdV Institute) of the *Universiteit van Amsterdam* (UvA), on-going research covers a wide range of subjects, both in pure and applied mathematics. Part of this research is internally motivated, while other parts have interactions outside mathematics: with natural sciences, life sciences, computer science, engineering, social sciences, economics, logistics, and even with humanities. That mathematics can interact with so many different sciences, is a consequence of the universal nature of mathematics, which provides a language for studying structures at an arbitrary high level of abstraction.

Besides aiming to be strong in a number of specialized mathematical fields, the KdV Institute stimulates mathematical research in areas where interaction between various fields is particularly intensive and promising. Indeed, the most interesting results often originate when different branches of mathematics interact with each other, or mathematics interacts with some other branch of science, or new mathematics is needed for an application in real life. The very name of our Institute illustrates this mechanism. KdV is an acronym known to mathematicians, physicists and engineers all over the world because the KdV equation occurs at so many different places in mathematics and physics. For those who do not know (see www.science.uva.nl/~janwieg/korteweg/): Korteweg was the first professor of mathematics here after the Amsterdam Athenaeum became a University. De Vries was a PhD student of Korteweg. The KdV equation, introduced in their paper of 1895, is a nonlinear partial differential equation describing waves in shallow water (such as a canal). The so-called solitary waves (solitons) are special solutions. From the sixties onwards there has been intensive activity by which hidden features of the KdV equation and its solutions were disclosed, thus catalyzing new theories and bringing together seemingly disconnected fields. There is still no end to this process.

Quality of research at the KdV Institute ranks high if measured by various external standards. In the VSNU Quality Assessment of Research in 1997 we ended second best. We are doing well in obtaining NWO funding. Notably in 1999 we had a rich harvest from this source. Furthermore we have a growing amount of *derde geldstroom* funding.

Here is some of our present focus. For convenience, some projects are clustered together in this description, but this clustering is certainly not rigid.

Pure mathematics and mathematical physics

For pure mathematics the UvA has a long and strong tradition in mathematical logic (Brouwer), algebra (H. Lenstra), geometry (N. Kuiper) and analysis (Korevaar). Recent international impact was made by our work on algebraic geometry (Van der Geer) and Lie theory and special functions (Koorwinder, Opdam). Mathematical Logic is now continued by Troelstra and Van Benthem in the nearby *Institute of Logic, Linguistics and Computation* (ILLC).

Our chair in mathematical physics, now occupied by Dijkgraaf, is unique within the Netherlands. By this chair we participate very actively in a movement which has already been going on for 20 years, namely that a substantial part of spectacular developments in pure mathematics finds its origin in physics (quantum field theory, string theory, statistical physics). The most fascinating aspect is that these physical ideas take on a life of their own

when transplanted into mathematics. There they give rise to new mathematical concepts, structures and theories, of great intrinsic mathematical interest, but also suitable for being applied again in physics and elsewhere. In particular, algebraic geometry, differential geometry and Lie theory, but possibly also number theory and stochastics profit from these ideas.

The KdV Institute is in an excellent position to give room to this dynamics. Some recent and forthcoming appointments will further contribute to this. On the side of pure mathematics Opdam started as a full professor last year. On the side of mathematical physics Landsman, whose position will be paid for some more years by KNAW and by FOM, will be tenured. Very noteworthy is the start of the *Center for Mathematical Physics Amsterdam* (CMPA) in 1998, with the support of the *College van Bestuur* (CvB) of the UvA. Dijkgraaf is the scientific director of this Center, in which groups from the KdV Institute (around Dijkgraaf, Van der Geer, Opdam, Koornwinder and Landsman) and the *Institute for Theoretical Physics* (ITF) participate.

The configuration just described will make the KdV Institute a strong player in algebraic geometry, Lie theory, special functions, string theory, and operator algebras and quantization, as well as their interrelations. In addition, our research in complex analysis should be mentioned.

Applied and numerical analysis

Differential equations, nowadays mostly nonlinear, are omnipresent for modelling phenomena in nature, engineering and other real life situations. The subtle tools of mathematical analysis can greatly contribute to qualitative understanding of solutions and to the development of numerical algorithms for obtaining approximate solutions. Conversely, the challenges of the applications assist in further developing the theories on the mathematical side. Furthermore, the theory of dynamical systems in the wider sense, both within and outside the context of differential equations, is nowadays extremely fruitful in many sciences.

Our group in *Applied Analysis and Dynamical Systems* (Doelman) works on the qualitative aspects of differential equations and, more generally, on dynamical systems. Doelman started as a full professor at the KdV Institute in 1998. The group is now considerably extending, with ample support of NWO. Interdisciplinary collaboration, such as with oceanography and biology, is part of its focus.

Research on the numerical aspects is performed by our group in *Numerical Algorithms*. The two professors in this group (Hemker and Van der Houwen) have their main affiliation at the *Centre for Mathematics and Computer Sciences* (CWI). The work of both projects is very relevant for computational science. In fact, the two groups participate in the *Amsterdam Center for Computational Sciences* (ACCS).

The KdV Institute has the intention to gradually merge these two groups. Expertise in Numerical Algorithms should remain of critical size in this merged group.

Stochastics

Another universal concept for modelling our world is stochastics. Almost no research in science and arts can avoid it, and few companies can do without, but unfortunately few are aware of the pitfalls when handling its tools in an unexperienced way, without a solid

mathematical foundation. Our Stochastics group, headed by Klaassen, is doing research on many of these mathematical aspects. It comprises Probability Theory, Mathematical Statistics and Industrial Statistics. This last project, headed by Does, is the most applied one, and has resulted into a very successful commercial enterprise *IBIS-UvA BV*, housed in the KdV Institute, and incorporated in the *UvA Holding*. This enterprise is feeding back interesting research questions.

In 1998 Keane joined the probability project as a part-time professor. His wide view, bridging stochastic and deterministic, and pure and applied mathematics, is a valuable addition to our institute. In 1999 Spreij joined this project as a UD.

Financial Mathematics

Financial Mathematics was started here a few years ago on a modest scale. It offers new intellectual challenges for Dynamical Systems and for Stochastics, and at the same time it opens new applications of mathematics and new possibilities for income from external sources. In cooperation with CWI and the *Vrije Universiteit Amsterdam* (VUA) the commercial enterprise *Financiële Wiskunde Amsterdam* (FWA BV) has been founded. It is our strong intention to form a larger group on Financial Mathematics within the KdV Institute on a mostly self supporting basis. Besides, basic courses on mathematical finance and the possibility of specializing in this direction will be introduced in the regular mathematics and statistics curriculum.

Discrete Mathematics

With Schrijver, part-time professor in discrete mathematics, our institute participates in world class research on network problems. The objectives are to analyze and optimize large and complex combinatorial structures (such as networks) with mathematical methods (algebra, geometry, topology, graph theory), to design efficient algorithms, and to test and apply the results to problems from practice (logistics, distribution, transport). A special program for Mathematics and Computer Science of Networks will be started soon by NWO. Furthermore, discrete mathematics is a topic in the math curriculum much chosen by students. This makes some further involvement of the KdV Institute with discrete mathematics desirable.

Collaboration with other groups and institutes

The KdV Institute also wants to extend its involvement in interdisciplinary research, departing from a solid foundation in the basic disciplines of mathematics. In addition to existing collaborations, most notably between mathematics and theoretical physics and in the Amsterdam Center for Computational Sciences, we are exploring possible joint projects within the Faculty of Science with the ILLC, the Institute of Computer Science, and the Department of Biology, and outside our Faculty with the Faculty of Economy and Econometrics and the Department of Psychology. Support from special NWO programs will be an important criterium in deciding to spend institute money on interdisciplinary projects. At present, Pijls collaborates with the Institute of Computer Science (Dorst) in supervising the PhD project *From Clifford Algebra to Geometric Algorithms*.

Outside UvA but at the *Amsterdam Science Center* (WCW), the presence of CWI is important to us. Amongst our researchers we have four part-time professors who have

their main affiliation at the CWI. This also provides links with research groups at CWI. Contacts with these groups will become still easier after the KdV Institute will have moved to WCW.

Another way of virtually extending our groups is collaboration with groups at other universities. In fact, many of our research groups participate in national networks, with regular intercity seminars, intensive courses for graduate students, and annual workshops with distinguished speakers from abroad. Organisational frameworks for these collaborations are the research schools *Thomas Stieltjes* (in which the KdV Institute participates), *MRI* and (for discrete mathematics) *EIDMA*, but many activities are nationwide or internationally oriented, transcending the boundaries of these research schools. We are exploring possible exchange agreements with some leading European research institutes in mathematics and mathematical physics.

Research related to teaching

The KdV Institute considers the teaching of mathematics as an important activity which should not be completely separated from our research activities, and which should be directed to many different groups of students, also in Social Sciences and in Humanities.

We identify some actual or potential activities which are on the borderline between research and education, and which are also very suitable for embedding in the new Faculty of Sciences. These concern computer algebra (developing algorithms in research and using it as a tool in math teaching), visualisation in mathematics as a didactical tool, didactical questions in computer aided high school teaching, and history of mathematics (in connection with more general history of science, and for the need of teaching). At present, van de Craats collaborates with the Amstel Institute in supervising the PhD project *Mathematical aspects of the beta-tool*.

List of research projects

Within the KdV Institute we distinguish 7 research *programmes*, most of which consist of two or three parts, called *projects*:

1. Algebra and Geometry
 - 1.1. Algebraic Geometry
 - 1.2. (old) Number Theory (ends in 1999)
 - 1.2. (new) Algebraic Groups (starts in 1999)
 - 1.3. Finite Group Theory
2. Analysis
 - 2.1. Lie Theory and Special Functions
 - 2.2. Complex Analysis
3. Mathematical Physics
 - 3.1. Quantum Field Theory, String Theory and Quantum Gravity
 - 3.2. Quantization and Operator Algebras
4. Stochastics
 - 4.1. Probability Theory
 - 4.2. Mathematical Statistics
 - 4.3. Industrial Statistics
5. Applied Analysis and Dynamical Systems
 - 5.1. Pattern Formation
 - 5.2. Financial Mathematics (joint with Stochastics)
6. Numerical Algorithms
 - 6.1. Multigrid, Sparse Grid and Overset Grid Methods
 - 6.2. Parallel Software for Implicit Differential Equations
7. Discrete Mathematics

A description of the projects, including plans for the next five years, has appeared in the Research Plan of the KdV Institute.

Roughly we consider our programmes 1, 2, 3 as within pure mathematics and programmes 4, 5, 6, 7 as belonging to applied mathematics. Mathematical Physics is put under pure mathematics because it relates very pure parts of theoretical physics (quantum field theory, string theory, statistical physics) with very pure parts of mathematics. Other, classical parts of mathematical physics, with old roots but still in vigorous development, better fit into Applied Analysis and Dynamical Systems. Altogether, we don't put a firewall between pure and applied mathematics: we consider what can be called "pure research" as an essential part of applied mathematics and we encourage pure mathematics to develop applied parts.

There is an enormous diversity in mathematics. In order to achieve some covering of the field, we therefore need a relatively large number of projects. As a consequence most groups are relatively small. This is in line with traditional practice in mathematics. Current international trends favour slightly bigger groups. However, quality and productivity are not necessarily correlated with the size of the group.

Composition of research groups in 1999

<i>position</i>	<i>name</i>	<i>funding</i>	<i>remarks</i>
Algebra & Geometry			
HL	v.d. Geer	1	
HL	Opdam	1	starting in August
UHD	Stevenhagen	1	
UHD	v.d. Waall	1	
PD	0.6 fte	4	
PhD	3.2 fte	1	
PhD	2.0 fte	2	
Analysis			
HL	Koornwinder	1	institute director
UHD	Wiegerinck	1	
UD	Hendriksen	1	
UD	De Paepe	1	smaller research task; management of <i>duaal leren</i>
PD	0.2 fte	2	until Oct. 2002, together with CWI
PhD	1.0 fte	1	
PhD	1.0 fte	2	
HL-Emer	Korevaar	0	
Mathematical Physics			
HL	Dijkgraaf	1	special position within Faculty; extra support from CvB
UD	Landsman	2	KNAW fellow
UHD	Pijls	1	smaller research task; management of math teaching
PD	1.0	2	
PD	1.0	4	
PhD	1.0 fte	0.6	
PhD	2.6 fte	2	
HL-Emer	de Jager	0	
Stochastics			
HL	Does	3,1	0.8 IBIS; smaller research task
HL	Klaassen	1	additional support from IBIS
HL	Keane	1	0.2, otherwise at CWI
UHD	Balkema	1	0.63 active; 0.37 retired
UD	Van Es	1	
UD	Spreij	0.9	started in February
UD	Edens	1	only teaching
TOZ	3.5 fte	3	at IBIS; smaller research task
PD	0.5 fte	2	
PhD	0.7 fte	1	
PhD	2.0 fte	2	
PhD	1.0 fte	3	financial mathematics, until 2002

Applied Mathematics and Dynamical Systems

HL	Doelman	1	
UD	de Vilder	1	0.2
PhD	0.2 fte	2	
HL	Van Strien	0	at Warwick; zero appointment at UvA

Numerical Algorithms

HL	Hemker	1	0.2 hired from CWI
HL	v.d. Houwen	1	0.2 on UD salary, otherwise at CWI,
UHD	Hoffmann	1	
UD	Pfluger	1	0.53 appointment, smaller research task
PhD	1.0 fte	1	

Discrete Mathematics

HL	Schrijver	1	0.2 appointment joint with FEE, otherwise at CWI
UD	de Vreugd	1	only teaching

Various

HL	v.d. Craats	0	popularization and didactics of math; zero appointment, otherwise at KMA and OU
OWP	Koper	1	only teaching
OWP	Geijssel	1	0.43 appointment; only teaching
PhD	0.5 fte	1	joint with Amstel Institute; paid by promovendi pool of Faculty

Unless otherwise mentioned the following will be valid:

- HL (full professor), UHD (universitair hoofddocent) and UD (universitair docent) have a permanent 1.0 position and spend 0.4 or 0.5 of their time on research.
- PD (postdoc) and PhD (PhD student) have a temporary 1.0 position and spend between 0.8 or 0.9 of their time on research.

Successful grant applications 1999 by members of KdV Institute

E. M. Opdam (NWO/GBE): PIONIER, 2000–2005.

E. M. Opdam (KNAW): 3-year KNAW fellowship 1-2-2000 until 1-2-2003 for J. V. Stokman
G. van der Geer, R. H. Dijkgraaf and T. H. Koornwinder (NWO/GBE): kf 200 for partial covering of two-year appointment of senior researcher V. Schechtman.

R. H. Dijkgraaf (KNAW): Continuation for two years of KNAW fellowship of N. P. Landsman, from 1-7-2000 until 1-7-2002.

R. H. Dijkgraaf (FOM): *Dakpanconstructie* UHD Mathematical Physics for Landsman: kf 250 for the two-year period 1-7-2002 until 1-7-2004.

N. P. Landsman: Feodor-Lynen grant (Germany) for postdoc position B. Kuckert; in principle for 2 years, where host institute is contributing 1 kf per month. Only 6 months of this grant will be ‘used’ (about kf 50) since Kuckert has also won a Casimir-Ziegler research prize (see below).

N. P. Landsman: Casimir-Ziegler research prize for B. Kuckert (a joint prize of the Nordrhein-Westfälische Akademie der Wissenschaften (NWA) and the KNAW in order to advance the exchange of researchers). DM 100.000 for 1 year postdoc.

N. P. Landsman (FOM/Mathematical Physics): project *Spin-statistics connection and Unruh effect in quantum field theory*. 2-year post-doc position for B. Kuckert.

R. H. Dijkgraaf and G. van der Geer (FOM/Mathematical Physics): project *Mirror symmetry: algebraic, geometric and arithmetic aspects*: 4-year oio position.

A. Doelman (FOM): project *Secondary tides and quasi-periodically forced nonlinear oscillators*. 1 PhD position for 4 years.

A. Doelman (NWO/GBE/Wiskunde): project *Pattern formation in reaction-diffusion equations*. Kf 212 for one 4-year PhD position.

A. Doelman (NWO *Prioriteitsprogramma Non-Linear Systems*): Kf 100 for 1 UD starting in 2000, who will be tenured afterwards.

T. H. Koornwinder and N. M. Temme (CWI) (NWO/GBE/wiskunde): project *Algorithmic methods for special functions by computer algebra*. Kf 180 for postdoc during 2 years.

T. H. Koornwinder (NWO/GBE/Wiskunde): continuation of PhD project *Yang Baxter equations* by G. Carnovale from 1-1-99 until 15-5-99.

H. G. Pijls and L. Dorst (Computer Science Institute): PhD-project *From Clifford Algebra to Geometric Algorithms*, 4 years grant from the multidisciplinary PhD project pool of Faculty WINS.

E. M. Opdam (KNAW): KNAW fellowship of J. V. Stokman from 1-2-2000 until 1-2-2003.

“Derde geldstroom” projects

IBIS It is the mission of IBIS UvA BV to actively promote the knowledge and optimal use of statistics in society. This mission was successfully accomplished during 1999, as can be seen from a rise of the number of projects and a sharp increase in the returns, exceeding a million guilders. Especially, our own developed product *Business Improvement Program*, that has been registered as trademark in the Benelux countries, is in great demand and has found much appreciation among a variety of companies in the Netherlands. On the 20th of January 1999 IBIS UvA BV organized a very successful first lustrum symposium entitled *Business Improvement*. More then 200 visitors were welcomed in the Auditorium of the Universiteit van Amsterdam and listened to five different talks. Three speakers were coming from companies where IBIS UvA BV has been implementing and assisting projects, while the other two were from IBIS UvA BV itself. The day was brought to a close with the handing over of the first copy of the book *Statistical Process Control in Industry* to the chairman of the board of commissioners. As for scientific research, IBIS UvA BV has an outstanding reputation. On the 11th of February 1999 one of its employees received his Ph.D. of the University of Groningen, on the basis of his thesis, entitled *Statistical Process Control for Serial Correlated Data*. In addition the employees published many articles in journals like *Quality and Reliability Engineering International*, *Journal of Chemometrics*, *ISI Review* and several proceedings.

Financial Mathematics During 1999 activities in the area of financial mathematics were further developed, and a number of post doctoral courses were set up. These courses were an initiative of *Financiële Wiskunde Amsterdam*, which intends to become a BV. It is a joint programme of CWI Amsterdam, the KdV Institute and the Vrije Universiteit Amsterdam. Present director is dr. Peter Spreij (KdV Institute).

INTAS project Georgia-97-1828 Estimation of parameters and construction of goodness-to-fit tests in some non- and semi-parametric models. The project runs from 1 March 1999 to 1 March 2002. Cooperation between the UvA, Razmadze Mathematical Institute of the Georgian Academy of Sciences and Limburgs Universitair Centrum, Diepenbeek, Belgium. The scientific coordinator of the project is prof. dr. C. A. J. Klaassen of the KdV Institute.

Important editorships, etc.

prof. dr. R. H. Dijkgraaf:

- Editor, Communications in Mathematical Physics (1992-).
- Supervisory Editor, Nuclear Physics B (1994-).
- Editor, Journal of Geometry and Physics (1995-).
- Editor, Advances in Theoretical and Mathematical Physics (1997-).
- Editor, International Mathematical Research Notices (1999-).
- Member advisory committee of several Mathematics and Physics book series.
- Member Board Dutch Mathematical Physics Society (1996-)
- Member Scientific Steering Committee Isaac Newton Institute (1998-)
- Organiser Amsterdam Summer Workshop
- Organiser Workshop Non-Commutative Gauge Theory, November 22-26, Lorentz Center.
- Member International Advisory Committee: Strings 2001, Strings 2002, Schools on Algebraic Geometry and Physics.
- Visiting Professor MIT (April 99)
- Selected Invited Lectures: Dies Natalis University of Amsterdam, Strings 99

prof. dr. A. Doelman:

- editor Physica D (Nonlinear Phenomena)

prof. dr. G. van der Geer:

- managing editor Compositio Mathematica
- Editor Geometriae Dedicata
- Member Advisory committee mathematics, NWO
- Mitglied der Wissenschaftlichen Berichts Research Institute Oberwolfach
- Member Scientific Committee Max-Planck Institute, Bonn

prof. dr. T. H. Koornwinder:

- Member of selection committee mathematics, NWO

dr. R. H. van der Waall:

- 1995–September 1999, chairman *kamer wiskunde VSNU*

Publications 1999 by members of the KdV Institute

1. Programme Algebra and Geometry

Scientific publications (articles in journals, proceedings, edited books; monographs)

- A. Causao, R. Re and T. Teodorescu, *Some remarks on linear spaces of nilpotent matrices*, Pragmatic 1997 (Catania). *Matematiche (Catania)* 53 (1998), suppl., 23–32 (1999).
- A. C. P. Gee, *Class invariants by Shimura's reciprocity law*, *J. Théor. Nombres Bordeaux* 11 (1999), 45–72.
- G. van der Geer, *Cycles on the moduli space of abelian varieties*, in: *Moduli of curves and abelian varieties (The Dutch Intercity Seminar on Moduli)*, C. Faber and E. Looijenga (eds.), *Aspects of Mathematics*, Vieweg, Wiesbaden, 1999, pp. 65–89.
- G. van der Geer and F. Oort, *Moduli of abelian varieties*, in: *Moduli of curves and abelian varieties (The Dutch Intercity Seminar on Moduli)*, C. Faber and E. Looijenga (eds.), *Aspects of Mathematics*, Vieweg, Wiesbaden, 1999, pp. 1–21.
- G. van der Geer and M. van der Vlugt, *Constructing curves with many points by solving linear equations*, in: *Applications of curves over finite fields*, M. D. Fried (ed.), *Contemporary Math.* 245, Amer. Math. Soc., 1999, pp. 41–48.
- R. C. Lindenbergh and R. W. van der Waall, *Ergebnisse über Dedekind-Zeta-Funktionen, monomiale Charaktere und Konjugationsklassen endlicher Gruppen, unter Benutzung von GAP*, *Bayreuth. Math. Schr.* 56 (1999), 79–148.
- P. Moree, *On primes in arithmetic progression having a prescribed primitive root*, *J. Number Theory* 78 (1999), 85–98.
- P. Moree, *Uniform distribution of primes having a prescribed primitive root*, *Acta Arith.* 89 (1999), 9–21.
- V. Talamanca, *A note on height pairings of polarized abelian varieties*, *Atti Accad. Naz. Lincei, Cl. Sci. Fis. Mat. Nat., IX. Ser., Rend. Lincei, Mat. Appl.* 10 (1999), Fasc. 1, pp. 57–60.
- C. G. Zaal, *A complete surface in M_6 in Characteristic > 2* , *Compositio Math.* 119 (1999), 209–212.

Preprints and Reports

- C. Ciliberto and G. van der Geer, *The moduli space of abelian varieties and the singularities of the theta divisor*, preprint <http://xxx.lanl.gov/abs/math.AG/9911127>, 1999.
- G. Farkas, *The geometry of the moduli space of curves of genus 23*, preprint <http://xxx.lanl.gov/abs/math.AG/9907013>, 1999.
- A. C. P. Gee and M. Honsbeek, *Singular values of the Rogers-Ramanujan continued fraction*, *Math. Preprint Series*, KdV Institute, Univ. van Amsterdam, Report 99-19, 1999.

G. van der Geer and T. Katsura, *On a stratification of the moduli of K3 surfaces*, preprint <http://xxx.lanl.gov/abs/math.AG/9910061>, 1999.

G. van der Geer and T. Katsura, *Formal Brauer groups and the moduli of abelian surfaces*, preprint <http://xxx.lanl.gov/abs/math.AG/9912169>, 1999.

G. van der Geer and M. van der Vlugt, *Kummer covers with many points*, preprint <http://xxx.lanl.gov/abs/math.AG/9909037>, 1999.

E. M. Opdam, *A trace formula for the Iwahori-Hecke algebra*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-21, 1999.

V. Talamanca, *A Gelfand-Beurling formula for heights on endomorphisms rings*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-03, 1999.

Other Publications

G. van der Geer, *Knopen*, in: *Onbewezen Vermoedens, Vacantiecursus 1999*, CWI Syllabus 45, 1999, pp. 75–92.

P. Stevenhagen, *Priemgetallen*, in: *Onbewezen Vermoedens, Vacantiecursus 1999*, CWI Syllabus 45, 1999, pp. 17–29.

Ph. D. Thesis

M. Boguslavsky, *Lattices, codes and Radon transforms*, Dissertation, Universiteit van Amsterdam, June 23, 1999; Promotor: Prof. dr. G. B. M. van der Geer.

2. Programme Analysis

Scientific publications (articles in journals, proceedings, edited books; monographs)

P. Beneker and J. Wiegerinck, *Strongly exposed points in uniform algebras*, Proc. Amer. Math. Soc. 127 (1999), 1567–1570.

A. Bultheel, P. González-Vera, E. Hendriksen and O. Njåstad, *Orthogonal rational functions*, Cambridge University Press, 1999.

A. Bultheel, P. González-Vera, E. Hendriksen and O. Njåstad, *A density problem for orthogonal rational functions*, J. Comput. Appl. Math. 105 (1999), 199–212.

N. Ciccoli, E. Koelink and T. H. Koornwinder, *q -Laguerre polynomials and big q -Bessel functions and their orthogonality relations*, Methods Appl. Anal. 6 (1999), 109–127.

M. S. Dijkhuizen and J. V. Stokman, *Some limit transitions between BC type orthogonal polynomials interpreted on quantum complex Grassmannians*, Publ. Res. Inst. Math. Sci. 35 (1999), 451–500.

H. T. Koelink, *Some basic Lommel polynomials*, J. Approx. Theory 96 (1999), 345–365.

H. T. Koelink and J. Van der Jeugt, *Bilinear generating functions for orthogonal polynomials*, Constr. Appr. 15 (1999), 481–497.

T. H. Koornwinder, B. J. Schroers, J. K. Slingerland and F. A. Bais, *Fourier transform and the Verlinde formula for the quantum double of a finite group*, J. Phys. A 32 (1999), 8539–8549.

J. Korevaar, *Chebyshev quadrature recognizes algebraic curves and surfaces*, in *Approximation Theory IX, Vol. 1*, C. K. Chui and L. L. Schumaker (eds.), Vanderbilt University Press, Nashville, TN, 1999, pp 165–174.

J. Korevaar, *On a question of Brézis and Nirenberg concerning the degree of circle maps*, Selecta Math. (N.S.). 5 (1999), 107–122.

J. Korevaar, *Roots under convolution of sequences* Indag. Math. (N.S.) 10 (1999), 539–548.

J. V. Stokman and M. S. Dijkhuizen, *Quantized flag manifolds and irreducible $*$ -representations*, Comm. Math. Phys. 203 (1999), 297–324.

Preprints and Reports

M. Carlehed et J. Wiegierinck, *The Lempert function and the pluricomplex Green function are not equal in the bidisc*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-24, 1999.

M. Carlehed et J. Wiegierinck, *Exemples de fonctions plurisousharmoniques extrémales*, Prépublication Lab. de Math. E. Picard, Univ. Paul Sabatier, 176, Toulouse III, 1999.

G. Carnovale and T. H. Koornwinder, *A q -analogue of convolution on the line*, preprint <http://xxx.lanl.gov/abs/math.CA/9909025>, 1999.

J. Korevaar and M. A. Monerie, *Fekete polynomials and potentials for continua*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-07, 1999.

P. J. de Paepe, *Examples of infinitely generated function algebras*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-22, 1999.

J. Wiegierinck, *Graphs of holomorphic functions with isolated singularities are complete pluripolar*, Prépublication Lab. de Math. E. Picard, Univ. Paul Sabatier, 161, Toulouse III, 1999.

J. Wiegierinck, *Pluripolar sets: hulls and completeness*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-25, 1999.

Other Publications

W. Koepf, T. H. Koornwinder and R. Askey (eds.), *Special Issue on Orthogonal Polynomials and Computer Algebra*, J. Symbolic Comput. 28 (1999), No.6.

Ph. D. Thesis

G. Carnovale, *Algebraic and analytic aspects of the quantum Yang-Baxter equation*, Dissertation, Universiteit van Utrecht, June 14, 1999; Promotores: Prof. dr. E. J. N. Looijenga and prof. dr. T. H. Koornwinder.

3. Programme Applied Analysis and Dynamical Systems

Preprints and Reports

H. Bruin, S. Luzzatto and S. J. van Strien, *Decay of correlations in one-dimensional dynamics*, IHES preprint IHES/M/99/83, 1999.

A. Doelman, W. Eckhaus and T. Kaper, *Slowly-modulated two pulse solutions and the onset of splitting bifurcations*, Preprint 1103, Department of Mathematics, Utrecht University, 1999.

A. Doelman, R. Gardner and T. Kaper, *Large stable pulse solutions in reaction-diffusion equations*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-13, 1999.

O. Kozlovski, S. J. van Strien and R. G. de Vilder, *The two-fixed point lemma*, Warwick Preprint 28/1999, Math. Institute, Univ. of Warwick, 1999.

G. Levin and S. J. van Strien, *Bounds for interval maps with one inflection point II*, IHES preprint IHES/M/99/82, 1999.

S. J. van Strien, *Misiurewicz maps unfold transversally in families*, Warwick preprint 29/1999, Math. Institute, Univ. of Warwick, 1999.

Other Publications

(also mentioned under Stochastics) P. Spreij and R. de Vilder, *Beurskoersen en toeval*, Pythagoras 38 (februari 1999), no. 3, pp. 9–14.

(also mentioned under Stochastics) P. Spreij and R. de Vilder, *AEX en DAX*, Pythagoras 38 (april 1999), no. 4, pp. 13–17.

4. Programme Discrete Mathematics

Scientific publications (articles in journals, proceedings, edited books; monographs)

H. van der Holst, L. Lovász and A. Schrijver, *The Colin de Verdière graph parameter*, in: *Graph Theory and Combinatorial Biology*, János Bolyai Mathematical Society, Budapest, 1999, pp. 29–85.

L. Lovász and A. Schrijver, *On the null space of a Colin de Verdière matrix*, Ann. Inst. Fourier (Grenoble) 49 (1999), 1017–1026.

A. Schrijver, *Bipartite edge-colouring in $O(\Delta m)$ time*, SIAM J. Comput. 28 (1999), 841–846.

S. van Vlijmen, S. Klusener and A. Schrijver, *The compact dynamic bus station*, Electronic Notes in Theoretical Computer Science 21 (1999), no. 7, Elsevier, Amsterdam.

5. Programme *Mathematical Physics*

Scientific publications (articles in journals, proceedings, edited books; monographs)

- R. Dijkgraaf, *Fields, strings, matrices and symmetric products*, in: *Moduli of curves and abelian varieties*, Vieweg, Braunschweig, 1999, pp. 151–199.
- R. Dijkgraaf, *Instanton strings and hyper-Kähler geometry*, Nuclear Phys. B 543 (1999), 545–571.
- R. Helling, J. Plefka, M. Serone and A. Waldron, *Three-graviton scattering in M-theory*, Nuclear Phys. B 559 (1999), 184–204.
- B. Kuckert, *A short cut towards spin & statistics*, in: *Path integrals from peV to TeV (Florence, 1998)*, World Sci. Publishing, River Edge, NJ, 1999, pp. 299–302.
- N. P. Landsman, *Constrained quantization in algebraic field theory*, in: *XIIth International Congress of Mathematical Physics (ICMP '97) (Brisbane)*, Internat. Press, Cambridge, MA, 1999, pp. 191–196.
- N. P. Landsman, *Representations of the infinite unitary group from constrained quantization*, J. Nonlinear Math. Phys. 6 (1999), 161–180.
- N. P. Landsman, *Lie groupoid C^* -algebras and Weyl quantization*, Comm. Math. Phys. 206 (1999), 367–381.
- N. P. Landsman, *Comment on “What is a gauge transformation in quantum mechanics?”*, Phys. Rev. Lett. 83 (1999), 1070.
- N. P. Landsman, *Essay review: Quantum mechanics on phase space*, Stud. Hist. Philos. Modern Phys. 30 (1999), 287–305.
- J. F. Morales, C. A. Scrucca and M. Serone, *Anomalous couplings for D-branes and O-planes*, Nuclear Phys. B 552 (1999), 291–315.
- C. A. Scrucca and M. Serone, *Anomalies and inflow on D-branes and O-planes*. Nuclear Phys. B 556 (1999), 197–221.
- C. A. Scrucca and M. Serone, *Gauge and gravitational anomalies in $D=4$ $N=1$ orientifolds*, J. High Energy Phys. 12 (1999) 024, pp. 1–20.

Preprints and Reports

- R. Dijkgraaf, *Discrete torsion and symmetric products*, preprint <http://xxx.lanl.gov/abs/hep-th/9912101>, 1999.
- B. Kuckert, *Localization regions of local observables*, preprint <http://xxx.lanl.gov/abs/math-ph/0002040>, 1999.
- N. P. Landsman *Compact quantum groupoids*, preprint <http://xxx.lanl.gov/abs/math-ph/9912006>, 1999.

J. Plefka, M. Serone and A. Waldron, *Matrix Theory and Feynman Diagrams*, preprint <http://xxx.lanl.gov/abs/hep-th/9903099>, 1999.

C. A. Scrucca and M. Serone, *Anomaly cancellation in K3 orientifolds*, preprint <http://xxx.lanl.gov/abs/hep-th/9907112>, 1999.

C. A. Scrucca and M. Serone, *Anomaly inflow and RR anomalous couplings*, preprint <http://xxx.lanl.gov/abs/hep-th/9911223>, 1999.

Other publications

R. Dijkgraaf, *Einsteins droom en de wiskundige werkelijkheid*, Diesrede 8 januari 1999, Univ. van Amsterdam, Vossiuspers AUP, Amsterdam, 1999.

N. P. Landsman, *Samenwerkingsverband Mathematische Fysica*, in: *FOM Jaarboek 1998*, 1999, pp. 68–69.

6. Programme Numerical Algorithms

Scientific publications (articles in journals, proceedings, edited books; monographs)

P. W. Hemker, G. I. Shishkin and L. P. Shishkina, *The numerical solution of a Neumann problem for parabolic singularly perturbed equations with high-order time accuracy*, in: *Recent Advances in Numerical Methods and Applications II*, O. Iliev, M. Kaschiev, S. Margenov, Bl. Sendov and P. Vassilevski (eds.), World Scientific, 1999, pp. 27–39.

P. W. Hemker, G. I. Shishkin and L. P. Shishkina, *Parallel methods based on a defect-correction technique for parabolic singularly perturbed problems*, in: *Analytical and numerical methods for singularly perturbed problems*, Nuova Science Publishing House, USA, 1999.

P. W. Hemker, G. I. Shishkin and L. P. Shishkina, *An ϵ -uniform defect correction method for a parabolic convection-diffusion problem*, in: *Recent Advances in Numerical Methods and Applications II*, O. P. Iliev, M. S. Kaschiev, S. D. Margenov, Bl. H. Sendov and P. S. Vassilevski (eds.), World Scientific, 1999, pp. 521–529.

P. J. van der Houwen and E. Messina, *Parallel Adams methods*, *J. Comput. Appl. Math.* 101 (1999), 153–165.

P. J. van der Houwen, E. Messina and J. J. B. de Swart, *Parallel Stoermer-Cowell methods for high precision orbit computations*, *Appl. Numer. Math.* 31 (1999), 353–374.

Preprints and Reports

H. Brunner, P.J. van der Houwen and B.P. Sommeijer, *Splitting methods for Volterra integro-differential equations*, Report MAS-R9909, CWI, Amsterdam, 1999.

J. E. Frank and P. J. van der Houwen, *Parallel iteration of extended backward differentiation formulas*, Report MAS-R9913, CWI, Amsterdam, 1999.

J. E. Frank and P. J. van der Houwen, *Diagonalizable extended backward differentiation formulas*, Report MAS-R9917, CWI, Amsterdam, 1999.

E. D. Havik, P. W. Hemker and W. Hoffmann, *Application of the over-set grid technique to a model singular perturbation problem*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-15, 1999.

P. W. Hemker and F. Sprengel, *On the representation of functions and finite difference operators on adaptive sparse grids*, Report MAS-R9933, CWI, Amsterdam, 1999.

P. J. van der Houwen, E. Messina and B. P. Sommeijer, *Oscillatory Stoermer-Cowell methods*, Report MAS-R9813, CWI, Amsterdam, 1999.

P. J. van der Houwen and B. P. Sommeijer, *Factorization in block-triangularly implicit methods for shallow water applications*, Report MAS-R9906, CWI, Amsterdam, 1999.

P. J. van der Houwen and B. P. Sommeijer, *Diagonally implicit Runge-Kutta methods for 3D shallow water applications*, Report MAS-R9907, CWI, Amsterdam, 1999.

P. J. van der Houwen and B. P. Sommeijer, *Approximate factorization for time-dependent partial differential equations*, Report MAS-R9915, CWI, Amsterdam, 1999.

Other Publications

P. W. Hemker and B. W. van de Fliert (eds.), *Proceedings of the 33rd European Study Group with Industry*, CWI Syllabus 46, CWI, Amsterdam, 1999.

7. Programme Probability Theory and Statistics

Scientific publications (articles in journals, proceedings, edited books; monographs)

A. A. Balkema, C. Klüppelberg and S. I. Resnick, Limit laws for exponential families, *Bernoulli* 5 (1999), 951–968.

P. C. Boon, H. Hendriks, C. A. J. Klaassen and R. Muijlwijk, *To t or not to t ?*, in: *Proceedings of the Thirty-third European Study Group with Industry*, P. Hemker and B. W. van de Fliert (eds.), CWI Syllabus 46, CWI, Amsterdam, 1999, pp. 1–10.

R. J. M. M. Does, *Real-life problems and industrial statistics*, in: *Bulletin of the International Statistical Institute, Proceedings of the 52nd Session of the ISI, Tome LVII, Book 2*, Edita, Helsinki, pp. 391–394.

R. J. M. M. Does, K. C. B. Roes and A. Trip, *Statistical process control in industry; implementation and assurance of SPC*, Kluwer Academic, Dordrecht, 1999.

R. J. M. M. Does, K. C. B. Roes and A. Trip, *Handling multivariate problems with univariate control charts*, *J. Chemometrics* 13 (1999), 353–369.

K. C. B. Roes, R. J. M. M. Does and B. S. Jonkers, *Effective application of $Q(R)$ charts in low-volume manufacturing*, *Quality and Reliability Engineering International* 15 (1999), 175–190.

E. S. Tan, A. W. Ambergen, R. J. M. M. Does and Tj. Imbos, *Approximations of normal IRT models for change*, J. Educational and Behavioral Statistics, 24 (1999), 208–223.

J. Wieringa, *Statistical process control for serially correlated data*, Dissertation, Rijksuniversiteit Groningen, 1999.

J. Wieringa *Control charts for autocorrelated data*, Transactions of the first International Symposium on Industrial Statistics, University of Linköping, 1999.

Reports and Preprints

K. Dzhaparidze, P. Spreij and E. Valkeila, *Hellinger and information processes in filtered experiments, part I: general concepts*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-18, 1999.

A. J. van Es and H.-W. Uh, *Multi bandwidth kernel estimators for nonparametric deconvolution problems: asymptotics and finite sample performance*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-01, 1999.

R. A. Ion and C. A. J. Klaassen, *Nonparametric Shewhart control charts*, Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-11, 1999.

C. A. J. Klaassen, Ph. J. Mokveld and A. J. van Es, *Squared skewness minus kurtosis bounded for unimodal distributions* Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-14, 1999.

A. Lucas, P. Klaassen, P. J. C. Spreij and S. Straetmans, *An analytic approach to credit risk of large corporate bond and loan portfolios*, VU research memorandum 1999-18, 1999.

A. Klein and P. J. C. Spreij, *On Stein's equation, Vandermonde matrices and Fisher's information matrix of time series processes. Part I: The autoregressive moving average process*, AE-Report 7/99, FEE. Univ. van Amsterdam, 1999.

A. Lucas, P. Klaassen, P. J. C. Spreij and S. Straetmans, *Tail Behavior of Credit Loss Distributions*, VU research memorandum 1999-60, 1999.

J. de Mast, J., K. C. B. Roes and R. J. M. M. Does, *The Multi-Vari Chart – A Systematic Approach* Math. Preprint Series, KdV Institute, Univ. van Amsterdam, Report 99-23, 1999

Other Publications

R. J. M. M. Does en E.R. van den Heuvel, *Zakelijk Verbeter Programma*, in: *Processen in beweging: Beheersen, vernieuwen, verantwoorden*, D. van de Lagemaat en P. de Mos (eds.), Samsom, Deventer, 1999, pp. 47–60.

M. S. Keane, *Over het ontstaan van meningen; een wiskundig vermoeden*, Afd. Natuurkunde KNAW, 1999.

P. Spreij and K. Dzhaparidze, *Statistical Methods for Financial and other Dynamical Stochastic Models*, ERCIM News 38 (1999), 9–10.

(also mentioned under Applied Analysis and Dynamical Systems) P. Spreij and R. de Vilder, *Beurskoersen en toeval*, Pythagoras 38 (februari 1999), no. 3, pp. 9–14.

(also mentioned under Applied Analysis and Dynamical Systems) P. Spreij and R. de Vilder, *AEX en DAX*, Pythagoras 38 (april 1999), no. 4, pp. 13–17.

J. Wieringa, *Regelkaarten voor gecorreleerde data: een SPC-valkuil*, Sigma, oktober 1999.

8. Publications on Didactics

Other Publications

J. van de Craats (ed.), *Onbewezen Vermoedens, Vacantiecursus 1999*, CWI Syllabus 45, 1999.

J. van de Craats, *Over de rol van vermoedens in de wiskunde*, in: *Onbewezen Vermoedens, Vacantiecursus 1999*, CWI Syllabus 45, 1999, pp. 1–15.

J. van de Craats, *Hoe hangt een ketting?* Nieuwe Wiskrant 19 (september 1999), nr.1, pp. 32–36.