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Korteweg-de Vries Institute for Mathematics

Faculty of Science, Universiteit van Amsterdam

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Chapter 1- General information

1.1 Mission Statement KdV Institute for Mathematics

The Korteweg-de Vries Institute for Mathematics furthers the science of mathematics, both in its theoretical and applied aspects, and aims to stimulate the application and appreciation of mathematics in other academic disciplines and in society as a whole.

For more than three thousand years people have been fascinated by numbers and geometry and humanity has acquired a treasure house of mathematical knowledge that will never become obsolete. The cultural value of mathematics, its intellectual depth and beauty cannot be overrated.

Mathematics serves as the language of the natural sciences and of technology, and increasingly of most other scientific disciplines. As such it plays a decisive role in society and consequently in many departments and institutes of our university.

The Korteweg-de Vries Institute has high standards in research as well as in teaching, and strives to collaborate with other institutes within and outside of the Faculty of Science for well-balanced contributions to the mathematical aspects of their research, teaching, and consultancy.

The Korteweg-de Vries Institute considers it a compelling task to protect the cultural heritage of mathematics by raising the interest in the study of mathematics and to educate its students to be open-minded, dependable mathematicians.

1.2 General Overview

In 2006 the International Congress of Mathematicians was held in Madrid. The Korteweg-de Vries Institute is extremely proud that Opdam was invited speaker at this very prestigious congress. Opdam was also co-organizer of the conference “Affine Hecke algebras, the Langlands program, Conformal Field Theory, and Matrix Models” held in the summer at CIRM, Luminy. Many top scientists attended.

During June and July Van der Geer held the Pichorides Distinguished Lectureship at the University of Crete at Iraklion.

The NWO cluster Geometry and Quantum Theory, in which the KdV Institute participates through the program Algebra, Geometry, and Mathematical Physics, has received funding for five years. Two PhD students are being financed by this cluster and both have started in the autumn. Partial funding of two assistant professors and one full professor is foreseen in the near future.
Mandjes supervised the thesis of Dieker who obtained his PhD with honours in March. It may be noticed that in the Faculty of Science a PhD with honours is very rarely conferred!

The vacancies of the chairs of mathematical physics and applied analysis have remained during 2006, but we are optimistic about next year. The part time position of Mandjes was extended to a full time professorship in June. We appointed one UD (assistant professor), several postdocs, and some AIO's in 2006, most of them on the basis of external funding:
- Kleijn and Zagaris obtained a VENI;
- Gijswijt obtained funding for a postdoc position from Schrijver’s Spinoza award;
- Stokman continued his VIDI project with the appointment of a PhD student;
- TNO financed a PhD student of Mandjes, and one PhD student started on an individual grant obtained in the NWO Open Competition.

In 2006 members of the KdV institute had 85 papers in refereed journals and refereed proceedings. Under supervision of KdV members six PhD theses were completed.

Although the KdV Institute is formally a research institute, teaching remains an important and agreeable task for its members. Within the KdV Institute, Pijls has an important task in the co-ordination of teaching activities, while a teaching committee (‘opleidingscommissie’) chaired by Opdam designs the new curriculum and discusses, together with student representatives, the performance by teachers and students.

The coordinator of the bachelor mathematics programme is Zaal, while Homburg, Van Es and Pijls are coordinators of the master of mathematics, stochastics and financial mathematics, and mathematical physics respectively. Last year these people all played an important role in the preparation of the ‘zelfstudie’ for the accreditation of the math teaching programmes in our faculty, as well as in the accreditation process itself. Because of the restructuring of the educational system in the Faculty of Science, their work will become even more important.

In 2006 Hemker, who held the chair of Industrial Mathematics, and Van der Waall, who was associate professor in programme 1, retired. The KdV Institute gratefully acknowledges their contribution to research and teaching.

1.3 Scientific evaluations

In December 2006 the Wetenschappelijke AdviesRaad (Scientific Advisory Board) visited the KdV Institute for two days. Their visit was planned to serve as the ‘mid-term review’ with respect to the self evaluation that will have to take place over period 2002-2007. As two of the members were new in the board, the visit also served to get them acquainted with the institute.
Preceding their visit, the Board received the report on the self evaluation covering the period 2002-2004. During the actual visit to the Institute, the Board talked with the dean of the Faculty, with the director of the institute and with many members of staff.

The report of the WAR was very favorable in general. The board is more than satisfied with the quality of our research. They were very pleased with the appointment of Mandjes. The board shares our concern about the future with two vital chairs unfilled. A very strong recommendation is that the chair of Analysis, now held by Koornwinder, must be kept up at the same high level after his retirement in 2008.

The board expresses the concern that director and members of the KdV institute are too modest about their excellent work and about mathematics in general. This impedes obtaining maximal recognition within the faculty, the university and society. Hence it threatens funding and should change!
Chapter 2 - Research

The KdV Institute distinguishes three research programs. Each of them is divided into three subprograms, which may have a further subdivision into research fields. The program Pure, Applied, and Numerical Analysis and the program Stochastics share a special theme: Financial Mathematics. Finally, the Institute collaborates with other institutes in research on didactics.

Algebra, Geometry and Mathematical Physics

*Algebra and Geometry*
- Algebraic Geometry
- Algebraic Groups
- (Finite) Group Theory

*Mathematical Physics*
- String Theory (jointly with ITFA)
- Quantization and Operator Algebras
- Geometric algebra (jointly with IAS-group)

*Discrete Mathematics*

Pure, Applied, and Numerical Analysis

*Pure Analysis*
- Lie Theory and Special Functions
- Complex Analysis

*Applied Analysis and Dynamical Systems*

*Numerical Analysis*

Stochastics

*Mathematical Statistics*

*Industrial Statistics*

*Probability Theory*

Financial Mathematics

Other Research

*Didactics (jointly with AMSTEL Institute and ILO)*
2.1 Algebra and Geometry

2.1.1 Algebraic Geometry

Van der Geer held the Pichorides Distinguished Lectureship at the University of Crete at Iraklion during June/July 2006.

Van der Geer was invited speaker at Bonn, Tokyo, Rome, Iraklion, Lille and Stockholm.

In May 2006, van der Geer and Moonen organized a highly successful ‘MRI Spring School’ on Abelian Varieties, which was held at the University of Utrecht. The Spring School was preceded by a Master’s course on Abelian Varieties, and was attended by some 60 students from all parts of the world. The Spring School was concluded by a 3-day Workshop on Abelian varieties, held at the University of Amsterdam.

In October 2006, B. Edixhoven (Leiden University), van der Geer and Moonen organized a conference on ‘Modular Forms’ at the island of Schiermonnikoog.

Edixhoven (Leiden), van der Geer and M. Lübke (Leiden University) organized a workshop ‘Geometry in Autumn II’, 28-29 September at the Lorentz Center in Leiden.

Visitors during the year include G. Bini (Università degli Studi di Milano), S. Grushevski (Princeton University), T. Katsura (Tokyo University) and A. Kouvidakis University of Crete).

Van der Geer and Kouvidakis found a system of cycle relations modulo algebraic equivalence for Jacobians of curves.

In March and April, T. Wedhorn (Universität Bonn) visited the department at the invitation of Moonen.

2.1.2 Algebraic Groups

Opdam co-organized the international conference, “Affine Hecke algebras, the Langlands program, Conformal Field Theory and Matrix models”, a large-scale international conference (the main organizer was I. Cherednik, Chapel Hill, USA). The conference took place at the CIRM, Luminy, France, from June 18-July 15, 2006 and hosted both mathematicians and mathematical physicists. Many international top scientists attended (such as Joseph Bernstein, Alexander Beilinson, Michael Harris, David Kazhdan, Gerard Laumon, Juan Maldacena, Nicolai Reshetikhin, Edward Witten, Shing-Tung Yau, Alexey Zamolodchikov and many others). The conference also attracted many junior scientists.

Opdam was invited speaker at the International Congress of Mathematicians (ICM) 2006 in Madrid in the Lie theory section.
In October Emsiz defended his PhD thesis on quantum periodic integrable systems with delta-potentials. The PhD-supervisors were Opdam and Stokman. A paper of Emsiz, Opdam and Stokman on this theme appeared in Communications in Mathematical Physics, a second paper is in progress.

B. Krötz (MPI, Bonn) and Opdam wrote a paper proving an exponential decay rate for Fourier coefficients of Maass cusp forms on locally symmetric spaces, also providing essentially sharp error estimates in the spherical case. The paper was accepted for publication in Geometric and Functional Analysis.

Stokman and U. Onn (Hebrew University of Jerusalem) wrote a paper on dimension formulas for irreducible spherical representations in different algebraic settings. One of the main results is an explicit dimension formula for a class of complex, irreducible representations of the general linear group over the ring of integers of a non-archimedean local field. The paper appeared in IMRP.

Van de Bult, Stokman and E.M. Rains (University of California–Davis) wrote a paper revealing the fundamental structures of univariate generalized hypergeometric integrals of elliptic, hyperbolic and trigonometric type. The paper will appear in Commun. Math. Phys. Van de Bult and Rains continued to work on multivariate generalizations of hypergeometric hyperbolic integrals.

Stokman and G. Letzter (Virginia Tech, USA) wrote a paper on Harish-Chandra series solutions of the system of basic hypergeometric difference equations governed by the Macdonald operators associated to root systems. Stokman and Van Meer continued this line of research, studying the bispectrality and duality of the Harish-Chandra series.

2.1.3 Finite Group Theory

Van der Waall continued his investigations, which started in the summer of 2003, on ‘Monomial Representations of Finite Groups’, in order to write a book on results about that field as obtained in the last thirty years.

The full classification of all those finite groups whose abelian subgroups of equal order are conjugate done by Van der Waall and S. Sezer (Çankaya University, Ankara) was published in the Turkish Journal of Mathematics.

For the retirement of Van der Waall due to his 65th birthday in April 2006, a Farewell Symposium was organized. Speakers at that symposium, among others, were H. Lenstra, G. Nebe, H.A. van der Waall, B. Huppert, B. Amberg et al. To the Liber Amicorum for this occasion contributions were made by several people of KdV Institute as well as outsiders.

2.2 Mathematical Physics
2.2.1 String Theory (jointly with ITFA)

The String Theory group at the Universiteit van Amsterdam is a common initiative of the Institute for Theoretical Physics (ITFA) and the KdV Institute. It receives additional funds from the University Board through the Center of Mathematical Physics Amsterdam (CMPA) and external funding by FOM with the programme String Theory and Quantum Gravity and by NWO with the award of the Spinoza Prize 2003 to Dijkgraaf. The group is at this moment mainly located at the ITFA, but will be given a more integrated housing once the move to the campus of Science Park Amsterdam (in Watergraafsmeer) is completed.

The UvA has supported string theory and related areas since 1992, both from the mathematics and physics side, when it created, as first institution in the Netherlands, permanent positions in this field. String theory is an important research theme in the research program of both the ITFA and the KdV Institute. String theory has a strong impact on and interaction with mathematics. This has been particularly encouraged in Amsterdam, and is reflected in the research profile at the KdV Institute.

The research of the String Theory Group was centered on several themes:

Black holes and Holography
Several results were obtained in this topic. In two papers Skenderis and Taylor, together with their collaborator, worked on a holographic dictionary for fuzz-ball geometries, conjectured to correspond to the microstate geometries of black holes. De Boer and collaborators studied how gravity arises when coarse graining microstates, confirming the microscopic description. In joint work of Verlinde, Dijkgraaf, De Boer and collaborators counted the microstates of 4-dimensional BPS black holes in IIA string theory on a Calabi-Yau manifold by an elliptic genus of a (0,4) conformal field theory, generalizing previous work to the case of attractor black holes. Dijkgraaf, Verlinde et al. have shown how the topological string partition function is related to a 4-dimensional D-brane system. Their results provide further mathematical evidence for the recently found connection between 4d and 5d black holes. Finally, Schalm and his collaborators explicitly showed that non-extremal black holes can be BPS, opposite to the common notion that they are not because they do not preserve any supersymmetry.

Cosmology
Skenderis et al. showed that any domain wall solution that admits a Killing spinor corresponds to a cosmology that admits a pseudo-Killing spinor, explaining the fact that all flat or closed FLRW cosmologies satisfy first-order equations. van der Schaar and Schalm et al studied a string inspired modified wavefunction of the universe and its possible effects on the Cosmic Microwave background. They showed that small effects due to string scale modifications might leave an imprint on the spectrum of the Cosmic Microwave Background, but only if inflation lasted a minimum number of e-folds.

Connections between String theory and Yang-Mills
Skenderis and Taylor constructed a first quantitative test of the gravity/gauge theory duality away from the conformal point. In another work they holographically computed the vacuum expectation values of all chiral primary operators for supergravity solutions corresponding to the Coulomb branch of N=4 SYM, to find exact agreement with the corresponding field theory computation.

Compactification and Geometry
De Boer and his collaborators have considered an open string version of the topological twist previously proposed for sigma-models with G2 target spaces. They find that this theory is connected to a proposal by Donaldson and Thomas for a higher-dimensional generalization of real Chern-Simons theory. Schalm et al studied $T^2$ orientifolds and their moduli space in detail. They derive half-supersymmetry preserving crosscap coefficients for generic unoriented Gepner models and construct the charges and tensions of Calabi-Yau orientifold planes.

In September 2006 Van der Schaar took up his appointment and started his research work on string cosmology. New post-doctoral members who joined the group in 2006 were Papadodimas, McFadden, Quella, and Reffert.

2.2.2 Quantization and Operator Algebras

Kowalzig, under the aegis of N. P. Landsman (RUN), has been investigating the definition of a ‘noncommutative Lie algebroid’ which turned out to be conceptually related to an alternative notion of Hopf algebroids over noncommutative base algebras. To this end, the cocyclic module structure of a Hopf algebroid and its associated cocyclic bicomplex was found and properly defined inasmuch the existing approach to such a theory seems to be unsatisfactory. This also allowed solving the problem of antipodes on universal enveloping algebras of Lie-Rinehart algebras as structurally generic examples. Furthermore, the (periodic) cyclic cohomology of such a universal object could be calculated thereby generalizing a result for Lie algebras. This may culminate in a Milnor-Moore theorem for Lie-Rinehart algebras, an adjointness of the functors 'Taking the Universal Enveloping Algebra of' and 'Taking the Primitive Elements of'. One direction of such a theorem could already be proven.

2.2.3 Geometric Algebra (jointly with IAS-group)

This project is an interdisciplinary cooperation between mathematics and computer science. The participant from the Informatics Institute is L. Dorst, member of the research group Intelligent Autonomous Systems (IAS). The aim of the project is to develop software for a geometry toolbox for practitioners of geometry and for computer scientists.

The mathematical theory behind it is Geometric Algebra, which is closely related to Clifford Algebra. We investigated whether this theory could provide an alternative approach to differential geometry.

So many results from Riemannian Geometry were formulated in the new formalism,
especially results concerning the Dirac operator. A monograph on this subject is in preparation.

2.3 Discrete Mathematics

Schrijver investigated and developed methods to characterize combinatorial parameters with the help of tensor algebra and invariant theory. Schrijver also proved a characterization of tensor subalgebras that form the invariant ring of a unitary group. This theorem applies to self-dual codes and graph parameters.

Schrijver was appointed member of the Deutsche Akademie der Naturforscher Leopoldina and received the Von Neumann Theory Award from INFORMS (The Institute of Operations Research and Management Sciences), with M. Grötschel (Technische Universität Berlin) and L. Lovász (Eötvös Loránd University, Budapest).

2.4. Pure Analysis

2.4.1 Lie Theory and Special Functions

Koornwinder continued his research on lowering and raising operators associated with root systems. In the rank one case these operators can be best understood from the structure relation, see his paper which became online in 2006 in Journal of Computational Applied Mathematics. This structure relation plays a role in Zhedanov’s algebra AW(3). In a new preprint Koornwinder showed that a slightly extended version of AW(3) can be embedded in Cherednik’s double affine Hecke algebra associated with the non-symmetric Askey-Wilson polynomials.

In quite different work Koornwinder considered how the filter coefficients in the specification for the MP3 encoding/decoding might have been obtained.

2.4.2 Complex Analysis

Wiegerinck was “opponent” at the defense of the thesis of L. Carlsson (Umeå University) and served on the committee for the thesis of T. Edlund (Uppsala University).

Korevaar gave a complex analysis proof for the Tauberian theorem of Wiener and Ikehara and continued his study of prime pairs. Under a reasonable hypothesis there must be many such pairs involving a relatively small difference.

Joint work of A. Edigarian (Krakow), El Marzguioui and Wiegerinck showed that graphs of finely analytic functions are contained in \( \infty \) sets of plurisubharmonic functions. This confirms our conviction that fine analyticity is crucial in understanding pluripolarity. El Marzguioui and Edlund (Uppsala University) are trying to apply these ideas to Wermer-like examples of polynomial hulls without complex structure.
De Paepe and Wiegerinck finished their project on approximation on discs.

2.5 Applied Analysis and Dynamical Systems

Stochastic Bifurcation Theory: Jointly with Zmarrou and Young (Ohio University), Homburg had initiated a research program to understand bifurcations of stationary measures. Following a general theory for randomly perturbed diffeomorphisms, Homburg and Zmarrou gave a detailed description of bifurcations in random circle diffeomorphisms.

Homoclinic Cycles in Equivariant Flows: In equivariant flows both robust and nonrobust homoclinic cycles can occur. A large class of nonrobust homoclinic cycles, which one can find in families of flows, have been investigated by Homburg in collaboration with J.S.W. Lamb and A.C. Jukes (Imperial College, London) and J. Knobloch (Technical University Ilmenau, Germany). It turned out that these bifurcations gave rise to the creation of suspended horseshoes.

Stabilization by Competing Instability Mechanisms: This is also the title of the thesis by Valkhoff, who graduated in November 2006, with Doelman and Hek as advisors. In the thesis, the impact of additional (slow) diffusion equations on a Ginzburg-Landau equation is studied analytically. It is shown that such a coupling may stabilize structures that are strongly unstable without such a coupling.

The Self-Replication Bifurcation: Together with T.J. Kaper (Boston) and L.A. Peletier (Leiden University), Arjen Doelman established a number of fundamental results on the nature of the self-replication bifurcation. The phenomenon is certainly not yet understood, but these results are the first to go beyond that of the singular perturbed setting, i.e. into the realm in which the bifurcation occurs.

Reduction for Michaelis-Menten-Henri kinetics with diffusion: This is a joint project of Zagaris with H. Kaper (NSF), T.J. Kaper (Boston U.), L. Popovic (Boston U.), & L. Kalachev (U. of Montana).

An article was completed on the possibility of reduction for Michaelis-Menten-Henri kinetics when all of the chemical species are allowed to diffuse. It turned out that such reduction is, indeed, possible in a variety of diffusivity regimes.

Workshops and Symposia:
‘Dynamics of Nonlinear Waves’, Groningen, April 24-28. Organizers: H. Broer (Groningen), Doelman (Amsterdam), Th. Gallay (Grenoble), M. Haragus (Franche-Comte).

2.6 Numerical Analysis

Research on stabilized integration of partial differential equations was done by Verwer. The existing Runge-Kutta-Chebyshev (RKC) method originally developed for parabolic partial differential equations (PDEs) (diffusion problems) has been extended for application towards parabolic PDEs containing also advection (and reaction) terms. Mixed advection- diffusion-reaction problems occur frequently, e.g. in many environmental, biological and chemical applications where transport and reactions of chemical substances are modeled. The extension of RKC now allows problems with purely imaginary eigenvalues in their spectrum, something which was not possible with the original method. The research is published in the CWI preprint MAS-E0616, which was written on invitation for a peer-reviewed special issue of the Journal of Computational Physics. This report has been accepted for publication, which is expected in 2007. The research concerns joint work with B.P. Sommeijer (CWI). Verwer co-organized the 11th Seminar NUMDIFF on ‘Numerical Solution of Differential and Differential-Algebraic Equations’, Halle, Germany, September 4-8, 2006.

On November 17, the retirement symposium for Hemker was held. Verwer, Brandts and Hoffmann were co-organizers of that special day. Part of the day was dedicated to a scientific meeting jointly organized by CWI and KdVI. Brandts was one of the editors of a special issue of Applied Numerical Analysis issued on the occasion of Hemker’s retirement, with contributions from national and international outstanding numerical analysts. Queen Beatrix of the Netherlands also bestowed Hemker with the honour of ‘Ridder in de Orde van de Nederlandse Leeuw’.

Brandts was involved in several international activities: he was co-organizer and webmaster of the 13th Conference of the International Linear Algebra Society, which was held from July 18 to 21 in the premises of the Free University in Amsterdam; he presented the opening plenary invited lecture at the third International Conference of Applied Mathematics in Plovdiv, Bulgaria; he taught an intensive one-week course on Eigenvalue Computation at the Graduate School of Mathematics of the University of Uppsala, Sweden.

2.7 Mathematical Statistics

On January 1, Kleijn joined the Mathematical Statistics group. Within the framework of his Veni-grant, entitled ‘Bayesian Bernstein-von Mises Theorem’, he visited P. Bickel and J. Rice at the Statistics Department of UC Berkeley.
The Workshop Statistics for Biological Networks has been organized by M.C.M. de Gunst (VUA/EURANDOM), Klaassen, and F.Rigat (EURANDOM) at EURANDOM, January 16-18. The themes were: gene regulatory networks, statistical analysis of neuronal data, and graphical models and Bayesian networks.

On May 4, Boguslavskaya defended her PhD thesis *Optimization Problems in Financial Mathematics: Explicit Solutions for Diffusion Models*. Her PhD advisors have been Balkema, Klaassen, and Shiryaev. This has been the first PhD at the UvA with Shiryaev as promoter. He is honorary professor in Financial Mathematics at the UvA and published this year the monograph: G. Peskir and Shiryaev (2006), *Optimal Stopping and Free-Boundary Problems*.

As assistant to the KNAW-committee ‘Verkenning Biowiskunde’ Kleijn has organized the workshop ‘KNAW Meeting for Young Biomathematicians’, November 26.

### 2.8 Industrial Statistics

The research work in industrial statistics at the Universiteit van Amsterdam is coordinated by the Institute for Business and Industrial Statistics (IBIS UvA). This institute combines scientific research with consultancy activities.

IBIS UvA aims to make valuable contributions to the scientific development of industrial statistics. The staff members of the institute spend about 40 percent of their time doing research. Each year IBIS UvA supervises and sponsors several PhD researches.

Statistical methods for the evaluation of measurement systems have been the subject of research at the institute for several years now. The paper of De Mast and Trip on destructive testing, which was published in the Journal of Quality Technology in 2005, was awarded with the Brumbaugh Award 2005. De Mast has continued his work on measurement methods for nominal and ordinal data. An overview paper was accepted by the American Statistician and two other papers are submitted.

Control charts and Statistical Process Control (SPC) has been one of the topics in the research of IBIS UvA for years. Vermaat defended his PhD thesis successfully in December. Does, Van der Meulen, Trip and Vermaat published four papers on control charts: one paper was published in Quality Technology and Quantitative Management, one in Quality and Reliability Engineering International, one in Statistica Neerlandica, one was accepted in Economic Quality Control, and two papers were submitted to Journal of Quality Technology respectively Statistics and Probability Letters.

Research in industrial statistics necessarily involves extra-mathematical topics, especially in methodology. This type of research has as its subject not so much statistical techniques, but rather the coherence between techniques and their applicability. Methodological research in the behavioral sciences and reconstruction research in the philosophy of science provide a good example of this type of research. Bisgaard, Does,
De Koning, De Mast and Vermaat published eight papers in different international journals. The subjects of the papers range from Lean Six Sigma in health care to exploratory data analysis.

Together with J. van den Heuvel (Canisius Wilhelmina Hospital), Bisgaard, Does, De Koning and Vermaat published a series of papers about Lean Six Sigma applications in hospitals. One of the papers written by Van den Heuvel, Does and Bisgaard, which has been published in Six Sigma Forum Magazine, was awarded the 2005 Cecil C. Graig Award.

IBIS UvA has had a leading role in the establishment of the European Network for Business and Industrial Statistics (ENBIS; see www.enbis.org). De Mast was chairman of the scientific organizing committee of the Sixth Annual Meeting of ENBIS in Wroclaw, Poland. Does was treasurer of this meeting.

Bisgaard and Vermaat were invited speakers at the ASA/ASQ Fall Technical Conference in Columbus, Ohio.

Bisgaard became elected member of the International Academy for Quality, 2006.

2.9 Probability Theory

Mandjes has been involved in a series of projects on queues with Levy input. With O. Kella (Hebrew University, Jerusalem) and O. Boxma (EURANDOM) he has studied a Levy process reflected at a Poisson age process, as well as a queueing model with service interruptions. Many results that were already known for queues with compound Poisson input were generalized. With Es-Saghouani, Mandjes has initiated work on the correlation structure of reflected Levy processes.

T. Dieker (CWI) defended his Ph.D. thesis, entitled Extremes and fluid queues, on March 9, 2006. It was granted the judicium ‘cum laude’. In his thesis, that was supervised by Mandjes, Dieker investigated a broad range of generic problems in the theory of stochastic processes: the distribution of the maximum attained by a Gaussian process, advanced simulation techniques for estimating rare event probabilities, and the distribution of reflected Levy processes (and their Markov-modulated variant). T. Rolski (University of Wroclaw, Poland) and I. Norros (VTT Technical Research Centre of Finland) participated in Dieker’s Ph.D. committee.

Lieshout (CWI/UvA) and M. Mandjes have studied a number of problems arising in the theory of queues with service differentiation. Their paper, jointly with S.C. Borst (TU/e, Eindhoven), ‘GPS scheduling: Selection of optimal weights and comparison with strict priorities’ won the best student paper award at ACM Sigmetrics/Performance. The striking conclusion of this paper is that, in order to maximize the system’s efficiency, there is little advantage of using GPS over simple priority scheduling.
Mandjes completed work on convergence to stationarity of reflected fractional Brownian motion (fBm), with P. Glynn (Stanford University) and I. Norros (VTT Technical Research Centre of Finland). Together with Es-Saghouani, Mandjes analyzed the related problem of the correlation structure of regulated fBm. Work of Mandjes and Norros, together with P. Mannersalo (Univ. of Vaasa, Finland), on busy period asymptotics has been published in Stochastic Processes and their Applications.

Mandjes and Roijers have worked, in collaboration with H. van den Berg (TNO) on the analysis of sojourn time characteristics in a bottleneck node of an ad hoc network. For the standard protocol this sojourn time could be fully analyzed in terms of Laplace transforms. Protocols with alternative resource allocation are currently studied. Mandjes has finished his book *Large deviations for Gaussian queues*, that will appear early 2007 (Wiley).

Mandjes and Lieshout did consultancy work for EMC Computer Systems. They solved a problem on optimal disk replacements. Mandjes became associate editor of Queueing Systems.

Mandjes co-organized the second Korea-Netherlands joint workshop on Queueing Theory and its applications to communication networks (jointly with H. Tijms, VUA), and a workshop on resource sharing models (jointly with R. van der Mei and R. Nunez-Queija, CWI).

Spreij continued work on the realization problem for Hidden Markov Chains jointly with L. Finesso and A. Grassi (ISIB (CNR), Padua) and on Approximate Factor Analysis. Techniques from linear algebra have also been used in work on statistical analysis for ARMA processes jointly with A. Klein (UvA, FEE). Spreij has also been involved in Evolutionary Game Theory, jointly with M. van Veelen (UvA, FEE). From September 1 until the end of the year, Spreij had a posting (for 50 percent) at Radboud Universiteit Nijmegen.

2.10 Financial Mathematics

Boguslavskaya, who left the institute in 2002, has defended her thesis at the UvA on May 4, 2006.

Spreij, together with J.M. Schumacher (UvT) organizes the annual Winter School on Mathematical Finance, which took place in Lunteren on January 23-25.
Chapter 3 – Dissemination of Knowledge

3.1 Colloquia

3.1.1 General Mathematics Colloquium

Traditionally the General Mathematics Colloquium takes place on Wednesday mornings. Each academic year, between 20 and 25 lectures are scheduled with speakers from other Dutch (mathematics or mathematics related) institutes or from abroad, as well as from the KdV Institute itself. In particular, guests from abroad who are staying at the KdV Institute for a shorter or longer period of time are invited to lecture in the colloquium. Furthermore, most defendants of a PhD thesis in mathematics at the UvA are invited to give a lecture in the colloquium shortly before their thesis defense.

The audience of the colloquium consists on average of 20-30 people. The colloquium thus forms an outstanding platform for the lecturers to disseminate new developments to the institute in all branches of mathematics as well as surveys of mathematical methods that are currently en vogue. The organizers are Moonen and Spreij. The list of past lectures can be found at: http://www.science.uva.nl/research/math/Calendar/colloq/.

3.1.2 The Algebra and Geometry seminar

The Algebra and Geometry seminar is a weekly seminar organized by Van der Geer devoted to new developments in Algebra and Geometry with also a large emphasis on the education of PhD students. Besides local people, guests from other places give lectures. In 2006 the schedule of the seminar was substantially reduced.

3.1.3 The Colloquium Stochastics and Financial Mathematics

The Colloquium has not been held in 2006.

3.1.4 The Representation Theory Seminar

The Representation Theory seminar is organized by Opdam and Stokman. It takes place on a weekly basis and provides a platform for members of the research group to present their recent research. Occasionally guests are invited to give a talk. The detailed schedule in 2006 can be found on the seminar web-site http://staff.science.uva.nl/~jstokman/Seminar.html.

3.1.5 AiO Seminar Mathematics
In 2006 Wiegerinck initiated a biweekly AiO Seminar. Organizers are Zmarrou and Van der Veen. The purpose of this seminar is to give PhD-students in all mathematical disciplines a chance to talk about their research in an informal way. The audience, mostly PhD students, gets an opportunity to broaden their view on mathematics. Technical details and formal fireworks should be left aside and the challenge for the speaker is to make the talk intelligible and fun for everyone in the audience (not just the specialists).

### 3.2 Compositio Mathematica

Compositio Mathematica is a prestigious journal for which Moonen is managing editor. The journal is published by the Foundation Compositio Mathematica in cooperation with the London Mathematical Society. The web page and electronic access to the journal may be found at [http://www.compositio.nl](http://www.compositio.nl).

### 3.3 Fifth European Congress of Mathematics

In June 2004 the council of the European Mathematical society decided to honor the bid of the Amsterdam Mathematical Institutions for organizing the fifth European Congress of Mathematics.

The congress will be held in 2008 at the RAI in Amsterdam from July 14 to 18. We expect some 1,500 attendants, originating from all European countries as well as from further abroad.

In order to facilitate the organization, CWI and the faculties of science of UvA and VUA founded *Stichting 5ECM*, a foundation in which all the activities of the organizing committee will take place. The KdV Institute is represented by Wiegerinck, treasurer of the foundation and the organizing committee, and by Klaassen. The congress will receive substantial support from the Dutch Research Organization NWO. Moreover, in 2006 the Foundation Compositio Mathematica decided to put up the prize money for the 10 EMS prizes that will be awarded at the congress.

### 3.4 Thomas Stieltjes Institute for Mathematics

The Thomas Stieltjes Institute for Mathematics is a Dutch inter-university research school. The participants are the relevant departments of the Universiteit van Amsterdam (UvA), Free University Amsterdam (VUA), Delft University of Technology (TUD), Technical University Eindhoven (TU/e), Leiden University (UL), and Tilburg University (UvT). The institute collaborates with CWI in Amsterdam and with Eurandom in Eindhoven. Leiden University is secretary of the Institute.

The Stieltjes Institute was founded November 12, 1992, and its research covers four main areas of fundamental and applied mathematics: Algebra and Geometry, Analysis, Stochastics, and Operation Research. The Institute has a training research program for
PhD students and its recognition as a research school (‘onderzoekschool’) from the KNAW has been renewed for the period 2004-2010. Further information: http://www.stieltjes.org.

On behalf of the UvA, Klaassen is chairman of the Board of the Stieltjes Institute, Opdam is member of its Science Committee and Doelman is chairman of its Education Committee. In various research projects within the Stieltjes Institute, researchers from the KdV Institute act as project leaders:
1.2. Geometry (Van der Geer)
2.2. Representation Theory, Operator Algebras and Complex Analysis (Opdam)
2.3. Differential Equations, Dynamical Systems and Numerical Analysis (Doelman)
4.1. Discrete Mathematics and Optimization (Schrijver)
4.2. Stochastic Operations Research (Mandjes)
T.1. Theme group on Mathematics and Economics (Spreij).

3.5 Mathematical Preprint Series

Since a few years the preprints in the Mathematical Preprint Series of the KdV Institute appear only electronically. Authors are encouraged to post these preprints to the Mathematics arXiv (see http://front.math.ucdavis.edu for convenient browsing of this arXiv), which is internationally the best known and most comprehensive electronic preprint archive in mathematics. Moreover it has an excellent user interface. The KdV Institute is proud that its preprint series is an overlay for this arXiv starting January 2001.

In our preprint series, 16 papers appeared in 2006. See http://www.science.uva.nl/math/research.cfm for the full list and for downloading of individual preprints.

3.6 Alumni

The KdVI is one of the few research institutes in the Faculty of Science that maintains its own alumni network. It started in 1994 with the production of a newsletter that was sent to former students who graduated in 1987 and later. Since then the newsletter has appeared twice a year, and its circulation number now reaches 400. It contains articles contributed by alumni and members of the staff of the KdVI. The driving force behind the network is De Paepe.

3.7 Mathematics and society

For the fourth consecutive year, KdVI, jointly with ILLC, organized a public relations day Leve de Wiskunde! It was held on May 12, and was aimed at high school math teachers, who were also invited to bring along a few of their interested pupils. From KdVI, Van der Geer, Hek, Kleijn and Zaal were active in the organization. There were
over 100 participants, who just about fitted into the largest lecture room at the Euclides building. Lectures were given by Schrijver (KdVI/CWI), K. Apt (ILLC), N. Antonini (Nederlands Kanker Instituut), Van der Craats (KdVI/OU), Hek (KdVI), and J. Doyen (Université Libre de Bruxelles). There were also some stands with information on research and teaching during the lunch break.

A full report of the day (in Dutch), including the talks that were given, is to be found on the webpage of the KdVI www.science.uva.nl/math.

In 2006 the KdV Institute, enabled by financial support from both Spinoza laureates Dijkgraaf and Schrijver, was able to hire a project manager in the field of public relations. The starting point for the new project manager was the report ‘Wat heb ik nou aan Algebra?’ published in 2005 as the result of a KdV project to research the job prospects of mathematicians. One of the aims of the PR manager is to further develop a network of high schoolteachers. The PR manager represents the institute at the Bètapartners project of the Faculty of Science and acts as a coordinator for the Wiskunde D project in which the university cooperates with high schools to develop a new curriculum in advanced mathematical topics.

Several members of the KdV Institute have contributed to the online “Biografisch woordenboek van Nederlandse wiskundigen”, a project in which Alberts is involved as supervisor. Koornwinder contributed two lemmas, one on Diederik J. Korteweg and one on Gustav de Vries, Pijls contributed a lemma on Hendrik de Vries, and Van der Waall on Pierre Joseph Henry Baudet.

On March 9, Van de Craats held the opening lecture entitled ‘Over de wiskundevoorkennis nu’ during the SURF-conference ‘Wiskundevoorkennis voor het hoger onderwijs’ (Mathematical knowledge needed for higher education) at Utrecht.

Together with Van der Veen, Van de Craats organized a highly successful ‘UvA Webklas wiskunde’ on the Riemann hypothesis for secondary school students. It was held two times: in February/March and in November. On April 7, Van de Craats and Heck gave a Master Course on ‘Wiskunde in beeld, - zelf wiskundige illustraties van hoge kwaliteit maken’, for high school teachers of mathematics and physics.

Van de Craats participated in the report ‘Versteviging van kennis in het onderwijs’ by the Onderwijsraad (December). Van de Craats is chairman of the ‘Resonansgroep wiskunde’, an advisory committee appointed by the Secretary of Education Maria J. A. van der Hoeven. Van de Craats was guest editor for the 45th edition of Pythagoras. The theme for the year was ‘Open problemen in de wiskunde’.

For his outstanding work in the field of science communication, Van der Craats won the 2006 NWO Eureka Price.

Van de Craats, Koornwinder and Zaal are members of the ‘Taakgroep Landelijke Wiskunde-PR’, a joint committee of Koninklijk Wiskundig Genootschap (KWG) and Nederlandse Vereniging van Wiskundeleneraren. This committee supervises the work of
the ‘Landelijk PR-medewerker Wiskunde’ (the national public relations officer for mathematics) and the ‘vakredacteur wiskunde’ of Kennislink (www.kennislink.nl), a website aiming at disseminating new developments in science to the general Dutch audience, in particular high school students. Van de Craats also chairs the ‘Raad van Advies’ of Kennislink, and Koornwinder is a member of the editorial board.

In 2006 the book ‘Een cultuurgeschiedenis van de wiskunde’ appeared to which Koornwinder contributed the final chapter on mathematics in the last sixty years.

Again Dijkgraaf developed many outreach activities in the form of public lectures, popular articles and media presentations. He wrote numerous columns for NRC Handelsblad and Folia. As highlights we mention his appearance on television in ‘God of Darwin’, Buitenhof television, January 1.

With vigor he continued his activities aiming to interest children for science, witness a few examples of interviews and news reports:

- Niet alleen voor kleine Einsteins, Interview, de Volkskrant (March 11)
- Begaafde kleuters, Sarah Blom, NRC Handelsblad (April 29)
- Voorwoord kinderuniversiteit, in M. van der Heijden, L. van de Oudewetering, “Waar komt de regenboog vandaan?”, Winkler Prins Kinderuniversiteit
- Belang van Huygens groter dan Ot en Sien; Canon negeert ten onrechte bètawereld, NRC Next (October 20)
- De eerste verjaardag, voorwoord in Techniek Toernooi 2006.

Furthermore, as part of Dijkgraaf's Spinoza Prize the websites www.proefjes.nl and www.kidzlab.nl have been developed, where many science activities for children can be found. This project will now be embedded in a national program promoting science at elementary schools. Dijkgraaf is also one of the organizers of ‘Talentenkracht’, a similar initiative aimed at preschoolers.

Moreover, Dijkgraaf took part in the organization of the following activities:

- New Topological Structures in Physics, semester program Mathematical Sciences Research Institute, Berkeley, Jan. 9 - May 26
- The generosity of Artificial Languages in an Asian perspective, Org. F. Staal, M. Stokhof, W. Stokhof, J. van Benthem, R.Dijkgraaf, De Balie, Amsterdam, May 18-20
- Amsterdam String Theory Summer Workshop, Universiteit van Amsterdam, July 3 – 13
- Under the Spell of Physics, 60th Birthday Conference for Gerard ‘t Hooft, Vlieland, July 14-16
- Nationale Wetenschapsdag, Korteweg de Vries Instituut te Amsterdam, Oct. 20
- De avond van de Wetenschap en Maatschappij, Amsterdam, Nov. 6.

Schrijver published several popular articles, gave lectures and gave a number of interviews in the national press and on the radio. Examples of these outreach activities are

- Radio-interview P. van der Wielen met A. Schrijver, programma Hoe?Zo!’, Teleac, 10 maart 2006;
-‘Nee, een tien zou ik niet halen’, interview M. Wiegman met A. Schrijver, Het Parool, 24 mei 2006, p. 17;
- ‘Wat is de kortste weg naar huis?’, Wakker Wordenlezing NEMO, Amsterdam, 19 november 2006;

The project ‘DisWis’, set up by ‘De Praktijk’ (an institute for scientific education) and subsidized by A. Schrijver’s Spinoza project, has developed a course in discrete mathematics and optimization, to be taught by university students at high schools. The goal is to bring the high school pupils in contact with discrete mathematics as an interesting, challenging and applicable branch of mathematics, and to inform them about the contents and prospects of studying mathematics, by direct interaction with students. During the school year 2006-2007, the project does test runs at a few high schools, and so far the prospects are very promising. The plan is to outspread the program in the school year 2007-2008, with a substantial increase of the number of schools and students involved.

Zaal is the organizer of the Amsterdam Math Circle, a network of Amsterdam math teachers. Twice a year the members of this network meet in the ‘Amsterdame Academische Club’. The KdV Institute sponsors these events, and is represented by 1 or 2 staff members. In this way the KdVI staff interacts with local math teachers.

The KdV Institute is co-sponsor Pythagoras, a mathematics youth magazine. Zaal is publisher of Pythagoras on behalf of the Koninklijk Wiskundig Genootschap. Swaen works one day per week as editor in chief for the magazine.

Zaal is chairman of a National Committee on ‘Studievoorlichting’, an unofficial network of ‘wiskundestudievoorlichters’. This group meets once a year, but they also undertake projects during the year, for instance to produce a classroom poster on future job prospects for mathematicians.
Chapter 4 – Management

4.1 Finance

Due to extensive changes in both the administrative organization and the administrative systems of the Universiteit van Amsterdam, there are considerable backlogs in the processing of financial data concerning the year 2006. As a result it is not possible to present the financial result of the KdV Institute at this time and place (April 2007).

4.2 Human resources

Compared to the previous year, the number of people working at the institute has increased considerably. Staff financed by the FNWI lump sum increased by 2.1 fte. The main increase however, took place with respect to staff financed by indirect funding (5.4 fte), as two Veni laureates joined our ranks and as we attracted new PhD students on the basis of various sources of NWO funding (Vidi, Open Competition and GQT cluster). Two vacancies for full professors still have to be filled.

Apart from people employed by the University, the institute welcomes a steady stream of visitors, who come to work here for shorter or longer periods of time.

The institute continues to be supported by a small and very well qualified secretarial and managerial staff. One member of the secretarial staff is working for and funded by IBIS and Compositio Mathematica.

As of 31 December 2006, the formation of the institute (i.e. members of staff employed by the University of Amsterdam) is as follows when calculated in fte (full time equivalent):

<table>
<thead>
<tr>
<th></th>
<th>Direct funding</th>
<th>Indirect funding</th>
<th>External funding</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full professor</td>
<td>6.5</td>
<td></td>
<td>0.8</td>
<td>7.3</td>
</tr>
<tr>
<td>Associate professor</td>
<td>6.7</td>
<td></td>
<td></td>
<td>6.7</td>
</tr>
<tr>
<td>Assistant professor</td>
<td>4.9</td>
<td>1.9</td>
<td></td>
<td>6.8</td>
</tr>
<tr>
<td>Postdoc</td>
<td>2.0</td>
<td>3.0</td>
<td></td>
<td>5.0</td>
</tr>
<tr>
<td>PhD. students</td>
<td>4.0</td>
<td>9.0</td>
<td>1.2</td>
<td>14.2</td>
</tr>
<tr>
<td>Non-academic staff</td>
<td>1.8</td>
<td>0.4</td>
<td>0.5</td>
<td>2.7</td>
</tr>
<tr>
<td>Total</td>
<td>25.9</td>
<td>14.3</td>
<td>2.5</td>
<td>42.7</td>
</tr>
</tbody>
</table>

In the table below the formation (including long-term visitors) is translated into research input during the full calendar year, distributed over the various research programs. On average, the research input is related to the human resources input in the following way: regular staff spend 50% of their time on research, postdocs/fellows spend 90%, and PhD students spend 75% of their time on research. G-1, G-2, and G-3 stands for Direct,
Indirect, and External funding respectively (see also appendices 3, 4, and 5), while G-4 stands for long-term visitors.

<table>
<thead>
<tr>
<th>Research program</th>
<th>G-1</th>
<th>G-2</th>
<th>G-3</th>
<th>G-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra &amp; Geometry</td>
<td>2.65</td>
<td>3.90</td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>Mathematical Physics</td>
<td>2.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discrete Mathematics</td>
<td>0.10</td>
<td>0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure Analysis</td>
<td>1.75</td>
<td></td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>Applied &amp; Numerical Analysis</td>
<td>2.70</td>
<td>1.80</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>Stochastics</td>
<td>2.10</td>
<td>2.35</td>
<td>3.00</td>
<td>0.40</td>
</tr>
<tr>
<td>Total</td>
<td>11.30</td>
<td>8.30</td>
<td>3.00</td>
<td>2.50</td>
</tr>
</tbody>
</table>

4.3 Facilities

4.3.1 Housing

With the number of people employed being on the increase, the institute has once again to be very resourceful as far as providing enough working space for its members of staff. Almost all full-time members of the tenured staff have a room of their own, while a number of emeriti members of staff who are still involved with the institute share a room as a ‘pied-a-terre’, a privilege we try to maintain but cannot continue to guarantee as the number of people employed keeps growing. Approximately once a year, usually due to changing proportions between senior and junior staff, a reshuffle takes place and a number of people move to a different room at the same time.

Most rooms, including a coffee area and the rooms of the manager and the secretarial staff are located on the second floor of the building, allowing for easy access and communication between people who work in the same programs and projects. A number of rooms are located on the first floor of the building, including a meeting room. Moreover, the institute offers a desk to visitors who come here for a more prolonged stay, occasionally using the offices of those members of staff who themselves are away for a visit abroad.

4.3.2 Computers

In 2006 a transformation in the management of computing systems was announced. Following the reorganization of non-scientific personnel in our University, also the function and structure of ICT support has changed drastically. The faculty of science, to which we belong, does no longer have its own ICT group; virtually everything which is ICT related, is in the process of being concentrated in the central ICT organization.

The institutes buy no longer their own computers, but will lease those from the ‘Informatiseringscentrum’ or IC, as it is called. The lease price of a computer will depend
on both its hardware and software. The transition from the old situation to the intended new situation takes much time and as it develops in parallel with a reconstruction of the IC group itself, the arrival at a new equilibrium doesn't happen as soon as we hoped for.

During the year 2006 an inventory of all computers of the University was drawn up. The idea of a standard computer for a standard workplace was disseminated, but especially in the Faculty of Science, much computing equipment is not meant to be used for standard office computing. So it takes a lot of time indeed to arrive at a balanced situation for all parties involved.

By the end of 2006 all computers of KdVI where on the inventory and listed by age and type of operating system (Windows, Linux, MacOS or UNIX). The lease contract will discriminate between operating systems. For a particular computer in use by somebody with special software or hardware needs, the lease contract may be extended to include this non standard situation. The actual situation at our institute is that most computers are either Linux or Windows PC's (roughly equally many). A few Apple computers with MacOS are in use and likewise a few UNIX workstations are still in operation.

The actions to be taken with respect to buying or replacing computers were not well defined at our institute by the end of 2006. In the new situation no computers should be used longer then 4 years. Some computers on our list are in fact older then 4 years, but it is still unclear when and by whom they are going to be replaced.

4.3.3 Library

The mathematics library of the Universiteit van Amsterdam is of vital importance for the research and education activities of the KdV Institute. The founder of the library was L.E.J. Brouwer, one of the greatest mathematicians of the 20th century. The library is located at the Euclides Building, the same building where the KdV Institute itself is housed. The library is part of the library of the Faculty of Science. Eventually, a united library of this Faculty will be completed, into which the mathematics library will then be absorbed.

The collection of libraries of the Faculty is managed by the Head of Scientific Information Services, who is appointed by the Dean of the Faculty. The library budget is determined by the Dean, rather than by the KdV Institute or by the Central University Library. This construction might change in the long-term future.

During 2006 Koornwinder represented the institute in the library council of the Faculty of Science. His membership of this council also involves preparing decisions about journal subscriptions and book purchases within the available budget. For this last task he collaborates with Ms. N. Abdalla, library staff member for mathematics.

As far as journals are concerned, subscriptions to math journals are increasingly being changed from a printed version delivered by mail to an electronic version immediately accessible through the internet. This development has huge advantages for users who can
download and print papers from their office. Simultaneously, the enormous yearly price increases of commercial scientific journals in the past have now been replaced by a fixed yearly increase, as a consequence of long-term license agreements between publishers and universities. Such licenses typically guarantee digital access to a large number of journals.

It is no longer possible to make precise the budgets for journals and for books exclusively for mathematics. Mathematics journals are financially pooled with those for physics and astronomy (total budget in 2006 is 84000 euro). The budget for books is now combined for all disciplines within the Faculty of Science. Historically, new acquisitions of mathematics books amount to about 9000 euro per year.

Within a few years there will be physically only one library for the Faculty of Science, to be realized in the new buildings at Kruislaan. There will be available much less shelf room for books and back volumes of journals there then at present. Library staff is already anticipating on these developments by marking some of the books and back volumes of journals for being moved to a distant storage (or worse).

4.3.4 Communication

The institute has a homepage http://www.science.uva.nl/math. Its aim is to reach visitors from outside the KdV Institute, and less so the KdVI members themselves. In particular, outreach activities and news about staff members and students are prominent. The homepage is strongly embedded within the UvA-CMS environment and therefore uniform in structure and lay-out with most other UvA webpages. Several people in the KdV Institute are responsible for alerting on changes in a specific area, and to report them to Brandts, who acts as editor.

Apart from the external homepage, KdVI also maintains a number of internal pages. It functions as an archive of the institute’s newsletter and has a few other practical pages.

Every three or four weeks a concise newsletter is sent around to members of staff by e-mail. It mentions the arrival of visitors and new members of staff, announces staff meetings, and contains other short messages on internal and external points of interest.

Communication between management and members of staff takes place in a more formal way twice a year during a meeting of tenured staff. Full professors get together approximately every month to discuss ongoing policy matters.
Appendices
1. People in the research programmes

(including all researchers, independently of source of funding)

<table>
<thead>
<tr>
<th>Programme</th>
<th>Algebra and Geometry</th>
<th>Mathematical Physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme</td>
<td></td>
<td></td>
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<tr>
<td>Algebra and Geometry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programme leader</td>
<td>prof. dr. G.B.M. van der Geer</td>
<td>prof. dr. R.H. Dijkgraaf</td>
</tr>
<tr>
<td>Projects</td>
<td></td>
<td>Projects</td>
</tr>
<tr>
<td>Project leaders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algebraic Geometry</td>
<td>prof. dr. G.B.M. van der Geer</td>
<td>(jointly with ITFA)</td>
</tr>
<tr>
<td>prof. dr. B.J.J. Moonen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>drs. R. Salomon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>drs. A.I. Zaytsev</td>
<td></td>
<td></td>
</tr>
<tr>
<td>drs. P.M.J. Joris (from 10-2006)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>drs. M.C. Hoeve (from 12-2006)</td>
<td></td>
<td></td>
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<tr>
<td>Project leaders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algebraic Groups</td>
<td>prof. dr. E. M. Opdam</td>
<td>Quantization and Operator Algebras</td>
</tr>
<tr>
<td>prof. dr. J.V. Stokman</td>
<td></td>
<td>Project leaders</td>
</tr>
<tr>
<td>dr. W.G.M. Groenevelt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>drs. F.J. van der Bult</td>
<td></td>
<td></td>
</tr>
<tr>
<td>drs. E. Emsiz (until 07-2006)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>drs. M.S. Solleveld</td>
<td></td>
<td></td>
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<tr>
<td>Programme leader</td>
<td></td>
<td></td>
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<tr>
<td>Mathematical Physics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programme leader</td>
<td>prof. dr. R.H. Dijkgraaf</td>
<td></td>
</tr>
<tr>
<td>Projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project leaders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>String Theory (jointly with ITFA)</td>
<td>prof. dr. R.H. Dijkgraaf</td>
<td></td>
</tr>
<tr>
<td>prof. dr. J. de Boer (ITFA)</td>
<td></td>
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<tr>
<td>prof. dr. E. Verlinde (ITFA)</td>
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<tr>
<td>dr. K. Skenderis (ITFA &amp; KdVI)</td>
<td></td>
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<tr>
<td>dr. T. Quella (KdVI &amp; ITFA)</td>
<td></td>
<td></td>
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<tr>
<td>(from 09-2006)</td>
<td></td>
<td></td>
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<tr>
<td>dr. J.P. van der Schaar (ITFA &amp; KdVI)</td>
<td>(from 09-2006)</td>
<td></td>
</tr>
<tr>
<td>further guests, postdocs and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PhD students, mainly at ITFA</td>
<td></td>
<td></td>
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<tr>
<td>Project leaders</td>
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<td></td>
</tr>
<tr>
<td>Geometric Algebra (jointly with IAS-group)</td>
<td></td>
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<tr>
<td>dr. H.G.J. Pijls</td>
<td></td>
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<tr>
<td>dr. L. Dorst (IAS-group)</td>
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<tr>
<td>prof. dr. E.M. de Jager (prof. em.)</td>
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<td>Programme</td>
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<td>Programme leader</td>
<td>prof. dr. A. Schrijver</td>
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<tr>
<td>Members</td>
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<td>Discrete Mathematics</td>
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<td>Programme</td>
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<tr>
<td>Programme leader</td>
<td>prof. dr. T.H. Koornwinder</td>
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<td>Projects</td>
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<td>Project leaders</td>
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<td>Lie theory and special functions</td>
<td>prof. dr. T.H. Koornwinder</td>
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<td>prof. dr. T.H. Koornwinder</td>
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<td>dr. E. Hendriksen (em.)</td>
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<td>prof. dr. J.J.O.O. Wiegerinck</td>
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<td>prof. J. Korevaar (prof. em.)</td>
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<td>dr. P.J. de Paepe</td>
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<td>drs. S. el Marzguioui</td>
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Projects

**Applied Analysis and Numerical Analysis**

Project leaders
- prof. dr. A. Doelman
- dr. G. Hek
- dr. A.J. Homburg
- dr. R.G. de Vilder
- dr. A. Zagaris (from 09-2006)
- drs. N.J.M. Valkhoff (until 12-2006)
- drs. H. Zmarrou
- drs. R. Driesse
- drs. A. Golmakani (from 09-2006)
- prof. dr. S.J. van Strien

Members
- dr. A.J. Homburg
- prof. dr. P.W. Hemker (until 12-2006)
- prof. dr. J.G. Verwer
- dr. J. H. Brandts
- ir. F. Geurts (09- until 12-2006)
- drs. N.J.M. Valkhoff (until 12-2006)
- dr. A.J. Homburg
- prof. dr. J. G. Verwer
- dr. J. H. Brandts
- ir. F. Geurts (09- until 12-2006)

**Dynamical Systems**

- prof. dr. A. Doelman
- dr. G. Hek
- dr. A.J. Homburg
- dr. R.G. de Vilder
- dr. A. Zagaris (from 09-2006)
- drs. N.J.M. Valkhoff (until 12-2006)
- drs. H. Zmarrou
- drs. R. Driesse
- drs. A. Golmakani (from 09-2006)
- prof. dr. S.J. van Strien

**Programme Stochastics**

Programme leader
- prof. dr. C.A.J. Klaassen

Projects

**Mathematical Statistics**

Project leaders
- prof. dr. C.A.J. Klaassen
- dr. A.J. van Es
- dr. J. de Mast
- dr. E. Edens

Members
- dr. A.J. van Es
- dr. J. de Mast
- dr. E. Edens
- drs. E. Edens

**Industrial Statistics (IBIS)**

Project leaders
- prof. dr. R.J.M.M. Does
- dr. A. Trip
- drs. B. de Groot
- drs. P.P. van der Meulen
- drs. H. de Koning
- drs. M.B. Vermaat
- prof. dr. S. Bisgaard
- prof. dr. C.A.J. Klaassen

**Probability Theory**

- prof. dr. M.R.H. Mandjes
- dr. P.J.C. Spreij
- prof. dr. M. Keane (prof. em.)
- prof. dr. A.N. Shiryaev (honorary)
- dr. A.A. Balkema (em.)
- drs. S. Gugushvili
- drs. A. Es-Saghouani (from 02-2006)
- drs. F. Roijers (from 08-2006)
- drs. P.M.D. Lieshout (CWI) (from 08-2006)

**Financial Mathematics**

(jointly with the projects Applied Analysis and Dynamical Systems, Probability Theory, and Mathematical Statistics)

Members
- dr. P.J.C. Spreij
- dr. R.G. de Vilder
- dr. R.Th. Peters (Newtrade) (until 10-2006)
- drs. M.P. Visser (Newtrade)
- drs. V.J.G. Leijdekker (ABN AMRO)
- dr. A.A. Balkema (em.)
- prof. dr. C.A.J. Klaassen
- prof. dr. A.N. Shiryaev (honorary)

**Other Research**

**Didactics (jointly with Amstel Institute and ILO)**

Members
- prof. dr. J. van de Craats
- dr. C.G. Zaal
drs. A.J.P. Heck (Amstel Institute & KdVI)
dr. A.L. Ellermeijer (Amstel Institute)
drs. L.J.B. Wesker-Elzinga (ILO)

Teaching

dr. G. Alberts
2. Editorships and affiliations

S. Bisgaard
Member of the Management Committee, Technometrics.
Member of the Editorial Review Board, Journal of Quality Technology.
Member of Editorial Board, Quality Engineering.
Column Editor for Quality Engineering.
Member of the Publication Management Board, American Society for Quality.

J.H. Brandts
Editor Applications of Mathematics.
Editor SIAM Journal on Matrix Analysis and Applications.
Editor Applied Numerical Mathematics.

A. Doelman
Coordinating Editor Physica D (Nonlinear Phenomena).
Member Academie Raad voor de Wiskunde, KNAW.
Member VSNU Kamer Wiskunde.
Program manager FOM/NWO Program Dynamics of Patterns.
Member, NWO VIDI Committee.
Member NWO Program Committee Climate Variability.
Member Scientific Steering Committee Lorentz Center.
Member Board NDNS+ cluster.
Member of Program Committee ‘SIAM Conference on Applications of Dynamical Systems (DS07)’.
Member Governing Board Stieljes Institute Research School.
Programme Leader Stieljes research programme 'Differential Equations, Dynamical Systems and Numerical Analysis'.Member of 'Stieltjesprijs' committee.
Chairman of the ACW-OOW Strategie Commissie Wiskunde.

R.J.M.M. Does
Member of Editorial Board Quality Engineering.
Member of Editorial Board Quality Technology and Quantitative Management.
Member of the Advisory Board of Quality Engineering.
Director, secretary and treasurer of the European Network for Business and Industrial Statistics.
Vice President of the International Society for Business and Industrial Statistics.Member of the Scientific Council of the Dutch Network for Quality.
Member of the Board of the Dutch Society for Statistics and Operations Research.
Chairman of the Dutch network of ENBIS.

R.H. Dijkgraaf
Supervisory Editor Nuclear Physics B.
Editor Journal of Geometry and Physics.
Editor Advances in Theoretical and Mathematical Physics.
Editor International Mathematical Research Notices.
Editor Journal of Differential Geometry.
Editor Communications in Number Theory and Physics.
Member editorial board of several book series (Elsevier Mathematical Library, Springer).
Member Executive Board, FOM/NWO Physics.
Chair Program Management, FOM-GBE Program Mathematical Physics.
Program Manager, FOM Program String Theory and Quantum Gravity.
Member Advisory Committee International Workshops on Algebraic Geometry and Physics.
Member Scientific Steering Committee, Max-Planck Institut für Mathematik, Bonn.
Member Scientific Steering Committee Mathematics, Lorentz Center, Leiden University.
Member Scientific Steering Committee Physics, Lorentz Center, Leiden University.
Member, Governing Board, School of Theoretical Physics, Dublin Institute for Advanced Study.
Member, Mathematics Council (Raad voor de Wiskunde), KNAW.
Member, Art and Science Committee, KNAW.
Member International Advisory Committee, Strings 2006, Beijing.
Member External Scientific Council, Service de Physique Theorique, CEN-Saclay.
Member ‘N-Profielcommissie’ Ministry of Education.
Member ‘Commissie Nieuwe Natuurkunde’.
Member, ‘Begeleidingscommissie Wetenschap en Techniek’, VTB
Member, Stichting Proefjes.nl.
Member, 'Stichting Heertje bibliotheek'.
Chair, Stichting Kidzlab.
Member, Stichting Kunst in de Openbare Ruimte, SKOR.
Member, Advisory Board, Gerrit Rietveld Academie.
Member, Stichting Premium Erasmianum
Chair, NWO Eureka Science Communication Prizes 2006.
Member, Advisory Board, Instutuut voor Interdisciplinaire Studies, Universiteit van Amsterdam
Member, Advisory Board, Adviesraad Academia Vitae.

G.B.M. van der Geer
Editor Geometriae Dedicata.
Editor EMS Monographs in Mathematics.
Editor Lecture Notes Unione Matematica Italiana.
Member Scientific Committee Max-Planck Institut fuer Mathematik, Bonn.
Member Board Foundation Compositio Mathematica.
Member of Gesellschaft fuer Mathematische Forschung.
Pichoridis Chair, June-July 2006, University of Crete, Iraklion, Greece.
Organizer (together with Moonen and B. Edixhoven) Conference Modular Forms, 8-13 oktober 2006, Schiermonnikoog.
Organizer (with B. Edixhoven) of Geometry in Autumn, Lorentz Center, Leiden, 28-29 September.

G.M. Hek
Chairman of Stichting Epsilon, a foundation that aims to publish low-priced mathematics books in the Dutch language.
Editor of Zebra-reeks, Epsilon Uitgaven (a series of topics in mathematics for high school students in the highest grades).

P.W. Hemker
Member Koninklijke Hollandsche Maatschappij der Wetenschappen.
Editor Computational Methods in Applied Mathematics.

M.S. Keane
Associate Editor Probability Theory and Mathematical Statistics.
Editor Indagationes Mathematicae.
Member of the governing board (treasurer) for Compositio Mathematica.
Organizer ’Bijeenkomst Stochastici’, Lunteren.
Member KNAW.
Foreign member Chilean Academy of Sciences.
Member, Center of Excellence, Keio University.
Ridder in de Orde van de Nederlandse Leeuw.

C.A.J. Klaassen
Chairman Board of Research School Thomas Stieltjes Institute for Mathematics.
Member Scientific Advisory Committee of the Netherlands Forensic Institute (NFI).
Advisor EURANDOM, theme Statistics in Biology.

J. Korevaar
Member Editorial Board Analysis in Theory and Applications.
Member Editorial Board Indagationes Mathematicae.
Member KNAW.
Honorary Member Koninklijk Wiskundig Genootschap (Royal Dutch Mathematical Society).
Honorary Member American Mathematical Society.
Member Mathematical Association of America.

T.H. Koornwinder
Member Board Mathematical Research Institute.
Secretary/Treasurer of Stichting voor Hoger Onderwijs in de Toegepaste Wiskunde.
Member Taakgroep Landelijke wiskunde-PR (joint committee of Koninklijk Wiskundig Genootschap and Nederlandse Vereniging van Wiskundelareren).
Member of editorial board Kennislink.
Member of SASTRA Ramanujan Prize Committee.
Member of editorial board of SIGMA (online mathematics journal).
Member of editorial board of Journal of Nonlinear Mathematical Physics.
Member of International Scientific Advisory Board of Max Planck Institute for Mathematics, Bonn, Germany.

M.R.H. Mandjes
Advisor EURANDOM, theme Queueing and Performance Evaluation.
Secondment at theme PNA2, Center for Mathematics and Computer Science (CWI).
Member Evaluation Committee VIDI, NWO.
Leader WP 5 and WP 5.2 of EU Network of Excellence EURO-NGI (Design and Engineering of the Next Generation Internet).
Technical Programme Committee Chair INFORMS Applied Probability (Eindhoven, 2007), jointly with O.J. Boxma.
Organizer of the 2nd Dutch-Korean workshop on queueing theory (Amsterdam, October 2006), jointly with H.C. Tijms.
Organizer of the workshop ‘Resource sharing’ (Amsterdam, November 2006), jointly with R.D. van der Mei and R. Nunez-Queija.
Associate Editor of the journal Stochastic Models.
Associate Editor of the journal Queueing Systems.
Member board Stieltjes Institute (representing CWI), project leader programme 4.2, Stochastic Operations Research (jointly with prof.dr. G.M. Koole).
Member of the supervisory board of IBIS UvA BV.

J. de Mast
Member of the Editorial Board Quality Engineering.
Member of Editorial Board Technometrics.
Program chair of the Sixth Annual Meeting of ENBIS in Wroclaw, Poland.
Section Editor of Wiley's Encyclopedia of Statistics in Quality and Reliability Engineering.
Guest editor of Statistica Neerlandica (special issue on industrial statistics).
Invited session organizer at the Joint Research Conference on Statistics in Quality, Industry and Technology 2006 in Knoxville, TN.

B.J.J. Moonen
Managing Editor Compositio Mathematica.

E.M. Opdam
Program manager NWO PIONIER Project Symmetry in Mathematics and Mathematical physics.
Local program manager and member of the board of the NWO research cluster Geometry and Quantum Theory.
Project leader Stieltjes Research Programme 2.2, Representation Theory, Operator Algebras and Complex Analysis.
Member Science Committee Thomas Stieltjes Institute for Mathematics.
Member of the ACW advisory committee of NWO (Adviescommissie Wiskunde).
Editor for IMRN (International Mathematical Research Notes).
Editor for Compositio Mathematica.
Deputy member of the Senate of the Universiteit van Amsterdam.

A. Schrijver
Editor-in-chief Combinatorica.
Editor Discrete Applied Mathematics.
Editor Journal of Combinatorial Optimization.
Editor Journal of Combinatorial Theory, Series B.
Editor Journal of Combinatorics, Information and System Sciences.
Editor SIAM Journal on Discrete Mathematics.
Editor of Discrete Optimization.
Advisory editor North-Holland Mathematical Library.
Member editorial board SIAM Monographs on Discrete Mathematics and Applications.
Member Board EIDMA -- Euler Institute for Discrete Mathematics and Its Applications.
Member KNAW.
Member Akademie Raad voor de Wiskunde.
Member Program Committee Networks NWO.
Chairman Advisory Committee of Mathematics NWO.
Chairman Program Committee 5th European Congress of Mathematics.
Member Program Board for Mathematics, Lorentz Center, Leiden.
Member Nordrhein-Westfälische Akademie der Wissenschaften.
Member Deutsche Akademie der Naturwissenschaften Leopoldina.
Member Scientific Committee Mathematisches Forschungsinstitut Oberwolfach.
Member Board DIAMANT-cluster.

P.J.C. Spreij
Chairman of the Section Mathematical Statistics of the VVS (Dutch Society for Statistics and Operation Research).
Associate Editor of the Journal of Applied Mathematics.
Theme leader Stieltjes theme group Mathematics and Economics.
Organiser VVS-SMS AIO afternoon (February 26).
Member Organising Committee Dag voor Statistiek en Besliskunde 2006 (June 14).
Organiser 5th Winter School on Financial Mathematics (January 23-25).
Member of the Steering Committee of AMaMeF, research project Advanced Mathematical Methods in Finance of the European Science Foundation ESF.

J.V. Stokman
Program manager NWO VIDI project Symmetry and modularity in exactly solvable models.
Member scientific committee of the annual Twente conference on Lie Groups.
Member NWO Open Competition committee.
Member of the research cluster Geometry and Quantum Theory (GQT).
Member, organizing committee GQT colloquium.

J.G. Verwer
Head CWI cluster Modelling, Analysis and Simulation and member Management Team CWI.
Senior editor Applied Numerical Mathematics.
Associate editor ACM Transactions on Mathematical Software.
Special editor of the proceedings NUMDIFF10 conference.
J.J.O.O. Wiegerinck
Treasurer of 5ECM organizing committee.
Treasurer of the foundation ‘Stichting fifth European Congress of Mathematics’.

C.G. Zaal
Member of the national reform committee of the secondary mathematics curriculum (commissie Toekomst Wiskunde Onderwijs).
Member Taakgroep Landelijke wiskunde-PR (joint committee of Koninklijk Wiskundig Genootschap and Nederlandse Vereniging van Wiskundeleraren).
Member of the Mathematics Webmaster Platform, a group of mathematicians which is professionally involved in making or maintaining mathematical websites.
3. ‘Eerste geldstroom’ projects

UvA


4. ‘Tweede geldstroom’ projects

NWO


G.B.M. van der Geer: project The geometry of the Moduli Space of Abelian Varieties in particular the Godaira dimension for genus 6, PhD student position for A.I. Zaitsev (09-2003 until 09-2007).


J.V. Stokman: VIDI project Symmetry and modularity in exactly solvable models (04-2005 until 04-2010); postdoc position for W. Groenevelt (09-2005 until 01-2008); PhD student position for M. van Meer (02-2006 until 02-2010); postdoc position for C.M. Field (09-2006 until 09-2008).

A. Doelman: project Interactions of Pulses and Fronts, PhD student position for P.J.A. van Heijster (05-2005 until 02-2009).


M.R.H. Mandjes and P.J.C. Spreij: project Large Deviations of Queues with Gaussian Inputs: Characterization and Analysis, PhD student position for A. Es-Saghouani (02-2006 until 02-2010).

E.M. Opdam: research cluster Geometry and Quantum Theory (09-2006 - until 09-2011); PhD student position for R.I. van der Veen (09-2006 until 09-2010); PhD student position for Ph. Joris (10-2006 until 10-2010).

A. Zagaris: VENI project Reduced models for multiscale reaction-diffusion dynamics (09-2006 until 09-2009).

G. B.M. van der Geer: project Stratifications of the Moduli Space of Curves, PhD student position for M.C. Hoeve (12-2006 until 12-2010).
5. ‘Derde geldstroom’ projects

**IBIS**

R.J.M.M. Does. The research work in industrial statistics is co-ordinated by the Institute for Business and Industrial Statistics (IBIS UvA BV), which is embedded in the UvA Holding. This institute combines scientific research with consultancy activities. For further details, see 2.6.2.

**Eurandom**

C.A.J. Klaassen, scientific co-ordinator of research program Statistics in Biology; posting for one day a week (09-2002 until 01-2008).

M.R.H. Mandjes, scientific advisor of research program Queueing and Performance Analysis; posting for one day every two weeks (09-2006 until 09-2007).

**ABN AMRO**


**Newtrade**


**TNO**


**Paid Editorships**

A. Doelman, coordinating editor of Physica D.

R.H. Dijkgraaf, supervisory editor of Nuclear Physics B.

B.J.J. Moonen, managing editor of Compositio Mathematica.

**Scientific publications**: articles in journals, proceedings and edited books; monographs. These are always refereed.

**Preprints and reports**: not included here; see http://www.science.uva.nl/math/research.cfm.

**Other publications**: book editor or professional or popularizing publication.

**Author names in bold** have or had an affiliation with the KdV Institute while research for the publication was done or while the publication appeared.

Mathematical publications: Documentation and review for most papers can be electronically obtained from MathSciNet at http://www.ams.org/mathscinet (not a free service).

Note: In the current report a few publications of the year 2005 have been included, which were not included in the previous annual report.

### Algebra and Geometry

#### Scientific publications - articles in journals


- **Moree, P.** (2006). Asymptotically Exact Heuristics for Prime Divisors of the Sequence $\{a^k + b^k\} \bmod k$. *J. Integer Seq.*, 9(article 06.2.8), 15.

- **Moree, P.** (2006). On the distribution of the order and index of $g(p \bmod p)$ over residue classes III. *Journal of Number Theory*, 120(1), 132-160.

- **Moree, P.** (2006). On the distribution of the order and index of $g(p \bmod p)$ over residue classes II. *Journal of Number Theory*, 117(2), 330-354.


#### Scientific publications – proceedings; other monographs


**Ph.D. Theses**


**Mathematical Physics**

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

**String Theory (jointly with ITFA)**

**Scientific publications - articles in journals**


**Discrete Mathematics**

**Scientific publications - articles in journals**


**Other publications**


**Pure Analysis**

**Scientific publications - articles in journals**


**Scientific publications – proceedings; other monographs**


**Other publications**


**Applied and Numerical Analysis**

**Scientific publications - articles in journals**


Scientific publications – proceedings; other monographs


Other publications


Ph.D. Theses


Stochastics

Scientific publications - articles in journals


**Scientific publications – proceedings; other monographs**


**Other publications**


Ph.D. Theses


Didactics (jointly with Amstel Institute)

Other publications


