MaPhySto News

THIS ISSUE

INTRODUCTION

Welcome to the fourth issue of MAPHYSTO NEWS.

In this newsletter we, and some of our guests too, report from recent activities that have taken place under the auspices of MaPhySto. We also look toward the future, reproducing (excerpts of) announcements of forthcoming events.

A new feature among the MaPhySto activities is announced below under SUMMER STIPENDS. We ask senior readers of the newsletter kindly to draw the attention of talented young researchers to the announcement.

New readers who may not yet be acquainted with the Centre, may find some general information about MaPhySto at the end of the newsletter.

Ole E. Barndorff-Nielsen,
Søren Have Hansen, eds.

SUMMER STIPENDS

As you will discover below, MaPhySto will in the month of August 2000 organize the courses

2–9 August, 2000, Sandbjerg Manor: *Summerschool on Quantum Field Theory — from a Hamiltonian point of view*

14–18 August, 2000, University of Copenhagen: *Concentrated Advanced Course on Interacting Particle Systems, Percolation Theory and applications in statistical mechanics*

28 August – September 1, 2000, University of Aarhus: *Concentrated Advanced Course on Lévy processes and Branching Processes*

As these activities span from pure mathematical physics over statistical mechanics to applications of stochastic processes, and as one of the main goals of MaPhySto is to strengthen the interaction between the subjects of mathematical physics and stochastics, it has been decided to award up to 5 subsistence stipends (of DKK 10.000 each) to younger European researchers / advanced graduate students, based on the following terms:

- To be considered for receiving a stipend an application must be sent to MaPhySto (see address on last page, or from `www.maphysto.dk`), marked "Summer Stipend 2000".

- The application must reach MaPhySto before **April 15, 2000**.

- The applicant must have the intention of attending (at least) two of the above-mentioned activities, and he/she (or the thesis advisor) must in the application

demonstrate the applicant's ability to gain from the courses in question.

- The applicant will spend the remaining time of August at any of the MaPhySto groups at the Universities of Aalborg, Aarhus, Odense/Southern Denmark or Copenhagen. The applicant should mention one or more specific researchers at these institutions, that he/she especially would like to develop contact with.

The applicants will on May 1, 2000 be informed whether they will receive a stipend or not.

The MaPhySto secretariat will of course assist the succesful applicants in finding suitable (cheap) accommodation.

For further information, please contact the MaPhySto secretariat.

RECENT EVENTS

Summer School on Empirical Processes.

Report by Aurea Grané, Jorge Graneri, Nora Gürtler, Reid Huntsinger and Ingo Steinke.

MaPhySto Summer School on Empirical Processes was held August 9–20 at the Department of Mathematical Sciences of the University of Aarhus. The 60 participants represented 16 countries.

The main lectures consisted of concentrated advanced courses on empirical process theory and its applications in statistics, given by some of the leading experts in the field. Professor R. M. Dudley (MIT) and Professor P. Gänssler (University of Munich) presented the core empirical process theory, with emphasis on characterization of functional classes (e.g. uniform Donsker classes) and behavior of random-measure processes (e.g. empirical and partial-sum processes), respectively. Professor J. Hoffman-Jørgensen lectured on a

new concept of convergence in law for random elements and sets; Professors J. Wellner (University of Washington, Seattle) and A. Van der Vaart (Free University, Amsterdam) focused on the use of empirical process methods in dealing with problems in statistics such as consistency of estimators and convergence rates.

Invited lectures were given by Professors V. Dobric (Lehigh University), S. van de Geer (University of Leiden), S. E. Graversen and G. Peskir (both of the University of Aarhus), M. B. Hansen (Aalborg University), V. de la Peña (Columbia University), and W. Stute (University of Giessen). In addition, approximately 10 participants contributed talks. These invited and contributed talks included assorted applications of empirical process theory to areas of current research. The atmosphere during the two weeks was characterized by the lively and stimulating discussions both during the scheduled question-and-answer periods as well as during the breaks. The very high quality lectures provided abundant material for such discussion.

FIGURE 1. The Summer School took place at the same time as the solar eclipse. Luckily the clouds broke at just the right time.

The tremendous success of the program is no doubt due in very large part to extremely careful and thoughtful organization. Printed and bound lecture notes and photocopied technical reports and handouts were distributed to participants; arrangements were made for easy computer and library access; a detailed schedule was maintained (and updated hourly); and the coffee, tea and cookie delivery mechanism functioned like a fine Swiss watch.

In addition, useful general information on Århus (restaurants, bars, bus routes, etc.) was provided to the participants.

The program of lectures was complemented by several social events during the course of the summer school, including a welcome reception; an excellent conference dinner featuring two wines, three meats, several salads, and the world-reknowned Rubinstein cake; and a guided tour of the old picturesque town of Ebeltoft.

FIGURE 2. Cutting the Rubenstein cake.

Last, but not least, many thanks to Jørgen Hoffmann-Jørgensen, Oddbjørg Wethelund, Ole E. Barndorff-Nielsen and Søren Have Hansen for organizing this summer school as well as to MaPhySto for generous logistic and financial support.

FIGURE 3. The participants of the Summer School on Empirical Processes.

Workshop on Mathematical Physics. On Thursday September 2, 1999 a short workshop on mathematical physics was held at Aalborg University. The workshop was organized by Arne Jensen (Aalborg). There were talks by

Helge Holden (Norwegian University of Science and Technology): *Hierarchies of soliton equations and their algebro-geometric solutions*

Vojkan Jakšić (University of Ottawa, Canada): *Spectral theory of corrugated surfaces*

Erik Skibsted (University of Aarhus): *Quantum scattering for homogeneous of degree zero potentials: Absence of channels at local maxima and saddle points*

Pavel Exner (Academy of Sciences, Prague, Czech Republic): *Anomalous bound states of a Pauli electron*

Workshop on Stochastics and Quantum Physics. On 21–26 October, 1999 MaPhySto held a workshop on areas where concepts and techniques from Stochastics (i.e. Probability and Mathematical Statistics) are, or seem likely soon to become, of real quantum physical importance. The workshop was organized by Klaus Mølmer and Ole E. Barndorff-Nielsen and was co-sponsored by the Danish Natural Science Research Council. Below follows a report kindly provided by one of the participants of the workshop.

Report by François Bardou

> "Since the seventeenth century, physical intuition has served as a vital source for mathematical problems and methods. Recent trends and fashions have, however, weakened the connection between mathematics and physics [...]. This rift is unquestionably a serious threat to science as a whole; the broad stream of scientific development may split into smaller and smaller rivulets and dry out."

These words from R. Courant, although written in 1924, still sound very relevant to our ears. Not because the rivulets of specialized research have dried out but, paradoxically, because the wealth of results challenges the ability of physicists/mathematicians to be simply aware of the key recent developments in mathematics/physics, let alone to technically master these developments.

The MaPhySto Workshop on Stochastics and Quantum Physics has been an excellent opportunity to revive the horn of plenty created by close relationships between mathematics and physics. I give here a personal view on the Workshop which reflects my own enthousiasms and biases, but does not do justice to all the presented works.

FIGURE 4. Discussions during a break.

A main topic of the Workshop dealt with quantum information, quantum communication and quantum computation. As a physicist, I learned about the impressive range of interesting mathematics involved in these topics. It was also striking to see how this field,

which was experimentally nearly inexistent a few years ago, is flourishing now with the prospect of fundamental experiments and of practical applications. We had a direct insight with the visit of the Quantum Optics laboratory of the University of Aarhus. More generally, modern quantum physics experiments, being performed today on more and more artificial and perfectly controlled systems (like nanoscale electronics, special atomic or light states...), promise to renew some theoretical debates in quantum physics.

Another related main topic was quantum stochastics and quantum optics. In these fields also, the latest physics results come to the point where they can stimulate mathematics and vice-versa. These situations are not so frequent in a researcher's lifetime and should be appreciated fully.

Apart from these main topics, many attractive results were presented. To name a few subjects: fractional brownian motion, Bell inequalities and relativity, numerical stochastic quantum calculations... I was especially stimutated by a talk revealing how even old

problems such as the stochastic interpretations of the Schrödinger equation could be fruifully revisited using modern statistical concepts. I had also the pleasing surprise to see that laser cooling of atoms, one of my preferred topics, raises mathematical questions in the theories of renewal processes and Markov processes.

The recipe of this Workshop proved a very tasty one: bring together a limited number of open-minded participants, on a rather specialized program, but with a broad range of approaches ranging from pure mathematics to physics. As other participants, I left Aarhus with new stimulating ideas to think about, only regretting that it had ended. Let this fruitful and perfectly organized Workshop serve as a model for other scientific meetings.

François Bardou, CNRS, Strasbourg.

Editors' remark: From the MaPhySto website you may down-load the booklet of extended abstracts of the talks given during the workshop. In the booklet you also find the program and the list of participants.

FIGURE 5. The participants of the workshop on Stochastics and Quantum Physics.

Conference on Number Theory and Spectral Theory, December 3–4, 1999. This conference covered an important range of problems in number theory and spectral theory. It gave rise to a valuable communication and interaction between different aspects of the subject.

A. Sebbar presented the connection between the capacity of compact sets (disjoint unions of intervals) and Jacobi forms. *M. Huxley* discussed counting of lattice points inside a plane closed curve. *E. Opdam* found the analytical approach to the description of representations of the Iwahori-Hecke algebra. *G. Wüstholz* studied the connection between algebraic values of hypergeometric functions and special points on rational curves in Shimura varieties. *U. Haagerup* gave a survey of the theory of random matrices and the distribution of zeroes of the Riemann zeta function. *D. Mayer* introduced a transfer operator approach to the Selberg zeta function for subgroups of the modular group. *A. Venkov* studied the spectrum of exceptional Hecke operators for congruence groups with primitive character.

FIGURE 6. About half of the participants of the Conference on Number Theory and Spectral Theory.

Graduate Course on Modular forms and Dirichlet series. In the fall term of 1999 *Alexei Venkov* taught this course at the Department of Mathematical Sciences, University of Aarhus. The course will continue in the spring term of 2000 under the same title.

Seminar on Geometric Mathematical Physics. The Geometric Mathematical Physics seminar, organized by *Jørgen Ellegaard Andersen*, has in the fall term of 1999 had talks by *Dietmar Bisch*, *Gregor Masbaum*, *Gorm Salomonsen*, *Herbert Lee* and *Vladimir Turaev*. The seminar will continue in the spring as an integrated half-part of the Department's topology seminar, with talks by *Brian Steer*, *Vladimir Turaev* and *George Thompson* among others.

More information can be found from:

`www.maphysto.dk/events/GMFseminar/`

Concentrated Advanced Course on Vassiliev invariants, chord diagrams, the Kontsevich integral, the structure of the algebra of Feynman diagrams, and the universal Lie algebra.

MaPhySto hosted 4 – 7 January, 2000, a Concentrated Advanced Course on Vassiliev Invariants, chord diagrams, the Kontsevich integral, the structure of the algebra of Feynman diagrams and the universal Lie algebra with *Pierre Vogel* as speaker. Pierre gave 6 lectures of 2 x 45 minutes and there were two exercise sessions.

The course started with the basic definitions, assuming only standard knowledge of algebra and ended in Pierre's own current results and state of the art conjectures for the structure of the algebra of Feynman diagrams, all in his usual crystal clear lecturing style. Pierre's lecture notes were distributed among the participants right at the beginning of the course. These notes, including the exercises from the course, is soon to appear in the MaPhySto lecture note series. The course was organised by *Jørgen Ellegaard Andersen*.

FIGURE 7. Lecturer Pierre Vogel.

Mini-symposium on Volatility and Derivative Securities.

On 10–11 January, 2000 MaPhySto and CAF (Centre for Analytical Finance) held a mini-symposium around some topics of mathematical finance. The symposium was organized by *Bent Jesper Christensen* (CAF).

FIGURE 8. The participants of the Workshop on Computational Stochastics.

Workshop on Computational Stochastics.
The Workshop on Computational Stochastics
was held January 17–21, 2000 at the Uni-
versity of Aarhus and was organized jointly
by Laboratory for Computational Stochas-
tics and MaPhySto, the organizing commit-
tee consisted of *Søren Asmussen* (University
of Lund) and *Eva B. Vedel Jensen* (University
of Aarhus). There were 36 participants, com-
ing from Australia, Czech Republic, Denmark,
France, Italy, Mexico, Poland, Sweden, United
Kingdom and the United States.

The programme was interdisciplinary, aim-
ing at presenting a broad selection of the many
separate topics of which the area of computa-
tional stochastics is formed. Some of the main
themes were numerical methods for Markov
chains, spatial statistics, Markov chain Monte
Carlo methods and computational genetics.

FIGURE 9. Excursion to the open air museum
"Den Gamle By" (the Old Town).

As it has become tradition, a booklet of ex-
tended abstracts of the talks given during the
workshop will appear in the MaPhySto Miscel-
lanea series.

**Concentrated advanced course on Lévy
Processes.** Following the interest engen-
dered by the international conference on *Lévy
Processses: Theory and Applications* organized
by MaPhySto and held January 18–22, 1999, it
was decided to have Lévy processes as a stand-
ing theme for MaPhySto activities through the
rest of the grant period.

As part of this programme the week 24–
28 January 2000 was devoted to two con-
centrated advanced courses and some addi-
tional lectures, on Lévy processes and on some
related questions (the questions particularly
concerned pseudo differential operators).

Professor *Ken-Iti Sato* (Nagoya University)
gave ten lectures on selected topics in the the-
ory of Levy processes, based on his recent book
*Levy Processes and Infinitely Divisible Distri-
butions* published November 1999 by Cam-
bridge University Press. However, the lec-
tures went beyond the material in the book
and notes prepared by Professor Sato and con-
taining additional developments will appear
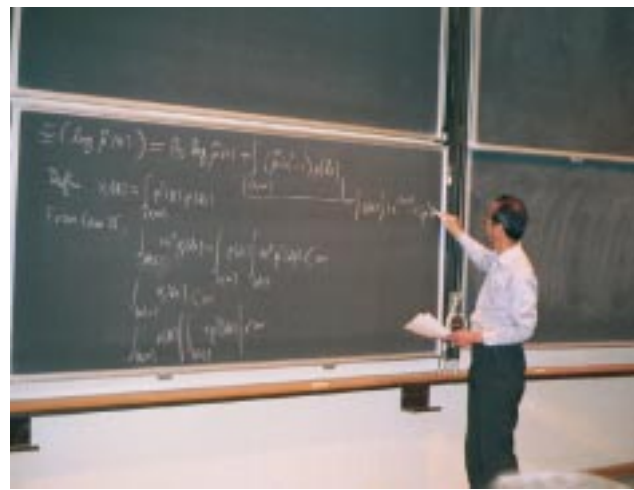in the MaPhySto Lecture Notes Series.

FIGURE 10. Lecturer Ken-iti Sato.

Associated to Professor Sato's lectures were tu-
torial classes on the results presented. These
classes were organized and held by *Elisa Nico-
lato* (long time visitor to Aarhus from the Uni-
versity of Padua).

FIGURE 11. The participants of the Course on Lévy Processes.

Several lectures on fractional calculus and relations to stable processes were given by Professors *Francesco Mainardi* (University of Bologna) and *Rudolf Gorenflo* (Free University of Berlin) and extensive lecture notes from their course will also appear in the MaPhySto Lecture Notes Series.

FIGURE 12. Lecturer Francesco Mainardi.

In addition there were talks by *Barbara Rüdiger* (University of Bonn) and *Sergei Levendorskiĭ* (Rostov State Academy of Economics).

The event attracted more than 50 participants from around the World (including Japan and Mexico) and the audience consisted in a nice mixture of junior and senior researchers.

The next events on Lévy processes will be a miniworkshop to be held 22–23 February 2000 and another Concentrated Advanced Course, this time on *Levy Processes and Branching Processes* August 28 – September 1, 2000 (for details, see p. 11).

FUTURE EVENTS

On the following pages you find excerpts of announcements of some forthcoming MaPhySto activities. In most cases more information can be found from our web-site.

For a full (and up-to-date) listing we refer you to our web-page

www.maphysto.dk/events/

Graduate course on Canonical Commutation Relations and their Applications in Quantum Theory.
While visiting MaPhySto, *Jan Dereziński* will give a series of lectures (2 hours of lectures plus 2 hours of exercise sessions per week) at the University of Copenhagen on *Canonical Commutation Relations and their Applications in Quantum Theory*.

The first lecture will be given in the first week of March, 2000. The course will continue until 15 May, 2000.

More information can be found from:
`www.maphysto.dk/events/QTGrad2000/`

Summer School on Stereology and Geometric Tomography.
May 20–25, 2000, Sandbjerg Manor.

The aim of the summer school is to give an overview of modern stereology and its relation to geometric tomography, including both the mathematical and statistical theory and the practical applications.

Stereology is the area of stochastics dealing with statistical inference about spatial structures from geometric samples of the structure such as two-dimensional sections and one-dimensional probes. The development of stereological methods involve the use of advanced mathematical tools, especially from geometric measure theory and integral geometry. Stereology is now in world-wide use in many areas of biology and medicine, most importantly in neuroscience and cancer grading. Other areas of application are geology, metallography and mineralogy.

Geometric tomography is closely related to stereology, as is apparent from its definition: "geometric tomography is the area of mathematics dealing with the retrieval of information about a geometric object from data about its sections, or projections, or both". Geometric tomography has connections with convex geometry, geometric probing in robotics, computerized tomography, and other areas.

The teaching team includes

- *Adrian Baddeley* (University of Western Australia)
- *Richard Gardner* (Western Washington University)
- *Hans Jørgen G. Gundersen* (University of Aarhus)
- *Eva B. Vedel Jensen* (University of Aarhus)
- *Kiên Kiêu* (Institut National de la Recherche Agronomique, Versailles)

Lectures by invited researchers in related fields such as convex geometry, stochastic geometry and spatial statistics are also planned, as well as lectures by the participants of the summer school.

The summer school will be held at Sandbjerg Manor, a conference centre owned by the University of Aarhus, situated in the southern part of Jutland, Denmark. The summer school is organized jointly by StocLab (Laboratory for Computational Stochastics, University of Aarhus) and MaPhySto.

The summer school is addressed to PhDs, PostDocs and other researchers in mathematics. Scientists from the natural sciences with a strong background and interest in mathematics are also welcome. The number of participants is limited to 50. Participation will therefore be by application only.

More information can be found from:
`www.maphysto.dk/events/S-and-GT2000/`

Workshop on Random Matrices and Free Probability.
5–9 June, 2000, Sandbjerg Manor.

This Workshop is organized by *Uffe Haagerup*, *Ken Dykema* and *Steen Thorbjørnsen*. Please contact *Uffe Haagerup* (`haagerup@imada.sdu.dk`) for further information.

Summer School on Quantum Field Theory — from a Hamiltonian point of view. Wednesday 2 – Wednesday 9 August, 2000, Sandbjerg Manor.

This Summer School will comprise the following series of lectures (3-4 hours each):

Prof. Volker Bach, Universität Mainz: *Title to be announced*

Prof. Jan Dereziński, University of Warsaw: *Spectral analysis of simple models of Quantum Field Theory*

Prof. Gian-Michele Graf, ETH Zürich: *Stability of (ultraviolet cutoff) non-relativistic QED*

Prof. Jens Hoppe, Max-Planck-Institut für Gravitationsphysik, Albert-Einstein-Institut, Potsdam: *Membranes and Matrix Models*

Prof. Michael Loss, Georgia Tech: *Self-energy of electrons in nonrelativistic QED*

Prof. Herbert Spohn, TU München: *Dynamics of classical charges and their radiation field*

The summer school will commence in the late afternoon of Wednesday 2 August and will conclude with lunch on Wednesday 9 August, 2000.

The Summer School is organized by *Jan Philip Solovej* and *Søren Fournais*, and is co-sponsored by the EU-TMR network on PDE and Quantum Mechanics.

More information can be found from:
`www.maphysto.dk/events/SummerMP2000/`

Concentrated advanced course on Percolation theory and applications in statistical mechanics. August 14 – August 18, 2000, University of Copenhagen.

In the above-mentioned week, MaPhySto will organize a Concentrated Advanced Course on *Percolation Theory and Applications in Statistical Mechanics.* Lecturers are *Olle Häggström* and *Johan Jonasson* (Chalmers University of Technology, Gothenburg).

The goal of this course is to present the basics of percolation theory, plus some applications in statistical mechanics and other recent developments. No particular prerequisites are needed, other than familiarity with probability founded on measure theory.

More information can be found from:
`www.maphysto.dk/events/PTandSM2000/`

Concentrated advanced course on Lévy Processes and Branching Processes. August 28 – September 1, 2000, University of Aarhus.

Lecturers of this course are *Jean Bertoin* (Université Pierre et Marie Curie) and *Jean-François Le Gall* (ENS, Paris). The main goal of this series of lectures will be to present some connections between Lévy processes with no negative jumps and branching processes or random trees. The lectures by J. Bertoin will describe some of the basic theory of Lévy processes, including subordinators, connections with Markov processes and fluctuation theory in the case of processes with no negative jumps.

The lectures by J.-F. Le Gall will deal more specifically with the coding of the genealogy of continuous branching processes, including applications to limit theorems for discrete Galton-Watson trees and to the construction of superprocesses.

In addition to the main lectures there will be a mini-course (4 hours) with lectures by Ole E. Barndorff-Nielsen (MaPhySto) on *Lévy Processes from a modelling perspective*.

More information can be found from:
`www.maphysto.dk/events/LevyBranch2000/`

Visitors

Below follows the list of visits currently arranged. From the "People" page of `www.maphysto.dk` you can always find up-to-date information about recent, current and coming visitors at MaPhySto.

Jerzy Jurkiewicz (Jagiellonian University): Visiting the Copenhagen node from 2000/01/10 until 2000/02/29.

Yuri Makeenko (ITEP, Moscow): Visiting the Copenhagen node from 2000/01/15 until 2000/04/15.

Ken-iti Sato (Nagoya University): Visiting the Aarhus node from 2000/01/22 until 2000/03/30.

Elena R. Loubenets (MSIEM, Moscow): Visiting the Aarhus node from 2000/02/14 until 2000/03/10.

Victor Perez-Abreu (CIMAT, Mexico): Visiting the Aarhus node from 2000/02/20 until 2000/02/26.

Albert N. Shiryaev (Steklov Math. Inst.): Visiting the Aarhus node from 2000/02/20 until 2000/02/23.

Jan Derezinski (Warsaw University): Visiting the Copenhagen node from 2000/03/01 until 2000/05/31.

Brian Steer (University of Oxford): Visiting the Aarhus node from 2000/03/29 until 2000/04/09.

Vladimir Turaev (CNRS, Strasbourg): Visiting the Aarhus node from 2000/04/09 until 2000/04/23.

George Thompson (ICTP, Trieste): Visiting the Aarhus node from 2000/04/23 until 2000/04/30.

Jan Derezinski (Warsaw University): Visiting the Aarhus node from 2000/08/09 until 2000/09/19.

Jan Rosinski (University of Tennessee): Visiting the Aarhus node from 2000/08/25 until 2000/10/31.

Personalia

Søren Asmussen. Together with *Colm Art O'Cinneide* (Purdue University), *Søren Asmussen* has on November 8, 1999, been awarded *The 1999 Marcel F. Neuts Applied Probability Award* for their joint paper *Representations for matrix-geometric and matrix-exponential steady-state distributions with applications to many-server queues* (*see* Cmm. Statist. Stochastic Models **14** (1998), no. 1-2, 369–387).

As of January 1, 2000, *Søren Asmussen* has been nominated editor-in-chief of the *Annals of Applied Probability.*

Eva B. Vedel Jensen. On November 26, 2000 *Eva B. Vedel Jensen* received the *Ib Henriksen Research Award* of DKK 200.000 for her continuing research in stereology and stochastic geometry.

Søren Fournais. From January 1, 2000 and one year onwards *Søren Fournais* will be employed as a MaPhySto postdoc at the Department of Mathematical Sciences, University of Aarhus. Søren received his Ph.D. from the University of Aarhus in the fall 1999 and came to MaPhySto after two months at the Erwin Schrödinger International Institute for Mathematical Physics in Vienna. His main research interest is current and magnetisation in quantum systems, with the most famous example being Quantum Hall Systems. A notable side interest of his is the study of the pointwise behaviour of (low energy) eigenfunctions — an area where methods from PDE and mathematical physics often combine with methods from stochastic analysis.

Jesper Møller. On January 21, 2000 *Jesper Møller* successfully defended his thesis for the doctoral degree in Natural Sciences (*dr.scient.*) at the University of Aalborg. The thesis is entitled *Aspects of Spatial Statistics, Stochastic Geometry and Markov Chain Monte Carlo Methods*. It is based on a survey, a research monograph and 20 selected articles. The survey is availiable at

`www.math.auc.dk/∼jm/dis5.ps.gz`

Elisa Nicolato. From February 1, 2000 and half a year onwards *Elisa Nicolato* will be employed as MaPhySto and CAF (Centre for Analytical Finance) part-time research assistant at the Department of Mathematical Sciences, University of Aarhus. Elisa is just about to defend her University of Padua Ph.D.-thesis entitled *A class of stochastic volatility models for the term structure of interest rates*.

PUBLICATIONS

Below you will find a list of recent publications from MaPhySto. You may order the publications from MaPhySto or go to the MaPhySto web-page `www.maphysto.dk` from where you may down-load (most of) the publications mentioned.

Research Reports (ISSN 1398-2699).

2000-3 (January 2000): *The kernel of Dirac operators on $\mathbb{S}^3$ and $\mathbb{R}^3$* by Jan Philip Solovej, László Erdős.

2000-2 (January 2000): *Lorentzian and Euclidean Quantum Gravity — Analytical and Numerical Results* by J. Ambjørn, J. Jurkiewicz, R. Loll.

2000-1 (January 2000): *On the relation between Euclidean and Lorentzian 2D quantum gravity* by J. Ambjørn, J. Correia, C. Kristjansen, R. Loll.

1999-47 (December 1999): *Bounding the Maximal Height of a Diffusion by the Time Elapsed* by Goran Peskir.

1999-46 (December 1999): *Atoms in strong magnetic fields: The high field limit at fixed nuclear charge* by Jan Philip Solovej, Bernhard Baumgartner, Jakob Yngvason.

1999-45 (November 1999): *The quantum stochastic evolution of an open system under continuous in time nondemolition measurement* by Elena R. Loubenets.

1999-44 (November 1999): *Finite N Matrix Models of Noncommutative Gauge Theory* by Jan Ambjørn, Y.M. Makeenko, J. Nishimura, R.J. Szabo.

1999-43 (November 1999): *Perfect Slice Samplers* by Jesper Møller, A. Mira, G.O. Roberts.

1999-42 (November 1999): *Markov jump processes with a singularity* by Ole E. Barndorff-Nielsen, Jens Ledet Jensen, Fred Espen Benth.

1999-41 (November 1999): *Spectral Theory of Laplacians for Hecke Groups with Primitive Character* by Erik Balslev, Alexei Venkov.

1999-40 (October 1999): *Random Matrices and Non-Exact C*-algebras* by Uffe Haagerup, Steen Thorbjørnsen.

1999-39 (October 1999): *Asymptotic Freeness Almost Everywhere for Random Matrices* by
Fumio Hiai and Denes Petz.

1999-38 (October 1999): *Laser Cooling and Stochastics* by
Ole E. Barndorff-Nielsen, Fred Espen Benth.

1999-37 (October 1999): *Fermionisation of the Spin-S Uimin-Lai-Sutherland Model:* (Generalisation of the Supersymmetric t-J Model to Spin-S) by
Jan Ambjørn, D. Karakhanyan, M. Mirumyan, A. Sedrakyan.

1999-36 (October 1999): *Branched Polymers Re-Revisited* by
Jan Ambjørn, Bergfinnur Durhuus, T. Jonsson.

1999-35 (October 1999): *Atiyah-Patodi-Singer Type Index Theorems for Manifolds with Corners and Splitting of j-Invariants II* by
Gorm Salomonsen.

1999-34 (October 1999): *Atiyah-Patodi-Singer Type Index Theorems for Manifolds with Corners and Splitting of j-Invariants I* by
Gorm Salomonsen.

1999-33 (September 1999): *The covariance of Donsker's Delta Functions* by
Fred Espen Benth, Siu-Ah Ng.

1999-32 (September 1999): *Equivalence of Sobolev Spaces* by
Gorm Salomonsen.

1999-31 (September 1999): *Abelian gauge fields coupled to simplicial quantum gravity* by
Jan Ambjørn, K.N. Anagnostopoulos, J. Jurkiewicz.

1999-30 (September 1999): *Screening and D-brane Dynamics in Finite Temperature Superstring Theory* by
Jan Ambjørn, Yu. Makeenko, G.W. Semenoff, R.J. Szabo.

1999-29 (September 1999): *A new perspective on matter coupling in 2d quantum gravity* by
Jan Ambjørn, K.N. Anagnostopoulos, R. Loll.

1999-28 (September 1999): *Heavy Traffic Limits for Some Queueing Networks* by
Maury Bramson, J. G. Dai.

1999-27 (August 1999): *Brown's Spectral Distribution Measure for R-diagonal Elements in Finite von Neumann Algebras* by
Uffe Haagerup, Flemming Larsen.

1999-26 (August 1999): *Mixed Moments of Voiculescu's Gaussian Random Matrices* by
Steen Thorbjørnsen.

1999-25 (August 1999): *Perfect simulation for sample-based inference* by
Jesper Møller, Geoff K. Nicholls.

1999-24 (August 1999): *Quantum scattering for homogeneous of degree zero potentials* (Absence of channels at local maxima and saddle points) by
Erik Skibsted, Ira Herbst.

Lecture Notes Series (ISSN 1398-2702).

No. 5 (August 1999): *Empirical and partial-sum processes* (revisited as random measure processes) by Peter Gaenssler, Daniel Rost.

No. 4 (August 1999): *Notes on Empirical Processes* by R. M. Dudley.

No. 3 (July 1999): *Marked Point Processes and Piecewise Deterministic Processes* by Martin Jacobsen.

No. 2 (March 1999): *Stochastic Simulation* (with a view towards stochastic processes) by Søren Asmussen.

No. 1 (December 1998): *An introduction to p-variation and Young integrals* by R. M. Dudley, R. Norvaiša.

Miscellanea (ISSN 1398-5957).

No. 16 (December 1999): *Mini-proceedings: Workshop on Stochastics and Quantum Physics* by O. E. Barndorff-Nielsen and Klaus Mølmer (eds.).

No. 15 (October 1999): *Asymptotics in Quantum Statistics* by Richard D. Gill.

No. 14 (July 1999): *Miniproceedings: Workshop on Finance and Turbulence* by Ole E. Barndorff-Nielsen, Bent Jesper Christensen, Henning Bunzel, Michael Sørensen (eds.).

No. 13 (July 1999): *Mini-proceedings: First MaPhySto Workshop on Inverse problems* (Inverse Problems in Stratified Media) by Arne Jensen, Jens Ledet Jensen, Bo Holm-Jacobsen (eds.).

No. 12 (May 1999): *Kolmogorov and the Turbulence* by A.N. Shiryaev.

No. 11 (April 1999): *Mini-proceedings: Conference on Lévy processes* (theory and applications) by O. E. Barndorff-Nielsen, S.E. Graversen and T. Mikosch (eds.).

No. 10 (January 1999): *Mini-proceedings from the Workshop on Product Integrals and Pathwise Integration* (January 11-13, 1999) by Ole E. Barndorf-Nielsen and Thomas Mikosch (eds.).

Books. We would also like to draw your attention to the fact that the lecture notes volume *Probabilistic Networks and Expert Systems* co-authored by *Steffen L. Lauritzen* is now available from Springer-Verlag.

Probabilistic expert systems are graphical networks which support the modelling of uncertainty and decisions in large complex domains, while retaining ease of calculation. Building on original research by the authors over a number of years, this book gives a thorough and rigorous mathematical treatment of the underlying ideas, structures and algorithms, emphasizing those cases in which exact answers are obtainable.

GENERAL INFORMATION ABOUT MAPHYSTO

The Centre for Mathematical Physics and Stochastics — MaPhySto — is a mathematical research centre funded by the Danish National Research Foundation. The Centre came into existence on 1 April 1998 and it is located administratively at the Department of Mathematical Sciences, University of Aarhus. The

Scientific Director is *Ole E. Barndorff-Nielsen* and a group of about twenty mathematicians, from the universities of Copenhagen, Odense, Aalborg and Aarhus, are associated with the Centre as "Principal Investigators". In addition, the Centre comprises a number of "Associated Investigators".

The main fields of activity of MaPhySto are *Mathematical Physics* (e. g. quantum mechanics, statistical mechanics, quantum field theory) and *Stochastics* (e. g. stochastic analysis, interacting particle systems, stochastic matrices, free probability), with some particular emphasis on the interplay between these two fields. Aspects of *Stochastic Computation, Inverse Problems* and *Analytic Number Theory* are also part of the ambit of the Centre.

The personal research of the participating investigators form the backbone of the Centre activities. Based on this, MaPhySto aims to build up knowledge and research in parts of the above-mentioned areas that seem of key importance for future developments in mathematics, whether theoretical or applied. It is sought, in particular, to expand and make more coherent the spectrum of competence represented in mathematics in Denmark.

Concretely, MaPhySto seeks to achieve this through a broad range of activities: short and long term visits by leading international researchers; workshops; conferences; concentrated advanced courses; and summer-schools. Longer lecture series by international or Danish mathematicians are also given.

As an important element in securing a lasting effect of these endeavours the Centre has a number of postdoc positions, that are generally announced internationally via electronic job-advertisment bulletin boards (and of course also via our own web-site).

Contact Information