BRÅKET

Information om seminarier och högre undervisning i matematiska ämnen i Stockholmsområdet

NR 14 **FREDAGEN DEN 11 APRIL 2008**

BRÅKET

Veckobladet från Institutionen för matematik vid Kungl Tekniska Högskolan och Matematiska institutionen vid Stockholms universitet

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Sista manustid för nästa nummer: Torsdagen den 17 april kl. 13.00.

Crafoord Symposium in Mathematics

Detta anordnas av KVA och äger rum torsdagen den 24 april. Se sidorna 10 – 12.

Nomineringar till CIAMs Examensarbetespris 2007

Se sidan 9.

SEMINARIER

Fr 04–11 kl. 13.15 – 14.15. Graduate Student Seminar. Richard Miles, Matematik, KTH: *Lehmer's problem and its role in algebraic dynamics.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 4.

Ti 04–15 kl. 14.00 – 15.00. Mittag-Leffler Seminar — Plurikomplexa seminariet. Jan-Erik Björk, SU: *Some topics in microlocal analysis and wavefront sets of distributions.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 5.

Ti 04–15 kl. 15.30 – 16.30. Mittag-Leffler Seminar — Plurikomplexa seminariet. Mihai Paun, Université Henri Poincaré, Nancy: *A Bergman kernel proof of the Kawamata subadjunction theorem.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 4.

Fortsättning på nästa sida.

Disputation i matematik

David Jacquet disputerar på avhandlingen *On complex convexity* måndagen den 14 april kl. 10.00 i sal 14, hus 5, Matematiska institutionen, SU, Kräftriket. Se Bråket nr 12 sidan 6.

Disputation i optimeringslära och systemteori

Fredrik Carlsson disputerar på avhandlingen *Utilizing Problem Structure in Optimization of Radiation Therapy* fredagen den 25 april kl. 10.00 i sal F3, KTH, Lindstedtsvägen 26, b.v. Se Bråket nr 13 sidan 6.

Disputation i matematik

Lennart S. Nobel disputerar vid SU på avhandlingen *Polynomial Hulls and Envelopes of Holomorphy* fredagen den 25 april kl. 13.15. Se sidan 13.

Seminarier (fortsättning)

On 04–16 kl. 10.15 – 12.00. Kombinatorikseminarium. Shmuel Friedland, University of Illinois at Chicago and Berlin Mathematical School: *Counting matchings in graphs with applications to the monomer-dimer models.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 5.

On 04–16 kl. 11.00 – 12.00. KTH/Nordita/SU Seminar in Theoretical Physics. *(Observera lokalen!)* **Gordon W. Semenoff,** UBC, Vancouver: *Graphene domain walls as quantum wires.* Sal FD41, Roslagstullsbacken 21, AlbaNova universitetscentrum.

On 04–16 kl. 13.15 – 14.15. Seminarium i analys och dynamiska system. Bo Berndtsson, Chalmers tekniska högskola, Göteborg: *Asymptotics of Bergman kernels.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

On 04–16 kl. 15.15. Seminarium i matematisk statistik. Peter Neal, School of Mathematics, University of Manchester: *Endemic diseases in heterogeneously mixing populations.* Rum 306 (Cramérrummet), hus 6, Matematiska institutionen, SU, Kräftriket. Se sidan 4.

To 04–17 kl. 9.00 – 10.00. Graduate Student Seminar. *(Observera dagen och tiden!)* **Jakob Björnberg,** Cambridge University och Matematik, KTH: *Ising-modellen.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 6.

To 04–17 kl. 13.15 – 14.15. Minicourse in mathematics. Michelle Bucher: *An introduction to bounded cohomology. Third lecture.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se Bråket nr 12 sidan 7.

To 04–17 kl. 14.00 – 15.00. Mittag-Leffler Seminar. Frank Kutzschebauch, Universität Bern: *Andersén-Lempert theory for automorphisms of affine space — generalizations and applications.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 7.

To 04–17 kl. 14.00 – 16.00. Kollokvium i filosofi. Jussi Haukioja, University of Turku, Finland: *Intuitions, Experiments and Externalism.* Rum D255, Filosofiska institutionen, SU.

To 04–17 kl. 15.30 – 16.30. Mittag-Leffler Seminar. Joël Merker, École Normale Supérieure, Paris: *The Hartogs theorem on* $(n-1)$*-complete complex spaces — An algorithm to generate all Demailly invariants.* Institut Mittag-Leffler, Auravägen 17, Djursholm. Se sidan 7.

Fr 04–18 kl. 11.00 – 12.00. Optimization and Systems Theory Seminar. Fredrik Carlsson, Optimeringslära och systemteori, KTH: *Utilizing problem structure in optimization of radiation therapy.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

Må 04–21 kl. 14.00. Licentiatseminarium i matematik. Eric Emtander, SU: *On hypergraph algebras.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket. Se sidan 9.

Fortsättning på nästa sida.

Seminarier (fortsättning)

Må 04–21 kl. 15.15–17.00. Seminarium i matematisk statistik. Professor Ali Mohammad-Djafari, Paris, håller två föredrag: *Inverse Problems: From regularization theory to Bayesian inference* och *A Gauss-Markov-Potts prior model for images in Bayesian Computed Tomography.* Seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Se sidan 8.

Professor Mohammad-Djafaris seminarium anordnas i samarbete med SIDEC AB.

On 04–23 kl. 10.30–11.30. AlbaNova and Nordita Colloquium in Physics. *(Observera dagen, tiden och lokalen!)* **Professor Edward Witten,** Institute for Advanced Study, Princeton: *Emergent phenomena in condensed matter and particle physics.* Svedbergssalen, Roslagstullsbacken 21, AlbaNova universitetscentrum. Se sidan 6.

Professor Witten är en av 2008 års Crafoordpristagare i matematik. Se Bråket nr 2 sidan 9 och detta nummer sidorna 10–12.

On 04–23 kl. 13.00. Seminarium i statistik. Professor Xavier de Luna, Statistiska institutionen, Umeå universitet: *Analysing the sensitivity to the unconfoundedness assumption in evaluation studies using register data.* Sal B705, Statistiska institutionen, SU, Universitetsvägen 10B, plan 7, Frescati. Se sidan 14.

On 04–23 kl. 13.15–14.15. Seminarium i analys och dynamiska system. Johan Thim, Linköping: *A fixed point theorem in locally convex spaces.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

On 04–23 kl. 13.15–15.00. Algebra and Geometry Seminar. Clas Löfwall, SU: *Filiform Lie algebras.* Rum 306, hus 6, Matematiska institutionen, SU, Kräftriket. Se sidan 6.

Observera att Clas Löfwall skall hålla sitt seminarium den 23 april. I Bråket nr 13 angavs fel dag för detta seminarium.

On 04–23 kl. 16.00. KTH/SU Mathematics Colloquium. Professor Peter Taylor, Queen's University, Kingston, Ontario, Canada: *The evolution of tag-based cooperation.* Seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Kaffe/te serveras kl. 15.30 i pausrummet, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 4. Se sidan 5.

On 04–23 kl. 19.00. Populärvetenskaplig föreläsning i fysik. Docent Per Berglund, Biokemi, KTH: *Kommer kläder att tvätta sig själva i framtiden? Om biokemins möjligheter.* Oskar Kleins auditorium, Roslagstullsbacken 21, AlbaNova universitetscentrum. Se sidan 13.

Må 04–28 kl. 18.00. Guest Lecture. Ilana Wartenberg, Tel Aviv: *Arabic and Hebrew Mathematics in the Middle Ages.* Sal 14, hus 5, Matematiska institutionen, SU, Kräftriket. Se sidan 7.

Ilana Wartenberg recently received her Ph.D. at Tel Aviv University and Université Paris 7 on a dissertation on medieval Hebrew mathematics.

GRADUATE STUDENT SEMINAR

Richard Miles:
Lehmer's problem and its role in algebraic dynamics

Abstract: Lehmer's problem concerns the range of Mahler measure, an important invariant arising in many areas of mathematics, from knot theory to algebraic dynamics. The problem is very simply stated in terms of polynomial roots, but has been open for over 70 years. This talk will cover some history of the problem, its dynamical context and some more recent developments.

Tid och plats: Fredagen den 11 april kl. 13.15 – 14.15 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

MITTAG-LEFFLER SEMINAR — PLURIKOMPLEXA SEMINARIET

Mihai Paun:
A Bergman kernel proof of the Kawamata subadjunction theorem

Abstract: The subadjunction theorem of Kawamata can be seen as a sophisticated, higher codimensional analogue of the usual adjunction theorem. We use convexity properties of the fibrewise m-Bergman metric in order to derive a quantitative version of Kawamata's result and point out some of its natural generalizations.

This is joint work with Bo Berndtsson.

Tid och plats: Tisdagen den 15 april kl. 15.30 – 16.30 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

SEMINARIUM I MATEMATISK STATISTIK

Peter Neal:
Endemic diseases in heterogeneously mixing populations

Abstract: During the past 15 years or so, much of the research into stochastic epidemic models has looked at incorporating more realistic population structure into the models to better describe the spread of infectious diseases. A prime example is the household model, where the population is partitioned into small groups (households), and whilst infectious individuals can pass the disease on to any member of the population but have an increased chance of infecting members of their own household. Another example is the network model, where individuals can only infect their friends. However, in most analysis only closed population SIR epidemics are considered. In this case individuals can only be infected once, and endemic disease behaviour is not possible.

In this talk we study the simplest epidemic model which can exhibit endemic behaviour, the SIS epidemic model. We consider the effect of incorporating heterogeneity into the population structure by focusing upon two examples, the household model and the great circle model (a spatial disease model). We shall show that both models can exhibit endemic behaviour, and we will provide a simple characterization of the endemic equilibrium, linking it with the probability that an epidemic initiated by one infective 'takes off'.

Tid och plats: Onsdagen den 16 april kl. 15.15 i rum 306 (Cramérrummet), hus 6, Matematiska institutionen, SU, Kräftriket.

MITTAG-LEFFLER SEMINAR — PLURIKOMPLEXA SEMINARIET

Jan-Erik Björk:
Some topics in microlocal analysis and wavefront sets of distributions

Abstract: The talk will expose results in analytic $\mathcal{D}$-module theory and microdifferential systems. A special topic is the geometry of complex Lagrangeans and quantized contact transformations.

Tid och plats: Tisdagen den 15 april kl. 14.00 – 15.00 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

KOMBINATORIKSEMINARIUM

Shmuel Friedland:
Counting matchings in graphs
with applications to the monomer-dimer models

Abstract: Let $G = (V, E)$ be an undirected graph with vertices V and edges E. A *dimer* is a domino occupying an edge $e = (u, v) \in E$ and a *monomer* is a single vertex $w \in V$. An l-match, or a *monomer-dimer cover* of G, is a subset E' of E, of cardinality l, such that any two distinct edges $e, f \in E'$ do not have a common vertex. Let $\phi(l, G) \geq 0$ be the number of l-matchings in G for any $l \in \mathbb{Z}_+$. In many combinatorial problems it is of interest to estimate from above and below the number $\phi(l, G)$. In the monomer-dimer models in statistical mechanics, as the integer lattice $\mathbb{Z}^d$, or the Bethe lattice, i.e. an infinite k-regular tree, one needs to estimate the number of l-matchings in bipartite regular graphs. Moreover, one needs to estimate the corresponding quantities $h_G(p)$, called the *monomer-dimer entropy,* for dimer density $p \in [0, 1]$, for infinite graphs G. In this lecture we will survey the recent developments in this area and pose several conjectures.

The slides of the lecture are available at
http://www.math-berlin.de/images/stories/friedland.pdf.

Tid och plats: Onsdagen den 16 april kl. 10.15 – 12.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

KTH/SU MATHEMATICS COLLOQUIUM

Peter Taylor:
The evolution of tag-based cooperation

Abstract: In the field of evolutionary ecology there has been much interest recently in the evolution of cooperation in animal societies. Many mechanisms have been proposed to enhance the selective advantage of cooperation, and one of these is based on tag recognition. In this system, every individual has a tag, and you cooperate with anyone you meet who has the same tag. Does this work? There is of course the problem of cheaters, those who have the same tag as you but who do not reciprocate. A simple but powerful method known as inclusive fitness has been developed to analyse such questions. I will explain how it works and present a few sample results.

Tid och plats: Onsdagen den 23 april kl. 16.00 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7. Kaffe/te serveras kl. 15.30 i pausrummet, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 4.

GRADUATE STUDENT SEMINAR

Jakob Björnberg: Ising-modellen

Sammanfattning: Ising-modellen av en magnet är den viktigaste modellen i statistisk mekanik. Trots det kan dess främsta egenskaper härledas ur en handfull ojämlikheter. Den första av dessa ojämlikheter (GKS) följer från en grundläggande ojämlikhet i teorin for slumpgrafer (FKG). Vi använder detta exempel för att illustrera ett fruktbart samband mellan Ising-modellen och slumpgrafer; det finns många andra sådana exempel. Inga förkunskaper krävs.

Plan: Introduktion till fasskiften. Ising-modellen. FK-modellen och FKG-ojämlikheten. GKS från FKG.

Tid och plats: Torsdagen den 17 april kl. 9.00 – 10.00 i seminarierum 3721, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

ALBANOVA AND NORDITA COLLOQUIUM IN PHYSICS

Edward Witten: Emergent phenomena in condensed matter and particle physics

Abstract: Traditionally, there is a close analogy between condensed matter physics and particle physics, reflecting the fact that both fields deal with large scale effects of local quantum degrees of freedom. The analogy is the reason that emergent phenomena, which are ubiquitous in condensed matter physics, are also important in particle physics. The traditional analogy between the two subjects actually fails in the presence of gravity, but modern "holographic" insights suggest a cure.

Tid och plats: Onsdagen den 23 april kl. 10.30 – 11.30 i Svedbergssalen, Roslagstullsbacken 21, AlbaNova universitetscentrum.

ALGEBRA AND GEOMETRY SEMINAR

Clas Löfwall: Filiform Lie algebras

Abstract: A filiform Lie algebra is an n-dimensional nilpotent Lie algebra of maximal degree of nilpotency among all nilpotent n-dimensional Lie algebras. They form an open set within the closed set of all nilpotent ones. They were originally studied by Michèle Vergne in 1966. The name comes from the fact that they have the form of a thread: L is generated by two elements and L^i/L^{i+1} is one-dimensional for $i = 2, \ldots, n-1$. Here $L^1 = L$ and $L^i = [L, L^{i-1}]$. An infinite filiform Lie algebra L is a Lie algebra such that L/L^n is filiform of dimension n for all n. An example of such a Lie algebra is the set of all vector fields in one variable generated by $x^i \frac{d}{dx}$ for $i \geq 2$. We will present some elementary facts about filiform Lie algebras including a new characterization of them in terms of generators and relations (joint work with Juan Nuñez, Sevilla) and a program that computes the dimension, given the presentation with generators and relations.

In particular we are interested in finding all filiform Lie algebras of a given dimension which are "infinitely extendable", i.e., a quotient of an infinite filiform Lie algebra (partial results are obtained by Fialowski (1984) and Millionschikov (2002)).

Tid och plats: Onsdagen den 23 april kl. 13.15 – 15.00 i rum 306, hus 6, Matematiska institutionen, SU, Kräftriket.

MITTAG-LEFFLER SEMINAR

Frank Kutzschebauch:
Andersén-Lempert theory for automorphisms of affine space — generalizations and applications

Abstract: We give some overview of recent results concerning and applying the theory of holomorphic automorphisms of complex n-space. Also generalizations to manifolds with density property will be explained.

The main results of the author presented in this talk are joint work with Shulim Kaliman.

Tid och plats: Torsdagen den 17 april kl. 14.00 – 15.00 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

MITTAG-LEFFLER SEMINAR

Joël Merker:
The Hartogs theorem on $(n-1)$-complete complex spaces — An algorithm to generate all Demailly invariants

Abstract: Employing Morse theory and the method of analytic discs but no d-barre techniques, we establish a version of the standard Hartogs theorem in a singular setting, namely: For every domain D of an $(n-1)$-complete normal complex space of pure dimension > 1, and for every compact set K in D such that $D \setminus K$ is connected, holomorphic of meromorphic functions in $D \setminus K$ do extend holomorphically or meromorphically to D.

The last 15 minutes of the talk will describe a complete algorithm, similar to Van den Essen's kernel algorithm, which engenders, in dimensions 2 and 3, all polynomials in jet variables that are invariant by reparametrization, for arbitrary jet order, answering theoretically a question raised by Demailly.

Tid och plats: Torsdagen den 17 april kl. 15.30 – 16.30 vid Institut Mittag-Leffler, Auravägen 17, Djursholm.

GUEST LECTURE

Ilana Wartenberg:
Arabic and Hebrew Mathematics in the Middle Ages

Abstract: In my talk, I will discuss the mathematical œuvre of the Jewish scholar Isaac ben Solomon Ibn al-Ahdab. Isaac was born in Castile in the middle of the 14th century. At some point, he spent some time in a Muslim country, where he studied Arabic mathematics. When he later arrived in Syracuse, Sicily, he was asked by the local Jewish community to compose a book on mathematics. He composed for them *The Epistle of the Number (Iggeret ha-Mispar),* which is a translation into Hebrew and copious adaptation of the famous Arabic arithmetical text *Talkhis A'mal al-Hisab* by the Moroccan mathematician Ibn al-Banna. It is the first extensive testimony of algebra that we know of on the medieval Hebrew mathematical bookshelf. The Epistle includes a rich novel algebraic vocabulary in Hebrew. I will give a mathematical and lexical dégustation of this text.

Tid och plats: Måndagen den 28 april kl. 18.00 i sal 14, hus 5, Matematiska institutionen, SU, Kräftriket.

SEMINARIUM I MATEMATISK STATISTIK

Seminariet består av två föredrag. Det första föredraget:

Ali Mohammad-Djafari:
Inverse Problems: From regularization theory to Bayesian inference

Abstract: In this talk, after a synthetic analysis of the main deterministic methods (analytical inversion, parametric methods, and regularization theory) used in inverse problems, the focus is given to the Bayesian inference approach. Then, in a first step, the link between Maximum A Posteriori (MAP) and the regularization criteria is described, and we will see how different prior modelling results to different regularization criteria. In particular we consider the cases of separable Gaussian and Non-Gaussian, Gauss-Markov and more general Markovian prior models.

Then, the advantages of the Bayesian approach to deterministic methods are highlighted through the possibilities of accounting more precisely for uncertainties of the data and model parameters, hyper parameter estimation, marginalization of nuisance parameters, and the possibilities of the exploration of the space of the possible solutions by the Markov Chain Monte Carlo (MCMC) methods. One last advantage is the possibility of accounting for more specific prior knowledge through the Markovian or mixture models with hidden Markovian variables of contours and region labels, which do not have equivalents in deterministic methods.

Finally, I introduce a class of Gauss-Markov-Potts prior models, which we have developed and used effectively in many imaging applications, which will stimulate, I hope, the audience to come to the second talk, which is focused more specifically on this model and on its application in Computed Tomography.

Det andra föredraget:

Ali Mohammad-Djafari:
A Gauss-Markov-Potts prior model
for images in Bayesian Computed Tomography

Abstract: In many inverse problems in imaging systems and in particular in image reconstruction in Computed Tomography (CT), we may know that the object under the test is composed of a finite number of materials, meaning that the images to be reconstructed are composed of a finite number of homogeneous compact regions. To account for this prior knowledge, we propose a family of Gauss-Markov fields with hidden region labels, modelled by the Potts Markov field. The marginal distributions of such models are the Gaussian mixture models, which have been appropriately used in classification methods.

Then we use these prior models in a Bayesian inference framework for imaging inverse problems, which give us the possibility to jointly reconstruct the images and segment them in an optimal way. In this talk, first these prior models are presented in details, then appropriate MCMC or variational Bayesian methods are used to compute the mean posterior estimators.

Finally some results are presented to show the efficiency of the proposed methods for different imaging inverse problems, and in particular, in CT with limited angle and number of projections.

Tid och plats: Måndagen den 21 april kl. 15.15 – 17.00 i seminarierum 3733, Institutionen för matematik, KTH, Lindstedtsvägen 25, plan 7.

LICENTIATSEMINARIUM I MATEMATIK

Eric Emtander:
On hypergraph algebras

The thesis consists of the following two papers:

Betti numbers of hypergraphs

Abstract: In this paper we study some algebraic properties of hypergraphs, in particular their Betti numbers. We define some different types of complete hypergraphs, which to the best of our knowledge are not previously considered in the literature. Also, in a natural way, we define a product on hypergraphs, which in a sense is dual to the join operation on simplicial complexes. For such product, we give a general formula for the Betti numbers, which specializes neatly in case of linear resolutions.

A class of hypergraphs that generalizes chordal graphs

Abstract: In this paper we introduce a class of hypergraphs that we call chordal. We also extend the definition of triangulated hypergraphs, given in a paper by Hà and Van Tuyl, so that a triangulated hypergraph, according to our definition, is a natural generalization of a chordal (rigid circuit) graph. In a paper by Fröberg, he shows that the chordal graphs correspond to graph algebras, $R/I(\mathcal{G})$, with linear resolutions. We extend Fröberg's method and show that the hypergraph algebras of generalized chordal hypergraphs, a class of hypergraphs that includes the chordal hypergraphs, have linear resolutions. The definitions we give yield a natural higher-dimensional version of the well-known flag property of simplicial complexes. We obtain what we call d-flag complexes.

Tid och plats: Måndagen den 21 april kl. 14.00 i rum 306, hus 6, Matematiska institutionen, SU, Kräftriket.

Nomineringar till CIAMs Examensarbetespris 2007

En av uppgifterna för CIAM (Center for Industrial and Applied Mathematics) är att stimulera högkvalitativa examensarbeten med tema industriell och tillämpad matematik. Vi kommer därför att dela ut CIAMs Examensarbetespris 2007.

Vi välkomnar nu nomineringar till detta pris. Examensarbeten som nomineras skall ha examinerats vid KTH, och de måste ha slutförts under år 2007. Nomineringar kan ske av examinator eller handledare. Nominerade examensarbeten skall inges till Marie Lundin, avd. för Optimeringslära och systemteori, KTH, i två exemplar senast onsdagen den 30 april 2008. Till examensarbetena skall bifogas en motivering för nomineringen där det också skall framgå

- examensarbetarens/examensarbetarnas namn och programtillhörighet,
- examensarbetets titel,
- examinators namn,
- eventuella övriga handledares namn,
- var examensarbetet har utförts.

Det skall speciellt framgå av motiveringen varför examensarbetet förtjänar ett pris inom industriell och tillämpad matematik.

Se http://www.ciam.kth.se för mer information om CIAM.

Eventuella frågor besvaras av Anders Forsgren, avd. för Optimeringslära och systemteori, KTH, e-post: andersf@kth.se, telefon: 08-790 71 27.

CRAFOORD SYMPOSIUM IN MATHEMATICS

From Physics to Geometry

In connection with the Crafoord Prize activities during April 21 – 24, 2008, the above-mentioned symposium in mathematics will be held on Thursday, April 24, in the Beijer Hall, Royal Swedish Academy of Sciences, Lilla Frescativägen 4A, Stockholm (lectures before lunch). During the symposium a number of well-known scientists in this field will give lectures. Two of the speakers are the Crafoord Laureates in Mathematics 2008, *Professor Maxim Kontsevich* and *Professor Edward Witten.*

Everybody interested is invited to attend the lectures (no need for registration for that). If you moreover wish to get a free lunch at the Academy (recommended!), you are invited to register for that at the bottom of the page
http://www.crafoordprize.se/events/programme.4.2f692b3510dbfce339680003937.html.
You should register rather soon, not later than Tuesday, April 15.

Programme

9.00 – 9.45 **Cumrun Vafa,** Department of Physics, Harvard University, USA: *Topological strings.*
Abstract: Topological strings has become an increasingly important tool in understanding the dynamics of string theory and supersymmetric quantum field theories. Not only is it a very rich mathematical object, but it also turns out to have unexpectedly rich and diverse physical applications. In this talk I provide a brief overview of this vast subject.

9.45 – 10.30 **Nikita Nekrasov,** Institut des Hautes Études Scientifiques (IHÉS), France: *Instanton partition functions.*
Abstract: The instanton partition functions are at the intersection of geometry, algebra, topology, combinatorics, and mathematical physics. I review the gauge and string theory instanton partition functions, both the established results and a few conjectures. Various moduli spaces and their compactifications, random discrete geometries and limit shapes, spectral curves and their quantizations, representation theory of infinite-dimensional algebra, invariants of four-manifolds, integrable systems, non-commutative geometry, all these matters will play a role in our story.

10.30 – 11.00 Break with refreshments.

11.00 – 11.45 **Robbert Dijkgraaf,** Institute for Theoretical Physics, University of Amsterdam, The Netherlands: *Gauge theory and quantum curves.*
Abstract: Many properties of four-dimensional supersymmetric quantum gauge theories are captured by two-dimensional conformal theories defined on algebraic (spectral) curves. However, more generally one can obtain a quantum deformation of this well-studied system, where the curve is replaced by a non-commutative object (a D-module). The simplest non-trivial example is given by the exact solutions of random matrix models. I will review the circle of physical and mathematical ideas that includes topological strings, integrable hierarchies, and D-branes.

(Continued on the next page.)

11.45 – 12.30 **Crafoord Laureate 2008 Edward Witten,** Institute for Advanced Study, Princeton, USA: *Electro-magnetic duality on a half-space.*

Abstract: In four-dimensional gauge theory with electro-magnetic duality, what is the dual of Dirichlet boundary conditions? And what is the dual of Neumann boundary conditions? If the gauge group is abelian, then Dirichlet and Neumann boundary conditions are simply dual to each other, but the non-abelian case is much more interesting. The dual of Neumann boundary conditions, at least in the classic case of $N = 4$ supersymmetric Yang-Mills theory, involves the unexpected appearance of an SU(2) group that plays the role of Arthur's SL(2) in the Langlands program of number theory. And the dual of Dirichlet boundary conditions involves a rather unusual three-dimensional conformal field theory. If the gauge group is simply-laced, then this particular conformal field theory is self-mirror in the sense of Intriligator and Seiberg.

In general, electro-magnetic duality on a half-space involves an interplay between SU(2) embeddings in the gauge group and three-dimensional conformal field theory. The Coulomb and Higgs branches of the relevant three-dimensional conformal field theories are important spaces in representation theory, nilpotent orbits of complex Lie groups and their Slodowy slices. Mirror symmetry exchanges one orbit with the Slodowy slice of another orbit. The relation between the two is order-reversing. Mirror symmetry in this sense is a three-dimensional analogue of the more familiar two-dimensional mirror symmetry.

These conformal field theories can be realized in string theory in several different ways, for example via intersecting branes, by studying M-theory at certain singularities, or as a limit of a Janus solution of string theory. Many of these systems have been much studied in the string theory literature, and many results that are already known give illuminating special cases of some of the above statements. One classic string theory question, whose answer is not yet clear but is likely to involve three-dimensional conformal field theories of the above-discussed type, is to describe a system of $D3$-branes ending on a (p, q) fivebrane.

The work presented in this talk has been done in collaboration with D. Gaiotto.

12.30 Lunch at the Academy (see above).

The symposium continues at the Department of Mathematics, Stockholm University, lecture hall 15, Kräftriket, after lunch.

14.15 – 15.00 **Crafoord Laureate 2008 Maxim Kontsevich,** Institut des Hautes Études Scientifiques (IHÉS), France: *Non-commutative wall-crossing formulae.*

Abstract: I will describe a new structure of a very elementary nature, associated with any graded Lie algebra. This structure was observed by Y. Soibelman and myself in the study of generalized Donaldson-Thomas invariants of three-dimensional Calabi-Yau categories. The applications go from the counting of BPS states in superstring theory (and lead to the mathematical definition of the vector-multiplet moduli space), to new identities in cluster algebras, and (possibly) to a new approach to L-functions in number theory via Arakelov geometry.

(Continued on the next page.)

15.00 – 15.45 **Graeme Segal,** Mathematical Institute, University of Oxford, UK: *Non-commutative geometry and quantum field theory.*

Abstract: There is a rough equivalence between the category of commutative rings and the category of topological spaces. It is the basis of the way in which quantum physics describes the world. Thinking about the equivalence leads us towards variants and generalizations of the objects on both sides of the picture. On the algebraic side we can consider non-commutative rings, or rings which themselves have a topology, but also more subtle kinds of algebraic structures. A two-dimensional quantum field theory is an example of such an algebraic structure. These algebraic variants have reflections on the geometrical side of the picture. For example, a commutative ring has a homotopy-type, but a non-commutative ring has a slightly coarser geometric structure, and a topologized non-commutative ring represents yet another kind of geometrical object. I shall describe some different ways of looking at these objects, and how they arise naturally from Floer-type infinite-dimensional variational problems. At the same time I shall explain how some technical-seeming distinctions made in traditional algebraic topology reflect the possible locality properties of quantum field theories.

15.45 – 16.15 Break with refreshments.

16.15 – 17.00 **Eduard Looijenga,** Mathematics Department, University of Utrecht, The Netherlands: *Triangulation of the Teichmüller spaces.*

Abstract: About 25 years ago Mumford and Thurston observed that for every genus g and positive integer n (take $n > 2$ if $g = 0$), the theory of Jenkins-Strebel differentials produces a rather concrete simplical complex endowed with an action of the mapping class group of n-pointed genus g surfaces plus a subcomplex invariant under that group with the property that the complement can be equivariantly identified with the corresponding Teichmüller space. This has had some profound applications, ranging from the homotopy theory of the mapping class groups (work of Harer) to the solution of the Witten conjecture (by Kontsevich). It has also repercussions for topological quantum field theory, Grothendieck's Lego game and the cohomology of the moduli spaces of curves. We shall review some of these uses and state some conjectures inspired by them.

Torsten Ekedahl, Carel Faber, Sergei Merkulov, Jan-Erik Roos

POPULÄRVETENSKAPLIG FÖRELÄSNING I FYSIK

Per Berglund:
Kommer kläder att tvätta sig själva i framtiden?
Om biokemins möjligheter

Sammanfattning: Biokemi handlar om livets kemi. Denna vetenskap används för att lösa små vardagliga bekymmer och för att konstruera stora komplexa industriprocesser. Biokemin har gett oss en detaljerad förståelse för hur enzymer fungerar, vilket lett till att man nu använder enzymer i hushållsprodukter och för framställning av kemikalier i industriell skala. På AlbaNova forskar vi om att utnyttja biokemins möjligheter genom att bygga om och skräddarsy enzymer för nya tillämpningar. Föreläsningen handlar om hur detta fungerar, och diverse exempel från enzymer i tvättmedel till framställning av läkemedelsbyggstenar kommer att diskuteras.

Tid och plats: Onsdagen den 23 april kl. 19.00 i Oskar Kleins auditorium, Roslagstullsbacken 21, AlbaNova universitetscentrum.

DISPUTATION I MATEMATIK

Lennart S. Nobel

disputerar på avhandlingen

Polynomial Hulls and Envelopes of Holomorphy

fredagen den 25 april 2008 kl. 13.15 i sal 14, hus 5, Matematiska institutionen, SU, Kräftriket. Till opponent har utsetts *professor Nikolay Shcherbina,* Bergische Universität Wuppertal, Tyskland.

Abstract of the thesis

The notion of polynomial hulls of compact subsets of complex Euclidean space plays a crucial role for approximation of holomorphic functions by polynomials — a topic which has many applications. Despite an abstract characterization of polynomial hulls in terms of currents, given by Duval and Sibony, it is often very difficult even for special classes of sets to decide whether the polynomial hull is trivial (i.e. coincides with the set) or not.

An interesting observation is that Oka's description of polynomial hulls using continuous families of analytic varieties links this topic to the so-called "continuity principle", the principle of compulsory analytic continuation of functions of several complex variables, which is a foundation of the notion of envelopes of holomorphy.

Our first result states that there are Cantor sets in the unit sphere in complex Euclidean space of dimension at least three, the polynomial hull of which contains interior points. (The case of dimension two was treated earlier by B. Jöricke.) Our result may be contrasted to a fact concerning analytic continuation: Cantor sets are removable, i.e. the envelope of holomorphy of the complement of any Cantor set in the unit sphere in complex Euclidean space of dimension at least three coincides with the whole unit ball.

Our second result is the construction of an open connected subset of the unit sphere in three-dimensional complex space, such that the envelope of holomorphy of this set has infinitely many sheets. On the other hand it is known that the envelope of holomorphy of an open subset of a strictly pseudoconvex boundary in two-dimensional space is always single-sheeted.

Our third result is a general form of the continuity principle which emerged from the correction of a respective erroneous result in the literature.

SEMINARIUM I STATISTIK

Xavier de Luna: Analysing the sensitivity to the unconfoundedness assumption in evaluation studies using register data

Abstract: In observational studies, the estimation of a treatment effect on an outcome of interest is often done by controlling on a set of pre-treatment characteristics (covariates). This yields an unbiased estimator of the treatment effect when the assumption of unconfoundedness holds, that is, there are no unobserved covariates affecting both the treatment assignment and the outcome. This is in general not realistically testable. It is, therefore, important to conduct an analysis about how sensitive the inference is with respect to the unconfoundedness assumption. In this talk we present a procedure to conduct such a Bayesian sensitivity analysis, where the usual parameter uncertainty and the uncertainty due to the unconfoundedness assumption can be compared. To measure departures from the assumption we use a correlation coefficient which is intuitively comprehensible and ensure that the results of sensitivity analyses made on different evaluation studies are comparable. Our procedure is applied to a study of the effect of college choice on income in Sweden.

Tid och plats: Onsdagen den 23 april kl. 13.00 i sal B705, Statistiska institutionen, SU, Universitetsvägen 10B, plan 7, Frescati.

MONEY, JOBS

Columnist: Johannes Lundqvist, Department of Mathematics, Stockholm University. E-mail: johannes@math.su.se.

Info = information. This will be given and repeated until obsolete. Rely on other sources as well.
BBKTH = Bulletin Board at the Department of Mathematics, KTH.
BBSU = Bulletin Board at the Department of Mathematics, SU.
The following information, with links, is also available at http://www2.math.su.se/~johannes/mj.html.
Unless stated otherwise, a given date is the last date (e.g. for applications), and the year is 2008. A number without an explanation is a telephone number.

Standard information channels

1. A channel to information from Vetenskapsrådet: http://www.vr.se/naturteknik/index.asp.
2. A channel to information from the European Mathematical Society: http://www.emis.de.
3. A channel to information from the American Mathematical Society: http://www.ams.org.
4. KTH site for information on funds: http://www.kth.se/aktuellt/stipendier.
5. Stockholm University site for information on funds: http://www2.su.se/forskning/stipendier/databas.php3.
6. Umeå site for information on funds: http://www.umu.se/umu/aktuellt/stipendier_fond_anslag.html.
7. Job announcement site: http://www.maths.lth.se/nordic/Euro-Math-Job.html. This is run by the European Mathematical Society.
8. Stiftelsen för internationalisering av högre utbildning och forskning (STINT) site for information on funds: http://www.stint.se.
9. Nordisk Forskerutdanningsakademi (NorFA) site for information on funds: http://www.norfa.no.
10. Svenska institutet (SI) site for information on funds: http://www.si.se.

Old information

Money to apply for

11. Stockholms universitet utlyser flera donationsstipendier för studerande vid SU (forskarstuderande prioriteras av de flesta fonderna). Sista ansökningsdag är den 15 april. Web-info: http://www.su.se/pub/jsp/polopoly.jsp?d=775.

(Continued on the next page.)

Jobs to apply for

12. SU söker en eller två doktorander i matematisk statistik. Ett antal förslag till doktorandprojekt finns specificerade på hemsidan för forskarutbildningen. Även andra forskningsprojekt kan bli aktuella. Sista ansökningsdag är den 2 maj. Web-info: http://www.math.su.se/matstat/foutb/.
13. SU söker doktorander i matematik. Sista ansökningsdag är den 2 maj. Web-info: http://www.math.su.se/matematik/forskning/2008/applsve08.pdf.
14. Uppsala universitet söker två biträdande lektorer i matematik. Anställningen är tidsbegränsad till fyra år men kan förlängas med högst ett år. Sista ansökningsdag är den 5 maj. Web-info: http://www.personalavd.uu.se/ledigaplatser/561,562bitrlekt.html.
15. Uppsala universitet söker en forskarassistent i matematik. Anställningen är tidsbegränsad till fyra år. Sista ansökningsdag är den 5 maj. Web-info: http://www.personalavd.uu.se/ledigaplatser/563forass.html.
16. Institutionen för matematik vid KTH söker upp till tre doktorander i Optimeringslära och systemteori till följande projekt: Storskalig ickelinjär optimering. Skalbar styrning av nätverkskopplade system. Optimering av lastbärande strukturer. Sista ansökningsdag är den 30 april. Web-info: http://www.math.kth.se/utlysning.tjanst/doktorander080320.html.
17. Uppsala University declares four PhD positions in Statistics at the Department of Information Science to be open for application. Two of these are connected to the project "Econometrics and Cointegration". The last day for application is April 15. Web-info: http://www.personalavd.uu.se/ledigaplatser/715dorand_eng.html.
18. Göteborgs universitet söker en biträdande universitetslektor i optimering med tillämpning inom medicin. Tjänsten är placerad vid Matematiska vetenskaper (samverkande med CTH). Det huvudsakliga forskningsområdet ligger inom projektet "Optimerad strålbehandling av cancer via biologiska modeller av bot och biverkningar och en förbättrad planering av dosfördelningen i intensitetsmodulerad radioterapi". Sista ansökningsdag är den 24 april. Web-info: http://www.math.chalmers.se/bitrlektoroptimering080229eng.pdf.
19. Göteborgs universitet söker en universitetslektor i matematisk statistik med inriktning mot statistisk inferens. Tjänsten är placerad vid Matematiska vetenskaper (samverkande med CTH). Sista ansökningsdag är den 22 maj. Web-info: http://www.math.chalmers.se/univlektormatematiskstatistik080228eng.pdf.
20. Chalmers tekniska högskola söker en professor i matematisk statistik. Sista ansökningsdag är den 22 maj. Web-info: http://www.math.chalmers.se/ProfMathStat4March08.pdf.