CMA
Centre of
Mathematics for
Applications

ANNUAL REPORT 2005

UNIVERSITY
OF OSLO

Norwegian
Centre of
Excellence

The **Research Council** of Norway

CMA IN BRIEF
FACTS AND FIGURES OF THE 2005 ACTIVITIES

In 2005, CMA counted 90 members (54,47 man years), among these

- 19 senior scientists in full positions, 29 PhD-students, 25 postdocs, 11 adjunct positions, 2 in researcher positions, 1 scientific programmer, 2 project coordinators, and 1 administrative officer
- 4 PhD-students finished their degrees in 2005

CMA received

- 14 long term international visitors (stays of more than one month), and 200 different international guests on short-time (less than one month) visits (some of them twice or more). These 214 international guests represent 36 different countries, and together they spent 8,41 person years at CMA
- around 200 different Norwegian guests (short-time), many of them several times, participating in our events (workshops, conferences, and seminar series) or collaborating with our members.

CMA members published:

- 107 refereed articles in international journals,
- 2 books
- 8 book chapters
- 63 scientific reports, preprints, contributions, proceedings etc (not refereed),
- and had 38 media appearances, 4 in national TV, 7 on radio, 8 in newspapers, 8 in magazines, and 11 on internet based media

CMA members gave 190 talks outside CMA, of which

- 16 scientific talks and 21 talks for a general audience in Norway
- 153 scientific talks abroad, in 30 different countries

CMA hosted

- 13 conferences/workshops with 518 participants (188 international, 150 national, and 180 CMA-members), in which 196 scientific talks were given:
  - 26 by CMA members,
  - 29 by national guests,
  - 141 by international guests,
- 5 seminar series, in which 52 scientific talks were given:
  - 23 by CMA members,
  - 8 by national guests,
  - 21 by international guests.
- 2 lecture series on selected topics, in which 80 lectures were given, all by CMA-members

Total revenues of 2005 were MNOK 41,0 (CoE funding: 11,0 , UiO: 15,2, SINTEF: 1,6, Other 13,2)
CMA also co-organized 19 other international workshops and conferences.

CONTENTS

SUMMARY
OVERALL REMARKS AND MAIN IMPRESSIONS OF 2005

2005 has been a good and productive year. We have set a series of records in terms of research achievements – more publications and more activity than ever. More people are involved and the economy is good. We have followed the main lines of our research plan, and we are still enthusiastic about the opportunity which the Centre of Excellence-scheme provides us with respect to performing important research and research training. We are grateful to the Research Council of Norway (RCN) and to our host, the University of Oslo, for providing excellent conditions.

- CMA has obtained outstanding research results on many parts of our research plan. We have published the first interdisciplinary results in accordance with the plan. Our experience is that the plan is well founded, and still serves as intended with challenging, but realistic goals.
- CMA research results appeared in the prestigious journal "Nature" in 2005. Other results provided the foundation for a cover story in "Scientific American".
- CMA's postdoc fellow Snorre Christiansen succeeded in the EURYI call by the European Science Foundation, and became Europe's one and only winner in mathematical subjects ever. We can quote leading international experts in regarding Christiansen "among the most exciting young numerical analysts in the world, and so both an asset to the CMA and a testimony of its success!"
- Postdoc fellow Boris Gudiksen was awarded the Swedish "2005 Science Prize" for having produced the best PhD thesis within physics in Sweden in 2004.
- Since the very beginning CMA has focused on establishing new research relations, and throughout the whole 2005 we have used incentives to encourage research activities that support our research plan. New CMA members have been employed with preferences to the focused areas of the research plan, and the total scientific activity of the centre fits the plan very well.
- Numerous seminar series and workshops have been arranged, with extensive external participation. Hundreds of guests have been received. CMA members have participated and contributed to research events in all parts of the world. We have committed ourselves to several national and international collaborations. Hence we regard ourselves as highly active and visible on the national and international scene of mathematics and its applications.
- SINTEF has proven to be a much more active partner than we anticipated at the inception of the centre. The cooperation is well established and fruitful to both parts. In 2005 budget terms, they contributed 200% more than originally committed.
- The relationship to our host departments, faculty, and institution is very good. We feel well integrated. Efficient administrative support is ensured by utilizing the existing university organization.
- We continue to outperform all financial estimates of the original plan. Total revenues in 2005 were MNOK 41,0 compared to 33,5 in the original budgets. The basic Centre of Excellence funding now releases almost 3 times the same amount from other sources.

■ SELECTED RESEARCH HIGHLIGHTS

The wave equations that successfully describe acoustic and electromagnetic phenomena important to industry treat physical fields that evolve in space. However there is increasing interest in situations where the fabric of space itself behaves like waves. In particular it is hoped that the recently constructed gravitational wave observatories will enable us to detect the propagation of the curvature of space predicted by Einstein's theory. Unfortunately current computer simulations based on this system do not produce reliable results. A paper by S.H. Christiansen and R. Winther (appearing in SIAM Jour. on Scientific Comput. 2006) is one of the first in the numerical analysis literature to study the Yang-Mills equations, which have difficulties similar to those of Einstein. Special attention is given to the study of how some constraints, preserved by the continuous system, behave for different numerical approximations. In fact, this paper can be seen as the beginning of a long term project of S. H. Christiansen called Numerical analysis and simulation of geometric wave equations, for which he won a European Young Investigator Award (EURYI) in 2005.

Several results within computational astronomy have received a lot of international attention. For example, it has long been believed that sound waves of high frequency play an important role in heating the solar chromosphere. We have used numerical simulations to study this problem, and it was found that the energy flux falls short by a factor of at least ten to balance the radiative losses. This result was published in Nature (App. 7a, no 11). In cosmology, new methods for the analysis of the microwave background radiation were applied to data from the satellite WMAP with astonishing results. We detected a significant asymmetry between the fluctuations in opposite hemispheres, as well as a significant non-Gaussianity. The results may very well prove to open new understanding of the existence of the first microseconds of the universe. They have already been widely cited, for example they were the subject of the cover story of the August 2005 issue of Scientific American. The head-line said "Is the Universe out of tune?", and the content was based on these new findings.

Together, CMA and its industrial partner SINTEF finished the EU FP5 Future and Emerging Technology-project "GAIA II" (IST-2001-35512), which has led to major advances in the use of algebraic geometry in CAGD. A main result from this project is a better understanding of the approximation of parametric representations by algebraic equations, which again has been applied to improve algorithms in CAGD. The results may open opportunities for patenting. This project also had a large international industrial partner "think3" (www.think3.com). The GAIA group has become a driving force in connecting algebraic geometry and geometric modelling in Europe. GAIA II has received remarkably positive reviews, which again has led to new and pending proposals.

The stochastic analysis group has focused its research on theoretical developments and applications of stochastic analysis, in particular to mathematical finance. New theory on stochastic differentiation and integration for non-Gaussian processes have been introduced and applied. The applications in finance have focused on hedging and pricing financial derivatives and portfolio optimization, in particular for insider trading and stochastic volatility. All the scientific work has resulted in numerous publications in prestigious journals. The group chairs AMaMeF (Advanced Mathematical Methods for Finance), a research network with 14 European member countries, sponsored by the European Science Foundation. In August 2005 the group organized the Abel Symposium on the occasion of Professor Kiyosi Itô´s 90 year anniversary, attracting many world-leading researchers.

The collaboration between CMA, Oak Ridge National Laboratory, USA, and Michigan State University, USA, (see section "International cooperation") has resulted in several articles. A main emphasis is put on the coupled cluster method and recent results now allow us to perform ab initio calculations of nuclear systems for nuclei greater than oxygen. This represents a major breakthrough for ab initio calculations of systems with many interacting particles in nuclear physics. Furthermore, CMA's Morten Hjorth-Jensen together with ORNL's Gaute Hagen (former PhD-student at CMA), were recently able to compute effective interactions for nuclear systems which include weakly bound states and resonances starting from realistic nucleon-nucleon interaction models. Combined with the Coupled-Cluster method, these interactions will allow us to study nuclear systems with resonances and/or weakly bound states, with a fully microscopic theory. These systems are studied at experimental facilities in Europe, Japan and the USA. Our calculations will thus provide important guidance and input to the experimental analysis. Several of the nuclei studied, both in experiment and theory, are crucial for our understanding of nucleosynthesis and the formation of the elements in the universe.

SCIENTIFIC ACTIVITY REPORT

INTRODUCTION, WITH A FOCUS ON THE INTERDISCIPLINARY ASPECTS

The main goal of the research activity of CMA is to create a national research centre with an atmosphere where the participants continue to do first rate research in the four main areas of the centre, i.e. geometry, stochastic analysis, differential equations, and applications in physical sciences. The activity in physical sciences is focused on computational astrophysics and computational quantum mechanics. However, in addition to preserve the high level activity in these areas, a central idea behind the establishment of the CMA is to create new interdisciplinary research activity based on the interplay between these areas. Examples are

i)   computational geometry and algebraic/differential geometry
ii)   computational geometry and differential equations
iii) stochastic analysis and differential equations
iv)   stochastic analysis and quantum mechanics
v)   differential equations and quantum mechanics
vi)   differential equations and astrophysics

During the first years of the CMA we have made a number of actions to stimulate such activities. First of all, in the announcements for new Ph.D. fellows and postdocs, we have always given candidates with an academic profile and interest in the directions of these topics the highest priority. Based on the same reasoning we have also stimulated the Ph.D. fellows to pick their two advisors from different research groups. As a consequence, most of the candidates who have been hired for these positions work with more interdisciplinary topics. Furthermore, many of our workshops and seminars have been dedicated to topics which we consider strategic for generating the desired new research activity. In the weekly CMA seminar, which has been run for three years, we encourage the speakers to bring in possible interdisciplinary research problems.

Even if most of the reported scientific work below still may be characterized as either geometry, stochastic analysis, differential equations, quantum mechanics or astrophysics, we see a clear trend in the direction of more interdisciplinary projects. Presently we have active groups in all the areas i-vi mentioned above.

MAIN SCIENTIFIC RESULTS

■ GEOMETRY

The activity in geometry is focused on geometric modelling. Many scientific and industrial problems require a digital description of geometry. The research at CMA in this area is a based on combining techniques and theory from splines and mesh based modelling, algebraic methods and differential equation methods.

Senior scientists at CMA working in this field are Tom Lyche, Mike Floater, Knut Mørken, Ragni Piene,and Tor Dokken.

Lyche has done further analysis of subdivision schemes together with Merrien (France). Their paper on C1 Hermite subdivision with shape constraints will appear in SIAM J. Numer. Anal. Lyche and Floater jointly found two chain rules for divided differences, both of which lead easily to Faa di Bruno's formula. The paper will appear in Math. Comp. Rasmussen and Floater have developed further point-based methods for computing curve lengths and surface areas, some of which are

joint work with Prof. Uli Reif, of Darmstadt, Germany. Rasmussen and Floater have continued to work on PDE approaches to computing surface parameterizations, joining forces with Nils Henrik Risebro in the PDE group. Tatiana Surazhsky and Floater wrote a survey paper on curve parameterization techniques, which will appear in a book on approximation theory. Prof. Nira Dyn (Israel), Kai Hormann (Germany) and Floater found a new four-point C2 curve subdivision scheme.

Mørken and Reimers have continued to work on algorithms for finding zeros of spline functions, based on properties of the control polygon. Their first paper will appear in Math. Comp. With Christian Schulz they are continuing their work in this area, and are considering intersections of spline curves. Mørken and Reimers, together with Eigil Samset at the Interventional Centre at the National Hospital, are continuing their effort to develop an interdisciplinary research group on medical image processing and augmented reality. Several master students and one PhD student are working in the field. This activity is expected to expand in the coming years.

Piene, her two Ph. D. students Pål Hermunn Johansen and Heidi Mork and one master student have pursued the study of real algebraic varieties with a view towards their use in geometric modeling. Johansen and Piene have completed a paper on quartic monoid surfaces (submitted in February 2006). Johansen talked on his results on closest point-location at the MEGA 2005 conference on Sardinia. Piene has been coediting the proceedings from the workshop Algebraic Geometry and Geometric Modeling (Nice, 2004), these have been accepted for publication by Springer-Verlag. Piene continues to collaborate with S. Kleiman (USA) on problems in enumerative algebraic geometry, related to string theory in physics. She has given various conference/colloquium/seminar lectures on this subject.

Together with representatives from the EU-funded IST-FET GAIA II project, Dokken organized the workshop Computational Methods for Algebraic Spline Surfaces II. The aim of the workshop was to present new results, algorithms, developments and applications of effective algebraic geometry in geometric modeling, and to present the achievements of the GAIA II project that ended September 30th 2005 with a very positive formal final review. The proceedings from the workshop, edited by B. Juettler and Piene, will be published in 2006.

The research activity in discrete geometry is concentrated around linear algebra and optimization. Geir Dahl is the only senior scientist at CMA in this field and the activity falls into the two areas Combinatorial matrix theory (A), and Discrete optimization (B). In area A Dahl has an ongoing collaboration with Richard A. Brualdi, University of Wisconsin where properties of classes of (0,1)-matrices with given line sums and additional properties are investigated. This resulted in one published paper and a forthcoming chapter in a book on discrete tomography, as well as conference presentations. In area B Dahl has a collaboration with Truls Flatberg (adjunct position at CMA). Their work on reconstruction of discrete images is published in journals as Discrete Applied Mathematics and Discrete Mathematics. Finally, we mention a new and interesting collaboration on a matrix approximation problem arising in the study of entanglement in quantum physics. This collaboration involve Prof. Leinaas (Dept. of Physics, University. of Oslo), CMA PhD-student E. Ovrum, Prof. J. Myrheim (Dept. of Physics, Norwegian University. of Science and Technology) as well as Dahl (CMA), and a technical report summarizes the work so far.

Regarding mesh-based modelling, Dyken and Reimers have worked on dynamically refining coarse geometry along silhouettes edges, to remove the artificial piecewise linear silhouettes that coarse geometries get in visualizations, a problem common in real-time applications like computer games. The work resulted in publication of the paper "Real-time Linear Silhouette Enhancement" in the proceedings of the Mathematical Methods on Curves and Surfaces 2004. Further, Reimers and Dyken have teamed up with Johan Seland to investigate migrating the technique to GPUs, with promising results. In addition, Dyken and Floater got their paper "Preferred directions for resolving the non-uniqueness of Delaunay triangulations" accepted in Computational Geometry: Theory and Applications.

The proceedings of the Tromsø conference, which took place in July 2004, appeared in May 2005, edited by Dæhlen, Schumaker and Mørken. Mørken has been heavily involved in a project aimed at getting a computational perspective

on the elementary teaching of mathematics and the mathematically oriented sciences. Reimers has also continued his participation in a multidisciplinary project working on the numerical simulation of air-flow in the human nasal cavity, a collaboration that resulted in two publications in 2005. Reimers and Floater, with Kos (Hungary) published a generalization of mean value coordinates to triangular meshes.

During the second year of The Research Council of Norway funded strategic research project "Graphics Hardware as a High-End Computational Resource", very promising results have been achieved with respect to solution of partial differential equations by difference schemes on programmable graphics cards, with an up to 30x performance improvement compared to traditional CPUs. The two Ph. D. students Jon Hjelmervik and Trond Hagen have developed a new method for view-dependent tessellation of parametric surfaces which takes advantage of the GPU to obtain a tessellation where each triangle covers only a few pixels. This is published in the book `Mathematical Methods for Curves and Surfaces'. Six master students have been supervised by the project. The first tests of the use of programmable graphics cards for acceleration of CAD-type intersection algorithms have been done with very promising results and a PCT-patent application has been submitted. A successful one day workshop on the project achievements took place in December.

◼ STOCHASTIC ANALYSIS

The research at CMA in stochastic analysis is closely related to applications in finance. Focused research topics are stochastic differential equations and stochastic control theory. The development of numerical methods for such problems is planned to be a central issue.

Senior scientists at CMA working in this field are Bernt Øksendal, Fred Espen Benth, Giulia Di Nunno, and Tom Lindstrøm.

The stochastic analysis group at CMA works on both theoretical developments and on applications to mathematical finance. The focus has been on stochastic differentiation and integration, the study of stochastic differential equations and stochastic control theory. Further, applications to optimal portfolio allocation, derivatives pricing and hedging incomplete markets have been the central issues in finance, with particular emphasis on problems related to the energy and weather markets.

During 2005 the stochastic analysis group organized several workshops and conferences:
1. A workshop in honour of Bernt Øksendal's 60th Birthday. 9th-10th June 2005 in Oslo.
2. The Abel Symposium in honour of Kyiosi Ito. 29th July- 4th August, 2005 in Oslo.
3. The 12th Workshop on Mathematics and Economics, on "Mathematical Finance and Insurance". 30th September in Oslo
4. The AMAMEF "Workshop on Stochastic Analysis and Computational Finance", November 9-12 in London. CMA was co-organizer.
5. The SAMSA Conference 2005, Nov 27-Dec3 in Malawi. CMA was co-organizer.

The big European research project "Advanced Mathematical Methods in Finance" (AMaMeF), involving 16 European countries, was approved by the European Science Foundation (ESF) in 2004 and it started in April 2005. The stochastic analysis group at CMA is heavily involved in this project, in which Bernt Øksendal and Giulia Di Nunno are elected project Chair and project co-Chair, respectively, of the Steering Committee. The programme involves 15 European countries at present and it is lasting 5 years. More information about AMaMeF can be found on the web site http://www.iac.rm.cnr.it/amamef/

Bernt Øksendal, Frank Proske and Tusheng Zhang proved existence and uniqueness results for a class of backward stochastic partial differential equations with jumps. This is a type of equations which appear as adjoint equations in the maximum priciple approach to optimal stochastic control of systems described by stochastic partial differential equations driven by Levy processes.

Tom Lindstrøm has continued his work on the nonstandard theory of Levy processes by developing a notion on nonlinear stochastic integrals with respect to such processes. The theory has been applied to stochastic differential equations, infinitesimal transformations of Levy processes, and minimal martingale measures. Klara Hveberg has completed her work on self-homeomorphic fractals. She defended her PhD-thesis in May.

Thilo Meyer-Brandis and Frank Proske have employed white noise methods for Levy processes to explicitly represent strong solutions of jump diffusions. Based on this formula they have developed a new approach to give sufficient conditions for existence of strong solutions of one-dimensional Ito diffusions with irregular coefficients. Thilo Meyer-Brandis has generalized the white noise theory to the case of Hilbert space valued Levy processes which allows the study of differential equations driven by Levy white noise in spaces of Hilbert space valued stochastic distributions. Further, he has given stochastic Feynman-Kac representations of generalized solutions of certain parabolic stochastic partial differential equations driven by Levy processes.

Francesca Biagini, Yaozhong Hu, Bernt Øksendal and Tusheng Zhang have continued their work on the book "Fractional Brownian Motion and Applications". To book is expected to be completed during the spring 2006, and will be published by Springer Verlag.

Giulia Di Nunno, Bernt Øksendal and Frank Proske have started to write on the book "Malliavin Calculus for Lévy Processes with Applications to Finance". This book will be published by Springer Verlag. Bernt Øksendal, Frank Proske, Agnes Sulem and Tusheng Zhang have continued their collaboration in stochastic control theory and applications.

Giulia Di Nunno, Thilo Meyer-Brandis, Bernt Øksendal, and Frank Proske have started research on an anticipating stochastic analysis for Levy processes with applications in finance, in particular insider trading. In one of these works, Arturo Kohatsu-Higa and Agnes Sulem have been co-authors. Together with his PhD-student Sure Mataramvura, Bernt Øksendal has started a project on risk minimization of financial portfolios. This leads to interesting problems in stochastic differential games and has connections to non-linear conditional expectation, which again may be represented as stochastic backward differential equations.

Giulia Di Nunno has continued her research in anticipating Malliavin/Skorohod type calculus and non-anticipating Ito calculus. Some new formulae for the explicit calculus of a non-anticipating derivative with respect to a stochastic measure with independent values on a general measurable space have been studied. More research is ongoing in this direction. Inga B. Eide and Giulia Di Nunno have been working on a version of the fundamental theorem of asset pricing for continuous time market models in which some stochastic bounds for the probability density are considered a-priori. This reinforced concept of equivalency of probability measures finds applications in the modeling of the pricing of insurance products via financial methods.

Fred Espen Benth and Jurate Saltyte-Benth have continued their development of a stochastic dynamical model for the temperature evolution (even including a spatial dependency structure), with particular emphasis on the seasonality of temperature "volatility". Applications to the weather derivatives market are considered. They have also analyzed spread options in the gas and electricity markets by means of linear mean-reversion models with jumps.

Fred Espen Benth, Jan Kallsen (Munich) and Thilo Meyer-Brandis have developed a class of linear mean-reversion models where it is feasible to obtain explicit formulae for forward prices with periodic delivery. By means of Fourier transforms, explicit formulae have been derived for options on forwards. This work has particular relevance in the gas and electricity markets.

Fred Espen Benth has collaborated closely with Steen Koekebakker (Agder University College) on developing reasonable

models for the forward prices in electricity markets directly. These models are based on an advanced dynamics involving jumps processes and volatility dependent on the delivery period of the forward contract. Further, we have collaborated with Frithjof Ollmar at Agder Energy to develop a smoothing algorithm for transforming forward prices with delivery period into fixed-delivery forward prices, a highly relevant problem in electricity markets.

The group has been active in developing numerical algorithms for solving different pricing and risk problems in finance. Fred Espen Benth has collaborated with Martin Groth on a solver for a Black & Scholes type of integro-partial differential equation to price options under the minimal entropy martingale measure for a stochastic jump volatility model. Fred Espen Benth, Martin Groth and Paul Kettler have designed a new quasi-Monte Carlo algorithm for simulating the normal-inverse Gaussian distribution.

Fred Espen Benth and Frank Proske have proved that in a simple two-dimensional geometric Brownian motion, the utility indifference price of an option written on one geometric Brownian motion is arbitrage-free, when you can hedge in the other. This result is applied to the pricing of interest-rate guarantees in life and pension funds. Paul Kettler, Oleg Yablonski and Frank Proske have analyzed an equilibrium model for price formation in a stochastic financial market. Finally, Fred Espen Benth has organized seminars/courses for Agder Energy and Elkem on modeling of energy markets, and been invited speaker at two EnergyForum conferences and Energy Risk World Asia in Singapore.

■ DIFFERENTIAL EQUATIONS

Mathematical modelling and numerical simulations has become an indispensable tool in science and engineering. Partial differential equations are one of the most fundamental tools in constructing such models. The activity in differential equations at CMA is devoted to theoretical aspects of partial differential equations and on the numerical treatment of such problems.

Recently there has been a growing realization that stability of numerical methods for differential equations can be obtained by designing methods which are compatible with the structure of the underlying continuous problem. This has led to a substantial international activity aiming for the construction of such numerical methods, where the differential equation group at CMA is a visible participant. For example, two main international workshops have been arranged during the last two years in field, first Compatible spatial discretizations for PDEs at the IMA, Minneapolis in 2004, and then a follow up workshop at CMA, Oslo in September 2005. Most of the recent work of Snorre Christiansen, Per Christian Moan, Runhild Klausen, and Ragnar Winther can be characterized as contributions to the development of such compatible schemes.

In a pioneering paper Christiansen has shown that a class of piecewise polynomial differential forms defines an isomorphism in cohomology, independent of the mesh and the degree of the polynomials. These results generalize classical work of Whitney to higher order finite element methods. Together with Annalisa Buffa, University of Pavia, he has also studied a strong form of a finite element analog of Hodge duality via the construction of a dual mesh. Winther has also worked with finite element analogies of differential forms in several joint papers with Douglas Arnold, University of Minnesota, and Richard Falk, Rutgers University. In particular, they construct new stable finite elements for the Hellinger-Reissner formulation of linear elasticity by utilizing a discrete version of the so-called *BGG resolution*.

For time dependent differential equations the time-discretization needs special attention in order to avoid introducing non-physical behavior in simulations. The research of Per Christian Moan has shown that the proper treatment of e.g. wave equations originating from variational principles is a time-discretization based on symplectic/variational methods as well. He has shown that invariants such as energy, momentum etc. are extremely well preserved by such methods, and that in addition they lead to a much smaller accumulation of errors with time. Runhild Klausen has worked on a rigorous mathematical convergence theory for the multi point flux approximation schemes. Such discretization schemes are proposed and used by the petroleum industry. These methods are designed to overcome the difficulties encountered in reservoir simu-

lation, with large variations in the permeability and irregular grids, and seem to perform well, but a rigorous convergence theory has been missing. In recent joint papers with Winther the first rigorous convergence proof of the multi point flux approximation scheme was presented, and in a subsequent paper the results are improved to show that the convergence is robust with the respect to the geometry of the grid as long as a proper version of the method is chosen.

Xue-Cheng Tai's has worked on several facets of discretizations of partial differential eqations, in particular on level set methods for image processing and inverse problems. In addition, he arranged a CMA conference on this topic in August of 2005 were many of the international leading scientists in the field did participate. A typical example of his research is the joint work with Eric Chung and Tony Chan, UCLA, on the use of level set representation and total variation regularization to electric impedance tomography.

The research activity of H. Holden, K. H. Karlsen, and N. H. Risebro, together with M. Bendahmane, G. M. Coclite, S. Evje, T. Flåtten, and S. Mishra, is devoted to basic research in modern nonlinear analysis of partial differential equations and their numerical methods, with emphasis on differential equations that are relevant to a number of applications, including solid-liquid separation processes, porous media flows, multi-phase flows, traffic flows, water waves, and finance. During 2005 we submitted more than 20 papers to international journals, many of which are by now accepted for publication. Some highlights of this research activity are discussed below.

Holden, Karlsen, and Risebro proposed and analyzed several finite difference schemes for the Hunter–Saxton equation. This equation has been suggested as a simple model for nematic liquid crystals. They proved that the numerical approximations converge to the unique dissipative solution as the discretization parameters tend to zero. No rigorous numerical methods have been known for this equation prior to this paper. A main aspect of the analysis, in addition to the derivation of several a priori estimates that yield some basic convergence results, is to prove strong convergence of the discrete spatial derivative of the numerical approximations, which is achieved by analyzing various renormalizations (in the sense of DiPerna and Lions) of the numerical schemes.

Holden has worked with Raynaud on the Camassa-Holm equation. Of special interest has been to study convergent numerical methods for the equation. Here they have derived a finite difference scheme in the periodic case and a convergent scheme based on approximations by specialized, explicit solutions in the full line case. Furthermore, they have recently shown that the Camassa-Holm equation is globally well-posed in the context of conservative solutions.

Karlsen and Coclite considered a shallow water equation of Camassa-Holm type, containing nonlinear dispersive effects as well as fourth order dissipative effects. They proved that as the diffusion and dispersion parameters tend to zero, with a condition on the relative balance between these two parameters, smooth solutions of the shallow water equation converge to discontinuous solutions of a scalar conservation law. The proof relies on deriving suitable a priori estimates together with an application of the compensated compactness method in the L^p setting.

Karlsen and Coclite initiated a study of the Degasperis-Procesi equation in classes of discontinuous functions. The Degasperis-Procesi equation has a form similar to the Camassa-Holm shallow water wave equation, and many authors have emphasized that the Degasperis-Procesi equation share several properties with the Camassa-Holm equation, such as bi-Hamiltonian structure, integrabillity, exact solutions that are a superposition of multipeakons, and the sobolev space H^1 as the relevant functional space for well-posedness. Karlsen and Coclite promoted the view that the Degasperis-Procesi equation could admit discontinuous (shock wave) solutions and that a well-posedness theory should rely on functional spaces containing discontinuous functions, that is, the Sobolev space H^1 is not the natural space for this equation. Indeed, they applied, somewhat unexpectedly, the theory of hyperbolic equations to establish existence, uniqueness, stability of discontinuous solutions of the Degasperis-Procesi equation.

Following up this research, Karlsen and Risebro (with Coclite) have constructed numerical schemes and proved that they converge to discontinuous solutions for the Degasperis-Procesi equation. Additionally, they provided several numerical

examples showing that shock solutions form independently of the smoothness of the initial data. Karlsen (with R. Burger and H. Frid) studied a zero-flux type initial-boundary value problem for scalar conservation laws with a genuinely non-linear flux. They suggested a notion of entropy solution for this problem and proved its well-posedness. The asymptotic behavior of entropy solutions was also discussed. The results have been accepted for publication in an international journal.

Karlsen and Bendahmane proved well-posedness (existence and uniqueness) results for a class of degenerate reaction-diffusion systems. A prototype system belonging to this class is provided by the bidomain model, which is frequently used to study and simulate electrophysiological waves in cardiac tissue. The existence result, which constituted the main thrust of their paper, is proved by means of a nondegenerate approximation system, the Faedo-Galerkin method, and the compactness method. The result has been accepted for publication in an international journal. They also proved existence of a renormalized solution to a system of nonlinear partial differential equations with anisotropic diffusivities and transport effects, supplemented with initial and Dirichlet boundary conditions. The data were assumed to be merely integrable. This system models the spread of an epidemic disease through a heterogeneous habitat. The results have been accepted for publication in an international journal.

Karlsen (with E. R. Jakobsen and C. La Chioma) derived error estimates for approximate (viscosity) solutions of Bellman equations associated to controlled jump-diffusion processes, which are fully nonlinear integro-partial differential equations. Two main results were obtained: (i) error bounds for a class of monotone approximation schemes, which includes finite difference schemes, and (ii) bounds on the error induced when the original Lévy measure is replaced by a finite measure with compact support, an approximation process that is commonly used when designing numerical schemes for integro-partial differential equations The results have been submitted for publication in an international journal.

Karlsen (with R. Burger, A. Gacia, J. D. Towers) extended a clarifier-thickener model, which can be expressed in terms of conservation laws with discontinuous coefficients, to account for a singular sink through which material is extracted from the unit. Clarifier-thickener units are widely used in chemical engineering, wastewater treatment, mineral processing and other applications to separate a suspension of finely divided solid particles dispersed in a viscous fluid into its solid and liquid components. A difficulty is that the sink term cannot be incorporated into the flux function; rather, the sink is represented by a new non-conservative transport term. The main result is a well-posedness theory for the extended model. In addition, numerical methods are proposed and analyzed. The results have been submitted for publication in an international journal.

The main focus of the works by Evje and Flåtten has been development of discrete approximations of two-phase models (two-fluid and drift-flux) that possess good properties in terms of accuracy and robustness. Explicit as well as partial implicit schemes have been derived which allow for an accurate resolution of the important mass waves. In one paper a comparison of the eigenvalue structure is made between the 4-equations two-fluid model and the 3-equations drift-flux model in order to shed light on similarities and differences between these two models. The results have been submitted for publication in international journals.

■ QUANTUM MECHANICS

The starting point for all of our investigations is the development of appropriate techniques for studying systems of many interacting particles, so-called many-body methods. The systems of interest span most of the fields in physics covered by non-relativistic quantum mechanics that is atomic, molecular, nuclear and solid-state physics and the physics of quantum liquids.

Beside the importance for our basic understanding of quantal systems, the capability to handle numerically quantum mechanical systems with many degrees of freedom is of strategic importance for both the materials science and nanotechnology programs in Norway. Analytic solutions are rare or impossible to obtain. Thus to develop and study stable numerical schemes is of utter importance.

The activity in partial differential equations and quantum mechanical systems involve Morten Hjorth-Jensen , Jan Brede Thomassen, Emil Lundh, Halvor Møll Nilsen, Per Christian Moan, Simen Kvaal.

Several topics within partial differential equations applied to quantum mechanical problems have been studied. A central topic has been the development of variational discretization techniques, in particular conservative time-evolution schemes for non-linear partial differential equations. Of special interest here is the application of properties of Bose-Einstein condensation and the dynamics of vortices in Bose-Einstein condensates. The vortex motion in a condensate with a non uniform background density, especially when the structure of the core is important, has also been studied, together with the stability of double quantized vortices forms. Other systems of great experimental and industrial interest currently are so-called quantum dots, electrons confined to small almost two-dimensional regions. There is a large experimental and theoretical activity on manipulation and control of such quantum mechanical systems. Nowadays it is possible to construct quantum circuits based on two-dimensional systems. These are extremely promising candidates for building quantum computers. This needs to be accompanied with a theoretical understanding of the dynamics of these systems. The development of stable numerical schemes is crucial to this. In this connection the group has worked on finite element methods with time-development of low-dimensional quantum mechanical systems such as quantum dots. Systems of interest are two-particle systems in (4+1) dimensions.

Furthermore, detailed investigations of the stability of discretizations of classical N-body problems over long time intervals have been performed. Here emphasis has been on artificial resonances and how these might cause instabilities. The working hypothesis is that such instabilities are also present in PDEs, and that the theory can give a foundation for understanding conservative PDE discretizations. Work is also under way in developing a sparse grid iterative technique for solving large Hamiltonian eigenvalue problems. These methods can overcome many of the dimensionality problems associated with quantum systems. Test problems will include quantum dots. Finally, discretizations schemes of the Skyrme model, a system of 3 nonlinear PDEs in 3+1 dimensions, have been constructed such that crucial geometric invariants have been preserved. Currently the schemes are being implemented, and it is expected that the approach will enable an accurate resolution of soliton collision dynamics.

Morten Hjort-Jensen has an ongoing activity on Monte Carlo methods. Together with collaborators and student from the Department of Physics large Monte Carlo codes, which can handle both variational and diffusion algorithms for bosonic and fermionic systems, have been implemented. The codes have been used to study Bose-Einstein condensations and quantum dots. The plans are to extend these codes in order to include Green's function Monte Carlo techniques. The areas of application will mainly be various aspects of Bose-Einstein condensation, with an emphasis on vortices and systems from solid state physics, quantum dots in particular. In agreement with the research plan of the CMA a collaboration between the stochastic analysis group and the quantum physics group has been initiated. This collaboration involves Fred Espen Benth, Thilo Meyer-Brandis, Mikael Signahl and one Ph.D. candidate from the stochastic analysis group. The aim here is to study numerical algorithms for solving stochastic partial differential equations and improved algorithms for performing Monte Carlo calculations, with an emphasis on diffusion Monte Carlo methods.

A substantial part of the activity of Torgeir Engeland, Morten Hjorth-Jensen, Eivind Osnes and Gaute Hagen is a collaboration with groups at Oak Ridge National Laboratory and Michigan State University at East Lansing on non-pertubative resummation of large classes of diagrams in many body physics. This project has already resulted in several articles, and several invited contributions to conferences and workshops, amongst these the International Nuclear Physics conference in 2004 (INPC2004), the international conference on Exotic Nuclei and Atomic Masses (ENAM04) and the International Nucleus-Nucleus collision meeting in 2006. The project centers on the coupled cluster method and allows performing ab initio calculations of nuclear systems for nuclei greater than oxygen. Oxygen is presently the limit of two of the other much favored ab initio methods in nuclear many-body physics, namely Green's function Monte Carlo methods and the so-called no-core shell model approach. This work is also an example of a successful interdisciplinary collaboration between physicists and chemists. It also shows that coupled-cluster theory provides a rigorous and universal many-body language, which enables one to describe physical systems as small as atomic nuclei and as large as polyatomic molecules with similarly

high accuracies. Our next plans will focus especially on extending the coupled cluster methods to a) include three-body forces, expected to be crucial for our understanding of shell closures, b) coupling to weakly bound systems and inclusion of resonances. A major breakthrough was made here recently by Gaute Hagen (now postdoc at ORNL) and Hjorth-Jensen. By their approach one is able to compute effective interactions for nuclear systems which include weakly bound states and resonances starting from realistic nucleon-nucleon interaction models. These interactions will in turn be used in coupled-cluster and shell-model calculations of systems with resonances and/or weakly bound states.

Recently the very first coupled cluster calculation of nuclear systems with valence particles has been done. These results were published in a Physical Review Letters article in 2005. The ab initio coupled cluster theory is a particularly promising candidate for studies of nuclei due to its enormous success in quantum chemistry. Two previous papers in Physical Review Letters (one in press), describes an application of coupled cluster techniques to nuclear structure. These techniques, which originated in nuclear structure theory, were thoroughly developed and exploited in quantum chemistry for molecular electronic structure calculations. The paper describes an application of quantum-chemistry inspired coupled cluster techniques for nuclear ground-state calculations and, for the first time, uses these methods for the computation of excited states in nuclei. The coupled-cluster methods are very promising, since they allow one to study ground- and excited-state properties of nuclei with dimensionalities beyond the capability of present shell-model approaches, with a much smaller numerical effort when compared to the more traditional shell-model methods aimed at similar accuracies. For the weakly bound nuclei to be produced by the proposed Rare Isotope Accelerator it is almost imperative to increase the degrees of freedom under study in order to reproduce basic properties of these systems. Judging by the success of coupled cluster theory in chemistry, it is expected that coupled cluster methods will enable the ab initio microscopic calculations for nuclei up to the mass 100 region. The codes have recently been extended so that they can deal with more than 800 active single-particle states.

■ASTROPHYSICS

The physical description of the outer stellar atmospheres results in large sets of coupled partial differential equations. There are major difficulties in constructing numerical methods for these equations related to highly nonlinear reaction terms and in devising proper boundary conditions, an activity pursued at CMA. In addition, the activity in cosmology is focused on developing improved algorithms for studying stochastic fields on a sphere and applying them to data on the Cosmic Microwave Background.

Senior scientists at CMA working in this field are Mats Carlsson, Egil Leer, Viggo Hansteen, and Per Barth Lilje.

One of the major specific goals of the Physical Applications Project in the Research Plan is to "Complete a 3D Radiation-Magneto-HydroDynamic code with non-restrictive boundary conditions". We have again expended considerable effort in developing the 3D code during 2005. The code is now capable of treating the whole outer solar atmosphere, from the convection zone to the corona, with a realistic description of the most important mechanisms of energy transport: convection, radiation and conduction. The boundary conditions allow the transmission of all wave modes without reflection through a formulation using the MHD equations in characteristic form.

It has long been surmised that convective motions below the photosphere are the ultimate source of the "mechanical" (as opposed to radiative) heat required to heat the outer solar layers. Whether this energy is transported in the form of waves or in the slower braiding of the solar magnetic field is not known. With the development of the 3d code mentioned above it is now finally possible to model all the relevant parts of these phenomena consistently. This includes convection below the photosphere, following the wave modes generated by this convection into and through the chromosphere as well as the changes in the magnetic field topology driven by granular motions, and finally how the transition region and corona react to these.

Post.doc Boris Gudiksen published two important papers on this problem, "An Ab Initio Approach to the Solar Coronal Heating Problem" and "An Ab Initio Approach to Solar Coronal Loops". Viggo Hansteen and Boris Gudiksen are current-

ly continuing this work in an effort to understand aspects of coronal heating in the most common "Quiet Sun" atmosphere. In short, they are searching for the magnetic field topologies and the magnetic field strengths conducive to achieving coronal heating through magnetic reconnection such as appears to be occurring on the Sun.

On a related project a version of the 3D code has been utilized to study the expansion of the solar wind through a magnetized corona. In this work it was found that while it was possible to construct models in which significant amounts of Helium are expelled as a result of magnetically closed regions opening, it is also true that the expelled Helium atoms require quite some time to attain the temperatures necessary for acceleration; thus, we expect Helium enriched flow to be preceded by a proton dominated precursor.

The new set of transport equations for fully ionized gases that was developed last year by PhD students Marit Janse and Mari Anne Killie under the guidance of Egil Leer has been used to study the helium abundance in quiescent coronal loops. The results suggest that the chromosphere underlying closed field regions of the Sun is highly stratified and that both helium and minor ion abundances are far from constant throughout the chromosphere.

The heating of the solar chromosphere in magnetically quiet regions has been a mystery for a long time. A leading theory has been the dissipation of acoustic waves of high frequency. The energy flux of such waves is difficult to determine observationally because of the disturbances in the Earth's atmosphere. PhD student Astrid Fossum and Mats Carlsson used numerical simulations to calibrate satellite observations of acoustic waves in the solar chromosphere. For the first time it has been possible to calculate the total acoustic energy flux entering the solar chromosphere. It was found that this energy flux falls short by a factor of at least ten to balance the radiative losses. The results were published in Nature.

In cosmology, the important results by Eriksen, Hansen, Banday, Gorski & Lilje (2004) showing an anisotropy between hemispheres in the Wilkinson Microwave Anisotropy Probe (WMAP) data that were reported in earlier annual reports have been supported by several studies and have caught widespread interest (our original 2004 paper has by March 3, 2006 been cited 89 times according to SPIRES). In a more detailed study of N-point correlation functions, Eriksen, Banday, Gorski & Lilje (2005) have shown that the results are stable. These results may hint towards a more complicated universe than we are used to thinking about, but the results need further study from new experiments like Planck. Jaffe, Banday, Eriksen, Gorski & Hansen (2005) showed that the anomalies found by us and others possibly can be explained if the Universe has global shear and rotation. This is followed up by a more detailed study by Jaffe, Banday, Eriksen, Gorski & Hansen (2006, in press). A special type of anomalies that have been reported in the WMAP maps have been special alignments between multipoles. To study the statistics of these anomalies, the multipole vectors originally studies by Maxwell have been taken into use. However, such studies are troubled by the existence of the galactic plane. We (Bielewicz, Eriksen, Banday, Gorski & Lilje, 2006 in press) have devised a new method to analyze the statistical distribution of the multipole vectors on a cut sphere, and have applied them to the WMAP data, finding that the mysterious correlation between the octopole and the quadrupole is stable.

The main reason for the future Planck satellite is to measure the power spectrum of fluctuations in the universe and from them determining the main cosmological parametres. So far, all methods to achieve this for data of the size Planck will give us (and even the size of the WMAP data set) have been forced to use approximations to the real likelihood function for the data to estimate the power spectrum and the parametres. However, in collaboration with I.J. O'Dwyer, J.B. Jewell, B.D. Wandelt, D.L. Larson, K.M. Gorski, S. Levin and A.J. Banday, we have implemented a method using Gibbs sampling for the estimation. We have applied this method to the WMAP data and have shown that exact estimation is indeed feasible. Most recently we have put a major effort into finding the optimal way of estimating and subtracting foreground emissions from CMB maps. Our new method is based on modern statistical techniques like Gibbs sampling and shows major promise.

In addition to his participation in these projects, Frode Hansen has been strongly involved in two other collaborations doing theoretical studies of the Cosmic Microwave Background. With international co-workers he has studied the Sunyaev Zeldovich effect from clusters of galaxies and he has studied formation of non gaussian features in the CMB from inflation models.

▪MAIN EVENTS

Below we briefly present the main contents of our research events, bringing hundreds of national and international researchers together in stimulating collaboration and transfer of knowledge. For statistical details on participants and lectures, see Appendix 5. For even more details on speakers, participants, programs and abstracts, please consult the CMA web for a full and detailed overview.

Workshop: Recent Advances in Nonlinear PDEs

Understanding properties of nonlinear PDEs is a fundamental challenge in pure and applied mathematics. The field has recently seen major advances in both theory, numerics, and applications. Long-standing open problems have been successfully handled with novel techniques and new phenomena have been discovered. At the same time a wide variety of new models and equations are being considered. The goal of the workshop was to bring together experts in an informal setting where specialists, students, and non experts can learn about current trends in the field. Topics covered included evolutionary PDEs, hyperbolic conservation laws, kinetic theory, free boundary problems, solid mechanics and elasticity, compressible and incompressible fluid flow.

Workshop: Iterative methods for elliptic eigenproblems

Multigrid preconditioned conjugate gradient schemes belong to the most efficient solvers for boundary value problems for elliptic partial differential operators. In contrast to this, the subject of efficient solvers for eigenvalue problems for self-adjoint elliptic partial differential operators has still not gained a similar attention, though direct multigrid solvers have been devised. The topics of this include preconditioned iterative solvers for self-adjoint elliptic eigenproblems. First a comparison of boundary value problems and eigenvalue problems for these differential operators was presented and similarities and dissimilarities were worked out. On this basis it was shown that several ideas underlying solvers for boundary value problems can be transferred to those for the eigenvalue problem. A central point of the main workshop lecture was a geometric interpretation of preconditioned eigensolvers which allows to derive a new theoretical framework for a larger class of preconditioned eigensolvers. The resulting schemes are conceptually simple, easy to implement, computationally cheap and robust with respect to the initial guess.

Miniworkshop: Adjoint error control: Mathematical analysis and applications in geophysics

Adjoint techniques have been used as a powerful technique in mathematics, science and engineering at least since the times of Euler and Lagrange. They have been developed in the fields of linear algebra, calculus and partial differential equations. These techniques are useful if you have a particular goal, like controlling an event via the choice of initial or boundary conditions (optimal control) or evaluating and reducing a specific aspect of the error. After giving a gentle introduction into the mathematical foundations and some theoretical results, we focused on some recent results, like the design of adaptive numerical methods for calculating instationary compressible flows. Finally we looked at tidal modals. In a high resolution tidal model boundary conditions are often obtained from models with coarser grid resolution and therefore are subject to errors. Better estimates of the boundary conditions can be obtained by adjusting the model to observational data within the model domain. This leads to an optimization problem with an adjoint model solution and a minimalization of a cost functional.

Workshop: Launch of the Transfer of Knowledge Project CENS-CMA,

The interdisciplinary CENS-CMA project runs from May 2005 to April 2009, carried out by CENS (Centre for Nonlinear Studies, Institute of Cybernetics, Tallinn University of Technology, Tallinn, Estonia, http://cens.ioc.ee) together with CMA, integrating modelling, theoretical and computational aspects of the research activities within both centers. As part of this project, research fellows from CENS will visit CMA for stays of 3-6 months, while CENS will hire international visiting research fellows to come and work in Tallinn. Annual seminars will be held by the project, alternating between Tallinn and Oslo, and this was the second one, since the first was held in Tallinn when we started the preparations for the successful proposal.

A CMA conference in honor of Bernt Øksendal's 60th Anniversary

On April 10, 2005, Bernt Øksendal turned sixty, and his close colleagues wished to honor him with this scientific conference to celebrate the occasion. The conference focused on the subjects more close to Bernt's past and present activity: stochastic analysis, stochastic differential equations, optimization, mathematical finance, complex analysis.

The 2005 Abel Symposium: Stochastic Analysis and Applications - A Symposium in Honor of Kiyosi Itô

The symposium was the second in the new series of Abel symposia. It was held on the occasion of Kiyosi Itô's 90th birthday and was devoted to his work and its further developments and applications. Distinguished researchers in stochastic analysis and applications from all over the world were invited, and participated in the celebration of this exciting and active research field, together with the presentation and discussion of future developments.

Conference: PDE-Based Image Processing and Related Inverse Problems

The purpose of the conference was to bring international researchers to present various aspects of new developments in using numerical techniques for partial differential equations to analyse and process digital images. Among the topics were: Noise analysis and removal, image inpainting, image segmentation, 3D image analysis including shading, motion, shape and edge detection, analysis and processing of MR images and brain mapping, diffusion-tensor image analysis, simulation and image techniques for ECG and other medical techniques, image processing and data mining for internet communication and information technology. Moreover, inverse problems for partial differential equations have large areas of applications. One widely studied application is for oil reservoir simulations. Although image analysis and PDE inverse problems seem to be unrelated at a first glance, there are many techniques used in one of these two areas that are useful for the other. For example, many of the regularization techniques and segmentation ideas used for image processing have found interesting applications in inverse problems within oil reservoir modelling. The conference highlighted some of the recent efforts in merging some of the techniques for these two research areas.

Workshop: Computational Methods for Algebraic Spline Surfaces II (COMPASS II)

Many algorithms within Computer Aided Geometric Design combine algebraic and parametric representations of curves and surfaces. This workshop aimed at promoting the dialogue between the algebraic geometry and the CAGD communities. The EU-sponsored IST-FET Project GAIA II has mixed researchers from both communities for addressing the challenges of surface intersection and surfaces self-intersection within Computer Aided Design. State-of-the-art overviews and research results from the GAIA II project were presented, with focus on implicitization, parameterization, classification and intersection algorithms for CAD. The workshop was arranged in cooperation with the Society for Industrial and Applied Mathematics (SIAM) Activity Group on Geometric Design.

Workshop: Compatible Discretizations for Partial Differential Equations

Compatible spatial discretizations can be defined as those that inherit or mimic fundamental properties of the PDE such as topology, conservation, symmetries, positivity and maximum principles. Some of these properties are found among schemes based on: mixed finite elements, mimetic finite differences, control volume methods, discrete differential forms, conservative difference schemes, discrete Helmholtz decompositions, finite integration techniques, staggered grid and dual grid methods etc. In a parallel development, so called "geometric" techniques for time-discretization have been developed and shown to be essential for proper discretization of certain ordinary differential equations (ODEs). For applications in areas like computational chemistry, celestial mechanics and particle accelerators the design of special methods inheriting the variational principles or time-reversing symmetries of the exact solutions are crucial. The aim of this workshop was to serve as a forum where different approaches to compatible discretizations were presented and compared. The attention was given to the identification of the fundamental structures essential to preserve in a discretization, and the implications of such properties on stability and accuracy. This workshop was in many respects a follow-up of the IMA "hot topics" workshop, Compatible spatial discretizations for partial differential equations, held at Institute for mathematics and its applications (IMA), University of Minnesota, May 11-15, 2004.

12th Workshop in Mathematics & Economics: Mathematical Finance and Insurance

This is an annual event, the 12th in a row, all held by the stochastic Analysis group in Oslo. This year's workshop was devoted to finance and insurance, and brought participants and speakers from both insurance companies and academia.

Workshop: Computers, computations and science education

The purpose of this seminar was to make the project 'Computers in Science Education' (see separate description in another section) better known around the faculty and at the same time receive input from others who have experience with computations in research and/or teaching. The seminar consisted of two parts. In the first part the project was presented and two international guests presented their ideas and experiences about computations in the teaching of mathematics and physics. In the second part local scientists presented their ideas about computations in our undergraduate teaching.

Workshop: High-Performance Computing in Physics

The workshop aimed at discussing high-performance computing topics with an emphasis on quantum-mechanical methods and parallelization. An efficient usage of parallelization tools is of great importance for our progress in studies of quantum mechanical systems with many interacting particles. This relates both to basic research in quantum chemistry and physics and to applications in materials science and nanotechnology. The methods addressed were: partial differential equations, diffusion and variational Monte Carlo methods, coupled cluster techniques and large scale diagonalizations, density functional theory

The seminar series of 2005

In addition to the specific workshops presented above, a number of seminar and lecture series have taken place as usual. Appendix 5 provides the full lists.

■ STRATEGIC CHALLENGES AT THE BEGINNING OF 2006

The main challenge and first priority continues to be the implementation of even more interdisciplinary research according to our research plan. In addition we intend to contribute significantly to the development of Norwegian research in our areas. Our aim is to increase the level of national and international collaborations.

As this annual report is being written, we also work on an extensive self evaluation report. Needless to say, a key goal for all activity in 2006 is the renewal of a Centre of Excellence contract for a second five-year period 2008-2013.

A main concern has been, and still is, the renewal of our project portfolio, especially with respect to individual grants. During 2005, the eVita programme was established in the Research Council of Norway, motivated from a joint national initiative among the mathematical as well as the computational communities. The first call for proposals will be made early 2006, and we intend to participate. We will also contribute to the preparations of EU's FP 7.

PRIZES AND AWARDS

Snorre Christiansen is mentioned and highlighted several times in this report. We need not repeat the background, but in a listing of prizes and awards, his EURYI award has an obvious position. His award was officially announced on August 3, 2005, and he officially received it in a ceremony in Budapest on November 9, 2005

Also postdoc **Boris Gudiksen** from Institute of theoretical astrophysics and associated member of CMA, received a distinguished prize in 2005: He was awarded the "Science Price" by the Swedish Association of Scientists for having produced the best Ph.D. thesis in physics at a Swedish university in 2004. The title of his thesis was "The Coronal Heating Problem". Boris received the prize at a ceremony at the Nobel Museum in Stockholm on October 12, 2005

We will also highlight a special award that is quite rare in our setting. CMA guest and participant in the ongoing EU project CENS-CMA, Professor **Tarmo Soomere**, was on December 9, 2005 celebrated as "The person of the Year" in his home country Estonia. Former winners include sportsmen, mountain climbers, songwriters, and soldiers. And this time, a true scientist! Specializing in surface wave research, he is cited for correctly predicting the extent and effects of a devastating storm with subsequent flooding in January 2005 after the failure of the national routine warning system to issue a realistic marine forecast. He warned the media and public about it, and not the least he was able to explain later on - in a language that could be understood by the public - what happened and why.

MANAGEMENT AND ADMINISTRATION

■ MANAGEMENT PHILOSOPHY

Our basic vision for research management still stands. We firmly believe that novel research will arise as a result of a combination of a stimulating research environment, focused research activities and academic freedom. The latter is important, but may potentially be problematic due to the nature of the project, which has clear goals and a limited lifetime. But we now have three years of experience with the following strategy, and we claim that it works.

- All senior scientists at CMA have signed personal contracts in which they commit themselves to conduct research in line with the research plan of CMA.
- We are focused when we produce descriptions of scientific positions for announcements, and in ranking of applicants. We emphasize the interdisciplinary nature of CMA, both with respect to the different scientific fields, but also with respect to the balance between theoretical, applied, and computational experience and interests of the applicants.
- We use our financial resources incentively, and we only grant research activities (seminars, workshops, guest researchers, travelling) that are founded on our research plan.

In this way we are filling our positions with candidates that have the right academic profile. The commitments of the senior scientists and the daily research activities motivate all CMA members to pursue research in the direction of our stated goals in the research plan.

■ DAILY LEADERSHIP

Last year we wrote that our deputy manager at that time being, Professor Geir Ellingsrud, would become vice dean of the faculty from 2006. Since then he entered, and subsequently won, the election process for becoming President of our University. He started on January 1, 2006. We are proud to release our deputy manager for such a distinguished reason! Nevertheless, upon the unison advice of our principal investigator group (see below) we asked Professor Fred Espen Benth to become the new deputy manager. He accepted, the CMA Board approved the decision, and he started on July 1, 2005.

CMA is on the daily basis run by the manager, Professor Ragnar Winther, the deputy manager, Professor Fred Espen Benth, and senior adviser and administrative leader Helge Galdal. These three constitute the leadership who have the authority to make day-to-day decisions on practical matters, financial transactions, research activities within the budget and the framework of the research plan.

For more principal decisions and commitments, the leadership is extended to a group of principal investigators consisting of 10 senior scientists of CMA. These are, in addition to the leading group: Tom Lyche, Ragni Piene, Tor Dokken, Bernt Øksendal, Helge Holden, Morten Hjorth-Jensen, and Mats Carlsson. This group has meetings when necessary, typically every second month. The group has a broad representation among the research groups, and serve as a consensus and advisory council for the leading group, ensuring democratic and good decisions in important choices of paths. Topics that are typically addressed in this group are:

- Description of scientific positions for announcement texts
- Appointing evaluation committees
- Final ranking of applicants for scientific positions
- Budget disposals
- Participation (or not) in boundary research actions wrt. the CMA research plan
- Coordination of scientific texts for reports etc

■ THE BOARD

The governing board of CMA has for 2005 consisted of the following members:

- **Kjell Bendiksen**, chair, Managing Director of The Institute for Energy Technology
- **Suzanne Lacasse**, co-chair, Managing Director of The Norwegian Geotechnical Institute
- **Trygve Helgaker**, Professor at the Department of Chemistry, UiO
- **Birger Kruse**, Director of the Faculty of Mathematics and Natural Sciences, UiO
- **Svein Longva**, National mediator of Norway

The CMA board is a professional administrative board. None of its members are scientific experts within the specific research areas of CMA. Its authorities emphasize strategic and control functions, with clear instruction to approve budgets, accounts, and annual report. Also the evolution of the research plan is a major topic of the board. Helping the CMA leadership and the board to make wise decisions in that matter, a scientific advisory board is constituted – see the next section.

The board reports to the Faculty management. It met only once in 2005, on March 10. In addition the CMA leaders had two meetings with chair Kjell Bendiksen, exchanging information on recent work and progress. For 2006 two board meetings are planned.

■ SCIENTIFIC ADVISORY BOARD

A scientific advisory board was appointed late 2003 in accordance with original plans, and according to a right specified in the general contract with The Research Council of Norway. So, CMA has chosen to distinguish between the business-like and the scientific content of the board activity. However, the board is still responsible overall for the research plan, the advisory board is appointed by the board without power to pass resolutions.

The main subject for the advisory board is to critically investigate and compare our research plan with our actual work and progress, and to guide and suggest when changes or additions are implemented. They should know us, but at the same time they should be courageous in challenging our scientific missions and disposals. Hence we need experts at the forefront of international research activities within our fields, willing and capable of challenging us in this work.

The Scientific Advisory Board consists of:

- Professor **Helmut Pottmann, chair** (Vienna University of Technology, Austria),
- Professor **Douglas N. Arnold** (Institute of Mathematics and its Applications (IMA), University of Minnesota, USA),
- Professor **Tom Bogdan** (High Altitude Observatory, National Center for Atmospheric Research, Boulder, USA), and
- Professor **Ivar Ekeland** (University of British Columbia, Vancouver, Canada).

They have all visited us once or more, but their first real job for CMA has been in connection with the ongoing self evaluation process. The presented material in that report has been influenced by the critisism and guiding of the advisory board, and a subsequent consequence will be an adjusted research plan later in 2006.

CMA has one administrative employee, senior adviser Helge Galdal. He is a member of the centre leadership, acting as Ragnar Winther's right hand, preparing general correspondence, reporting, board papers, budget and accounting figures, financial transactions, communications, web-pages etc. Another role of his is to inspire and help the centre researchers to write proposals for external funding. Finally he is responsible for coordinating all other administrative functions which are "outsourced", that is first line services, economy & book-keeping, IT-support, guest relations & bureaucracy, student's administrations, personnel matters, and archives. Details on these services are outlined in previous annual reports, and need not be repeated.

We have established an effective administrative organization. As far as possible we utilize the existing professional organization. CMA contributes to the surrounding host units with financial support due to the extra load of work and services in the host organization. This system is cost-effective (much cheaper than building a separate CMA-administration to cover the same services). We are also confident that this system has helped CMA becoming an integrated part of a larger scientific community.

ECONOMY

■ STATEMENTS ON THE ACCOUNTING AND BUDGETING PRINCIPLES

The economy of CMA – meaning the financial plan, the cost plan, budgeting and accounting – has a complex structure that is not fully covered in one complete electronic system. Not all figures are, or can be, included in the standard UiO-routines. Even those which are parts of this system cannot necessarily be presented with respect to CMA as one defined unit, since this would seriously disturb the figures of the involved departments. Hence a complete and transparent system that presents the total CMA figures was a serious concern the first year, but we feel confident that we have found good solutions that present the true and full picture. These solutions were conscientiously described in the 2003 report, and need not be repeated. The same solutions and remarks apply this year.

Moreover, this year we have chosen to clearly distinguish between those parts accounted by ourselves on one hand, and those not on the other. In this way the first part, to which we are completely responsible, is presented with full accuracy. Also this part includes all of the deficits/surpluses. The second part, which consists of the representative figures outside our own accounting figures, is balanced.

■ TOTAL REVENUE AND EXPENDITURE FIGURES

Below the main figures are presented (More details, together with all notes, are presented in appendix 2 and 3). The three columns to the left present the figures from the CMA-specific account, meaning the funding and costs that we control ourselves. The next three columns present "representative" figures from host funded activity, from Sintef personnel and projects dedicated to CMA, and from project activity associated to CMA. With other words: Activities within CMA, but with the funding and costs outside CMA's books. The three rightmost columns give the sums.

	Budget 2005	Account 2005	Budget 2006	Budget 2005	Account 2005	Budget 2006	Budget 2005	Account 2005	Budget 2006
	CMA specific revenues			**Additional CMA related rev.**			**Total revenues**		
RCN, CoE	-11 000	- 11 000	- 11 000	0	0	0	-11 000	-11 000	-11 000
UiO funding	-3 950	- 4 336	- 4 689	-10 544	- 10 853	- 10 896	-14 494	-15 189	-15 585
SINTEF	-600	- 600	- 592	- 1 111	- 992	- 1 242	-1 711	-1 592	-1 834
EU-contrib.	0	- 1 221	- 600	-2 050	- 1 693	- 889	-2 050	-2 914	-1 489
Other RCN	-691	- 1 418	- 4 314	- 5 444	- 4 976	- 2 781	-6 135	-6 394	-7 095
Other public	-736	- 1 010	- 479	- 3 382	- 2 304	- 2 626	-4 118	-3 314	-3 105
Private	0	- 40	- 60	-574	- 574	- 345	- 574	-614	-405
Sum rev.	-16 977	- 19 625	- 21 734	-23 105	- 21 392	- 18 779	-40 082	-41 017	-40 513

	Budget 2005	Account 2005	Budget 2006	Budget 2005	Account 2005	Budget 2006	Budget 2005	Account 2005	Budget 2006
	CMA specific expenditures			**Additional CMA related expend**			**Total expenditures**		
Salary Costs	13 670	14 629	15 390	16 519	15 483	13 938	30 189	30 112	29 328
Indirect costs	2 000	2 387	2 450	2 932	2 921	2 509	4 932	5 308	4 959
Teaching serv	200	195	250	0	0	0	200	195	250
Equipment	750	244	350	1 451	1 110	941	2 201	1 354	1 291
Other	3 775	3 778	3 911	2 203	1 878	1 391	5 978	5 656	5 302
Sum expend.	20 395	21 233	22 351	23 105	21 392	18 779	43 500	42 625	41 130

	Budget 2005	Account 2005	Budget 2006	Budget 2005	Account 2005	Budget 2006	Budget 2005	Account 2005	Budget 2006
Annual result	3 418	1 608	617	0	0	0	3 418	1 608	617
Transferred	-4 766	-4799	-3191	0	0	0	-4 766	-4 799	-3 191
For transfer	-1 348	-3 191	-2 574	0	0	0	-1 348	-3 191	-2 574

Table 1. The CMA accounting figures for 2005 and corresponding budget figures for 2006.

■ SOME MAIN CONCLUSIONS AND REMARKS

Both in the beginning of 2004 and 2005 we transferred a significant surplus between fiscal years, mainly due to the six months delay for entering our own premises in 2003. One year ago we presented a plan to reduce the transfer in the beginning of 2006, and then balance the accounts in 2007. Only reading table 1 above, it may seem as we have not reached this goal. But we actually have. Last year we did not present the clear distinction between CMA-specific and related figures. All project activity was kept outside the ambitions tied to the core centre activity, independent on whether or not CMA itself was in charge of the book keeping. Now the figures include postponed activity from CMA's own project portfolio, and the main contributions are:

- The YFF-project of Kenneth Karlsen had delayed starting dates for its fellows, and contributes KNOK 777 to the result.
- PhD-student An Ta Thi Kieu has an individual RCN-grant. She entered a maternity leave in 2005, leaving the project status for 2005 with a KNOK 399 surplus.
- Finally the 2005 EU cash contribution is tied to one Marie Curie individual postdoc grant of Mikael Signahl. The payment received this year also covers parts of 2006, contributing KNOK 710 surplus to the 2005 result.

Deducting these three parts brings the sum for transfer down to KNOK 1305, very close to our budget.

This is also the reason why we can and must stick to the same plan for 2006. Most of the budgeted transfer from 2006 to 2007 lies in the projects, which in turn will be balanced.

As an overall conclusion: We now have transparent and solid accounting systems and principles which provide us necessary control and managing information. As a second conclusion: We continue to beat our estimates and we have in 2005 still grown in terms of activity and funding. As a third conclusion: Project activity is turned towards the centre itself as more and more of previous established activity is finished. This is a natural consequence, since less new project activity incepts outside CMA. This also indicates that we probably have reached a maximum size, and that we do not foresee further growth, unless the core centre idea and research goals are extended.

■ CHANGES IN THE FINANCIAL PLAN

Changes in the UiO funding

In 2005 CMA has once again experienced that its host has raised their contributions from original commitments, both with specific funding and related activities. These are the new items in 2005:

- Institute of theoretical astrophysics has employed postdoc fellow Frode K. Hansen, and Department of informatics has employed researchers Truls Flatberg and Eigil Samset in adjunct positions. They are all included in the CMA community and hence add to the CMA-related figures.
- For 2006 we expect a minor reduction in these contributions. The expected inflation is added, but from Jan 1, 2006, we no longer count Geir Ellingsrud among the CMA personnel since he became President of the university. No replacements are expected.
- The cash transfer was increased with a renewed contribution to our "Computers in Science Education"-project (see separate section). Also we received additional contributions to a specific conference and the extra sabbatical year for Giulia Di Nunno as a gender equality grant.
- For 2006 we have already been granted new promises. The sabbatical for Di Nunno continues, and so does the contribution to CMA's researcher school. We will be granted a three-year starting pack for Snorre Christiansen. Finally the board of the Faculty has granted the centre a new PhD-position from July 2006. We have not calculated further contributions to our CSE-project, but we will submit new proposals.

Changes in the SINTEF contributions

In addition to Tor Dokken and Ewald Quak, CMA also employed senior scientist Knut-Andreas Lie from Sep 1, 2005, which then also brought a similar representative Sintef share into the cooperation. Moreover we agreed to grant PhD-student Jon Hjelmervik of the GPU project a fourth year from CMA on his thesis. This made it possible for him to enter the cotutelle agreement with University of Grenoble. CMA covered 6 months in 2005 (which explains the reduced representative figures), and we will cover the final six months in 2008.

Changes in the project portfolio

We have achieved new projects also in 2005, and hence increased the funding figures wrt. the budgeted estimates. New fellows have entered during 2005 or will be coming in 2006. The full list of projects is presented in appendix 4, but we will highlight one achievement with considerable economic impact for CMA: Our first ever employee, postdoc fellow Snorre Christiansen, who was about to complete his four years with CMA in 2006, succeeded in the EURYI-call (see selected highlights), and the project brings almost MNOK 10 over five years from 2006-2010. Other new items are:

- Two new postdoc proposals succeeded (Thilo Meyer-Brandis and Hans Kristian Eriksen), who both have been with CMA as PhD-students, and both defended their thesis in 2005.
- CMA ran a mathematical theatre project (see separate description) which brought KNOK 200 to the 2005 funding from different external sources.
- The large international conference on PDE based image processing raised KNOK 130.
- We hosted the 2005 Abel symposium, and was granted KNOK 350 from the Abel memorial fund – these will however be accounted on 2006.
- Through the NUFU project (see International collaboration), one more PhD-student (Eliot Chikodza) is included as from January 1, 2006.

The budget figures for 2006 are lower than 2005, despite these new contributions, which reflect that several projects have expired in 2005 or will do in 2006. We intend to compete with more proposals in the coming year, but it is not necessarily a goal to continue further growth. We have earlier reported that the creation of CMA has led to a consolidation of existing projects in the nearby scientific sphere. We have boosted our estimated original figures. However, the centre itself is our main and dominating project. It is therefore natural that expiring projects not fully will be replaced as time goes along.

We have earlier expressed concern for the lack of individual grants to which promising PhD-candidates could apply. Moreover, the BeMatA programme has reached its end. We have capacity to do training activities, which is why individual grants are perfect. We have emphasized the importance of the new initiative eVita, and we are happy to see that it became a reality. Our expectations are high.

■ CHANGES IN THE COST PLAN

The total sum of expenditures indicates an even higher activity level than estimated, despite a few underestimates in some of the different items. The travelling and workshop activity together with the guest frequency have broken every record in 2005, but still not at the cost level we had in our budgets. We continue to experience that CMA personnel and incoming guests very often are (partly) covered from other sources. In 2006 we cannot possibly break the records again, so we continue to carefully downscale these budgeted expenses with respect to the 2005 figures.

The most important resolution made in order to oppose the effects of unexpected savings, has been to advance the scheduled employment plan, which we have done. We have also granted several prolongations of well functioning fellows. These resolutions have taken full effect in 2005, and we expect a moderate reduction in terms of man year production (and salary costs) for 2006.

THE PEOPLE

STATUS AND SOME STATISTICS

On December 31, 2005, CMA consisted of 74 people. They are all presented in appendix 1. In addition, appendix 1 contains CMA members who completed their mission with CMA in 2005 (16), and also new employments with confirmed starting dates early 2006 (7). Hence the presented lists include a total of 97 names (though if we restrict ourselves to count heads, the final number is 92, since five persons appear twice, under different categories).

Only counting 2005-members (i.e. 97 - 7 = 90) we may present the following statistical details on 2005-distributions:

- 19 senior scientists in full positions, 29 PhD-students, 25 postdocs, 11 adjunct positions, 2 in researcher positions, 1 scientific programmer, 2 project coordinators, and 1 administrative officer
- 75 men and 15 women
- 54 native Norwegians and 36 with foreign nationalities (representing 17 different countries)
- 44 funded/employed by CMA, 27 by the host, 5 by SINTEF, and 26 through affiliated projects.

PERSON-YEAR PRODUCTION 2005 AND ESTIMATES FOR 2006

The careful reader will notice that the content of the latter bullet point above sums up to 102. This indicates that several members are tied to CMA through different funding sources, either through parallel contributions (like the SINTEF personnel), or through subsequent engagements (the host postpones affiliated projects, or CMA employs former affiliates and so on). Appendix 1 provides the details. Table 3 below is calculated with respect to all these details, providing the exact man year production figures of 2005, and new estimates for 2006. As in all budget presentations, we use conservative figures; only confirmed new persons with confirmed starting dates are included.

	CMA	UiO funded	Sintef	Other	Total
2005 (real)					
PhD	10,71	1,97	1,50	6,35	20,53
Postdocs	8,78	0,37		6,79	15,94
Senior scientists	4,85	10,68	0,47		16,00
Tech/Adm	1,00	1,00			2,00
Sum	25,34	14,02	1,97	13,14	54,47
International guests	0,08			8,33	8,41
2006 (estimates)					
PhD	10,75	2,03	2,00	6,22	21,00
Postdocs	6,67	0,40		5,70	12,77
Senior scientists	4,80	10,30	0,60	1,00	16,70
Tech/Adm	1,00	1,00			2,00
Sum	23,22	13,73	2,60	12,92	52,47
International guests				7,00	7,00

Table 2. Calculation of person-year production in CMA, taking the funding source into account

OTHER CONTRIBUTORS

As described in the "Management and administration"-section, most of the daily administrative services are "outsourced". We utilize the exisiting organization as optimal as we find possible. The following persons are most directly affected by this system, and are specifically mentioned. Executive officer Dina Haraldsson and secretaries Anita Smeby / Maren Isachsen provide the reception service at the Department of Mathematics. Senior executive officer Diana Holand of Department of Mathematics provides help with Norwegian beaucracy etc. Senior executive officer Jørg Gjestvang of Department of Mathematics is the book-keeper of CMA and also provides service on reports and analysis. Computer engineers Terje Kvernes and Bård Kristiansen of Department of Mathematics are responsible for technical support. Senior executive officer Grete Andresen of The Faculty of Mathematics and Natural Sciences is handling personnel matters. Several other people could have been mentioned, in the four host departments, the faculty, and in the central administration.

GUESTS

It is a privilege of ours to invite prominent guest researchers and –speakers as well as close collaborators of our groups. In 2005, we have received 14 international guest researchers who stayed for more than 1 month (see appendix 6). These 14 contributed more than three full man years to CMA in 2005. In addition, we received 200 other international guests for periods of 1 – 30 days, the full list is presented in appendix 6. Counting all periods, they spent 1150 working days at CMA, which in fact are 5 full man years. The number of international guests was extremely high in 2005, see comments under section "International collaboration". Finally also around 200 different national guests have visited us, many of them several times. We have not accurately counted or registered these, neither have we calculated these in the person-year figures in table 2.

RESEARCH EDUCATION

A main goal of CMA is the training of new researchers. On December 31, 2005 26 PhD-students and 18 postdoc fellows were active in the CMA. In last year's report we expected 5 doctoral defences to take place in 2005. Two of these have not yet finished (they will during 2006), and one candidate actually managed to reach his defence in December 2005, six months prior to his full period. So we can report on four doctoral defences in 2005:

- April 29, 2005: **Thilo Meyer-Brandis** defended his thesis: *"White noise analysis and stochastic calculus for Levy processes with applications to finance"* for the dr. scient.-degree. His supervisor was Professor Bernt Øksendal. After the defence, Meyer-Brandis has worked at CMA in a researcher position. In December 2005 he was granted an individual 3-year stipend from the Research Council of Norway, a project which he will conduct at CMA.
- May 13, 2005: **Gaute Hagen** defended his thesis: *"The Contour Deformation Method in Momentum Space, and Effective Interactions for Weakly Bound Nuclei."* for the dr. scient.-degree. He worked under the supervision of Professor Morten Hjorth-Jensen. In June 2005 he entered a postdoc position at Oak Ridge National Laboratory in Tennessee, USA.
- May 26, 2005: **Klara Hveberg** defended her thesis *"Injective mapping systems and self-homeomorphic fractals"*. She worked under the supervision of Professor Tom Lindstrøm. After her defense, she entered a position as project coordinator of CMAs educational project; "Computers in Science Education" – see separate description.
- December 20, 2005: **Hans Kristian Kamfjord Eriksen** defended his thesis *"Practical analysis of current and future CMB experiments"*. His supervisor has been Professor Per Barth Lilje. Eriksen continues to work at the Institute of Theoretical Astrophysics, and he also remains affiliated to the CMA. He has six months left of his original PhD-grant, and new project funding for a three-year postdoc period is already ensured.

Together with previous defenses in 2003 and 2004, 12 doctoral candidates have so far successfully finished their PhDs at CMA. In 2006, we expect that we will have seven new PhD defences in CMA. For comparison, our original ambitions were that 10 PhD-students should defend their theses during the first five years of CMA, and 25 during all 10 years (see the research plan). In our ongoing self evaluation we have reset these goals to 25 in the first five years, and 60 for the full 10-year period.

Researcher school

In last year's report we described the system of researcher schools in Norway, and at UiO specifically. There is nothing new to report, no political progress has been achieved as far as we are aware. We maintain our status as a researcher school, and we receive an annual funding (NOK 50.000), for which we have invited international guest speakers. In 2006 we plan a one-week research training school with Nordic participation.

Cotutelle agreements

We also described our efforts to enter a formal cotutelle (or joint) supervision agreement in last year's report. Such agreements and common PhD-degrees are important political signals in the educational Europe. Because of the pivotal nature, several months were spent on both sides to ensure the quality of the formal agreement texts, but we are pleased to report that we reached a common understanding, and that the final papers were signed in late 2005. CMA associated PhD-student Jon Mikkelsen Hjelmervik is at present (from October 1, 2005 – June 30, 2006) situated at University of Grenoble for his first period in France through this agreement. A second period is scheduled in 2007/08.

BASIC EDUCATION

CMA is devoted to researcher education, and is not supposed to take major responsibilities at bachelor or master level. Nevertheless, an entire period of study must consist of coherent parts. Moreover we are deeply interested in candidates/applicants to our PhD positions with a solid and adequate background with respect to our needs (and our conviction on how modern mathematics should be taught). This is partly why CMA has chosen to let the senior scientists continue to teach at all levels, and not restrict ourselves to do PhD supervision and advanced level teaching. Also our research plan signalizes this attitude. Based on the same philosophy, CMA has chosen to enter the responsibility for the following project:

Bachelor level: Computers in Science Education

This project was initiated in 2004 by staff from the CMA in cooperation with colleagues from the Departments of Mathematics and Physics. The aim is to renew the teaching of mathematics and science by including a computational perspective even in the elementary courses.

The focus in the first half of 2005 was to establish a strategy for future work and gain the support of our faculty in this work. Our efforts were successful in that the faculty included the statement "The faculty will integrate central and modern aids and techniques in order to extend and modernise the teaching of science. Numerical computations and modelling have an important role in this context " in its new strategic plan for 2005-2009 as one of five key focal points for teaching in the period. In September CMA hosted a seminar with participants from most of the 'math heavy' departments to discuss the role of computations in our teaching. There was unanimous support from all present that it is now time for computations to become a natural tool in our teaching at all levels.

Njål Foldnes moved to Stavanger in July, and Klara Hveberg replaced him with added support from the CMA and the University's initiative for flexible teaching. Klara is working full time as an assistant to the staff in the maths department to bring more of a computational perspective into the two maths courses in linear algebra and multivariate calculus. This work is supervised by Tom Lindstrøm, also from CMA.

Master level:

Rather than establishing separate master programs, CMA wants to influence on the existing programs by our ordinary and frequent teaching duties. This strategy is based on a confidence that the existing programs suit, and will continue to do so, our research profile. And we do receive qualified applications for our positions, both from international and national candidates. We feel confident that our strategy is efficient and ensures the full and necessary emphasis on our primary objectives in the research plan.

We have though chosen two strategic actions with respect to master students: First, we have dedicated a reading room in our premises for 12 master students. They are included in our mailing lists, they share the kitchen and lunch area with us, and they receive invitations to most of our scientific and social events. The second action is to move some central master courses to be taught in our seminar room. Both actions are intended to bring the master students closer to us, and vice versa. We hope to build down artificial borders so that the CMA appears as an obvious and attractive environment also among our nearest and maybe most important recruiting base; UiO's own master students with an interest for mathematics for applications.

COOPERATION

ACTIVE PARTNER, SINTEF

SINTEF is CMA's only active partner (i.e. contracted as a formal Centre of Excellence partner). In each annual report we have reported on an increased cooperation. And so we will also for 2005. One more senior researcher from Sintef is employed by CMA, also including a corresponding Sintef contribution. The project activities have run as estimated, and we have discussed further extensions of the cooperation in the GPU-activities (see below). Details will be described in the 2006-report.

From CMAs point of view, we continue to regard the cooperation as very constructive and fruitful, and most important: the cooperation seems to imply really mutual benefits. We can list the main cooperative items in 2005 as follows:

- Tor Dokken and Ewald Quak continue to contribute as originally intended with the contracted 20% share in addition to their 20% positions at CMA. Moreover, on September 1, 2005 senior scientist Knut-Andreas Lie entered the cooperation with similar shares from both sides.
- SINTEF runs an RCN-initiated Strategic Institute Program "Graphics hardware as a high-end computational resource", which is fully included in the CMA research activity. See the 2004-report for details.
- We arranged two workshops in close and successful cooperation in 2005: "Computational Methods for Algebraic Spline Surfaces (Compass II) on Sep 14-16, and "GPU as a computational resource", on December 12. Two new commonly arranged workshops are planned in 2005.
- Together we have finished the EU FP5 Future and Emerging Technology-project "GAIA II" (IST-2001-35512), which has led to major advances in the use of algebraic geometry in CAGD. The results may open opportunities for patenting. This project also had a large international industrial partner "think3" (www.think3.com). GAIA II has received remarkably positive reviews, which again has led to new and pending proposals.
- Also the FP6 EU-funded Network of Excellence AIM@SHAPE runs as expected, with Ewald Quak as technical manager. The network has 14 active partners.
- CMA members participate in different actions of these projects, research is conducted and results obtained. In the appendices 6, 7, and 8 several items are connected to the GPU, GAIA II, and AIM@SHAPE projects.

NATIONAL COOPERATION

One national project started (together with Rogaland Forskning) in February 05, but the agreement was made late 2004, and is described in the 2004 report. So is the cooperation with CIPR in Bergen which we intend to further extend in 2006. However, we would like to emphasize the broad national cooperation which led to the establishment of the eVita-program in The Research Council of Norway. All major institutions made a common effort, and CMA contributed to the result. We expect that this program will open opportunities for extended collaborative project activity as well.

For the established national collaborative activities, please consult the annual reports of 2004 and 2003. As a final comment we note that also 2005 brought more than 200 unique national guests for our events or for the purpose of general research collaboration.

INTERNATIONAL COLLABORATION

In our COE proposal, we named approximately 50 international collaborators, and they were only the very most important ones. In 2005 we received 214 international guests (all listed in appendix 6), of which 14 stayed with us for more than 1 month. For comparison, we received 88 international guests in 2004 and 73 in 2003. The key reason to the very high number in 2005 was two big international conferences here at the centre. But also without those, the number would exceed 100, and hence indicate a continuous growth from previous years.

All 12 internally arranged conferences/workshops had international participation (Appendix 5a). CMA-members have been (co)organiser of 19 international conferences in addition to those at CMA (Appendix 5c). Among the 117 refereed articles (107), books (2) and book chapters (8), 66 were written together with international partners (Appendix 7a-c). Out of 168 scientific talks outside CMA (Appendix 8a and 8b), 152 were given abroad (in 30 different countries, on all continents). CMA has a large circle of international collaborators and networking.

However, as a Centre of Excellence we also aim at establishing some formal and obliging institutional cooperation, and we have taken a few steps towards this.

- The EU FP6 / Transfer of Knowledge project "CENS-CMA" (Co-operation of Estonian and Norwegian Scientific Centres within Mathematics and its Applications) incepted on May 1, 2005. It will run for four years. This is a joint project between CENS (Centre for Nonlinear Studies) in Tallinn, Estonia, and CMA. The key issue is researcher exchange, and Ewald Quak from Sintef/CMA started his 48 months period immediately on May 1, 2005. In November 2005 Prof. Tarmo Soomere from CENS became the first CENS visitor at CMA. Ragnar Winther and Helge Galdal are both members of the project board.
- CMA, through its stochastic analysis group, participates in the Mathematical Modelling program for Southern Africa, based in Harare. Professor Bernt Øksendal is the Norwegian coordinator and Giulia Di Nunno and Knut Aase are the other Norwegian members of the Steering Committee. This program is sponsored by NUFU and it has been very successful: Since 1996 it has produced more than 60 Master candidates and about 10 PhD students, a substantial part of the whole production in the region. These are now all in important positions at Universities and other institutions in the Southern African region. Currently 3 PhD-students are associated to CMA through this project (Mataramvura, Chikodza and Kufakunesu, see appendix 1).
- The stochasticians also have a formalized cooperation with the University of Botswana. This cooperation involves research and teaching, plus jointly organized annual workshops in mathematical finance in the Southern African region, in cooperation with SAMSA (Southern African Mathematical Sciences Association) (since 1997). The next such workshop (number 6) will be held in Gaborone, Botswana in November/December 2006. For this we are seeking support from IMU.
- Finally we will also participate in the IMU Millenium Science Initiative. Here the University of Botswana and the University of Cameroon are two of the countries involved, where IMU wants to establish mathematical research centers. In addition to the scientific activity by the stochastic analysis group, also Professor Ragni Piene is involved in this cooperation at a high IMU administrative (and more general) level.
- Bernt Øksendal is a member of the Committee for Developing Countries (CDC), which is one of the committees established by the European Mathematical Society. Bernt Øksendal is also a member of the Research/visiting Fellowships Committee of the African Millennium Mathematical Sciences Initiative (AMMSI).
- In 2003 a large collaboration on computational many-body physics between CMA, the department of Physics in Oslo, Oak Ridge National Lab (ORNL), and Michigan State University (MSU) in USA was established. This collaboration counts presently 15 researchers in Norway and USA, and several postdocs, PhD students, and master students. It spans quantum chemistry, nuclear many-body physics, and computational science. David Dean of ORNL was appointed as Prof II at CMA, while Hjorth-Jensen is adjunct Professor at MSU, East Lansing.
- Appendix 4 provides a full list of all projects at CMA, many of them with extensive international collaboration, and also some of them coordinated by CMA/CMA-members.

HEALTH, ENVIRONMENT AND SAFETY

CMA does not store chemicals or other possibly dangerous materials etc. No work-related accidents occured in 2005.

In late 2004 we ran a comprehensive work environment survey. The conclusions were generally very positive, and were described in the last report. We also presented a few key challenges to address during 2005, which have been resolved as follows:

■ We scheduled and ran formal appraisals with all our PhD- and postdoc fellows (those located in our premises). We will run a new round in 2006.
■ We strengthened the IT-support budget, and installed a wireless LAN network in the centre area, in order to make it easier for our numerous guests to work online without needing the full local registration and authentication processes.
■ One detail that became very clear to the management during the round of appraisals (not especially emphasized in the work environment survey), was that we could improve on internal information. This led to the establishment of an internal newsletter, which came out with 6 issues in 2005 (e-mail based). The main topics are presentation of new members, coming events and so on.

We also intended to engage an ergonomist to suggest individual solutions on solvable problems. This is yet to be executed, and is postponed to 2006. Finally we should upgrade the estetics (art and posters). A few steps are made, and we will continue in 2006.

■ INTERNAL SEMINAR AND SOCIAL EVENTS

On November 24-25 we invited all centre members to a two-day internal seminar at Holmen Fjordhotell in Asker. Almost 60 members were able to participate on all or parts of the arrangement, which served several purposes: First, and as the main motivation: We wanted to initiate the self evaluation process which will be the foundation in our efforts for a renewed 5-year centre contract. The first working day was covered with scientific presentations (all by centre members) focusing on our interdisciplinary projects. On the second day we divided the group: All senior personnel worked on the templates of the evaluation process. The PhDs and postdocs had a one-day seminar on project management with an external consultant. However, socializing and "teambuilding" were other aspects to the seminar. The positive effects of a good dinner and a pleasant evening in nice surroundings should not be underestimated. The feed-back from the participants was positive, and we regard the arrangement as successful, both with respect to the scientific content for our evaluation process as well as the social outcome.

In mid June we arranged a four-hour "cruise" on the Oslo fjord for the centre members and our present guests at that time. We had an informal and nice dinner on board. Finally we have had several smaller social events in the centre premises.

PUBLIC OUTREACH

It is important to make the general population more aware of the importance of mathematics in society, and CMA intends to contribute. Norway has no tradition of great mathematical publicity, so any progression in this matter will not just happen by itself. We have to seize all possibilities, and in 2005 we again increased the efforts and results:

■ We have registered 38 media appearances (13 in 2004 for comparison), among these both national TV, radio NRK P1 and P2 as well as a feature article in the main national newspaper "Aftenposten". The full list is presented in appendix 9. We highlight two special topics which received particularly much attention:
  ■ Our mathematical theatre (see description below) was presented in both TV, radio and in newspapers.
  ■ The EURYI award of Snorre Christiansen was covered by all main newspapers and a series of magazines and internet resources.
■ Appendix 8c presents a list of talks, given in 2005 which were meant for a general audience.
■ We continue our sponsorship for www.matematikk.org, see description in former reports.

During the spring semester of 2005 we ran a mathematical theatre project for school children, especially aiming at the 5th and 6th grade. Together with professional instructors and actors, CMA's Njål Foldnes was in charge of the project called "Prima og Nulle tar kaka". Detailed description is provided on our web-site, but the key idea was to present the importance of mathematics in daily life. Big problems that seemed impossible to overcome suddenly became both achievable and funny when the bright girl "Prima" was able to mathematically formulate and solve the problems of the helpless "Nulle". The group visited 30 schools in the Oslo area, and around 2500 school children saw the popular play. The project received a lot of media attention (see above, and appendix 9), and also raised a considerable amount of funding from different sources.

APPENDICES

APPENDIX 1
CMA-MEMBERS

The following tables give a total overview of all CMA-members in 2005 and in the foreseeable future. Some more positions will be announced by CMA itself during 2006, but since no names are yet known, these are not included in the lists. Any further speculations or not-yet-confirmed project fellows are also neglected (according to our budget philosophy we do not calculate any new contributions). Any such contributions provided from now on, will appear in the 2006 annual report. The information provides the foundations for the accounts and budget disposals in this report, and also for the statistics on the personnel.

SENIOR SCIENTISTS

Name	Nationality	Position	Period	CMA share	Funding (see budget)
Fred Espen Benth	Norway	Professor	Mar03-Feb08	75%	Host
Kjell Arne Brekke	Norway	Researcher II	Jan06-Dec06	10%	CMA
Mats Carlsson	Sweden	Professor	Mar03-Feb08	40%	Host
Snorre Christiansen	Norway	Assoc. Prof.	Jan06-Feb08	100%	Ass. proj
Geir Dahl	Norway	Professor	Mar03-Feb08	75%	Host
David Dean	USA	Researcher II	Jan04-Feb08	10%	CMA
Giulia Di Nunno	Italy	Assoc. Prof.	Mar03-Feb08	75%	Host
Tor Dokken	Norway	Chief scient.	Mar03-Feb08	20%	SINTEF
		Researcher II	May03-Feb08	20%	CMA
Geir Ellingsrud	Norway	Professor	Mar03-Dec05	75%	Host
Truls Flatberg	Norway	Researcher II	Nov05-Feb08	20%	Host
Michael Floater	England	Professor	Nov03-Feb08	75%	Host
Viggo Hansteen	Norway	Professor	Mar03-Feb08	40%	Host
Morten Hjorth-Jensen	Norway	Professor	Mar03-Feb08	40%	Host
Helge Holden	Norway	Researcher II	May03-Feb08	20%	CMA
Yaozhong Hu	China	Researcher II	Jul05-Feb08	10%	CMA
Kenneth Karlsen	Norway	Professor	Jul04-Feb08	100%	Host
Egil Leer	Norway	Professor	Mar03-Feb08	40%	Host
Knut-Andreas Lie	Norway	Sr. scientist	Sep05-Feb08	20%	SINTEF
		Researcher II		20%	CMA
Per Barth Lilje	Norway	Professor	Mar03-Feb08	40%	Host
Tom Lindstrøm	Norway	Professor	Mar03-Feb08	75%	Host
Tom Lyche	Norway	Professor	Mar03-Feb08	75%	Host
Knut Mørken	Norway	Professor	Mar03-Feb08	75%	Host
Eivind Osnes	Norway	Professor	Mar03-Feb08	40%	Host
Ragni Piene	Norway	Professor	Mar03-Feb08	75%	Host
Ewald Quak	Germany	Sr. scientist	Mar03-Feb08	20%	SINTEF
		Researcher II	Aug03-Feb08	20%	CMA
Nils Henrik Risebro	Norway	Professor	Sep04-Feb08	75%	Host
Eigil Samset	Norway	Researcher II	Jan06-Feb08	20%	Host
Stein Arild Strømme	Norway	Researcher II	Oct03-Feb08	10%	CMA
Xue-Cheng Tai	China	Researcher II	Nov03-Feb08	20%	CMA
Ragnar Winther	Norway	CMA-director	Mar03-Feb08	100%	CMA
Tusheng Zhang	China	Researcher II	Aug04-Jul07	20%	CMA
Bernt Øksendal	Norway	Professor	Mar03-Feb08	75%	Host
Knut Aase	Norway	Researcher II	Jan04-Feb08	20%	CMA

PHD-STUDENTS

Name	Nationality	Period	CMA-share	Funding (see budget)
Elise Bergli	Norway	Mar03-Jul05	40%	Ass. project
		Aug05-Jul06		Host
Imran Habib Biswas	India	Apr05-Mar08	100%	CMA
Eliot Chikodza	Zimbabwe	Jan06-Dec08	100%	Ass. project
Erik Christopher Dyken	Norway	Jul03-Jun06	100%	Ass. project
Inga Baadshaug Eide	Norway	Feb04-Jan07	100%	CMA
Hans Kristian Kamfjord Eriksen	Norway	Jul03-Jun06	40%	Ass. project
Franz Fuchs	Germany	Apr06-Mar09	100%	Ass. project
Martin Groth	Sweden	Jan05-Dec07	100%	CMA
Gaute Hagen	Norway	Mar03-Aug04 *	100%	Ass. Project
		Sep04-Dec04		CMA
Tore G Halvorsen	Norway	Feb06-Jan09	100%	Ass.project
Jon M. Hjelmervik	Norway	Jul04-Jun05 + Jan06-Dec07	100%	SINTEF
		Jul05-Dec05 + Jan08-Jun08	100%	CMA
Klara Hveberg	Norway	Jan05-Apr05	100%	CMA
Åse Marit Janse	Norway	Mar04-Feb08	40%	Host
Pål Hermunn Johansen	Norway	Mar03-Sep05	100%	Ass. project
		Oct05-Dec05		CMA
Maxim Kartamyshev	Russia	Jan04-Dec07	40%	Host
Paul Carlisle Kettler	USA	Aug03-Jul06	100%	Ass. project
Mari Anne Killie	Norway	Mar03-Jan06	40%	Ass. project
		Feb06-May06	100%	CMA
Rodwell Kufakunesu	Zimbabwe	Jan04-Jun06	100%	Ass. project
Simen Kvaal	Norway	May04-Apr07	100%	CMA
Sure Mataramvura	Zimbabwe	Mar03-Jun04 *	100%	Ass. project
Thilo Meyer-Brandis	Germany	Mar03-Feb05	100%	Ass. project
		Mar05-Apr05		CMA
Heidi Camilla Mork	Norway	Jul04-Jun07	100%	CMA
Eirik Ovrum	Norway	Oct03-Sep06	100%	CMA
Victoria Popsueva	Russia	May04-Apr07	40%	Ass. project
Atgeirr Flø Rasmussen	Norway	May03-Apr06	100%	CMA
Marie Rognes	Norway	Sep05-Aug08	100%	CMA
Christian Schulz	Germany	Nov04-Oct08	100%	Host
Johan Simon Seland	Norway	Aug04-Jul07	100%	SINTEF
Torquil Macdonald Sørensen	Norw / England	Sep05-Aug08	100%	CMA
An Ta Thi Kieu	Vietnam	May04-Apr07	100%	Ass. project
Olli Wallin	Finland	Jul04-Jun07	100%	CMA
Knut Waagan	Norway	May03-Apr06	100%	CMA

* The funding ended in 2004, but Hagen defended his thesis in April 2005. Mataramvura is expected to hold his defense during 2006. These two are not counted in the man-year production or accounting figures.

POSTDOCS

Name	Nationality	Period	CMA-share	Funding (see budget)
Mostafa Bendahmane	Morocco	Sep04-Aug06	100%	CMA
Steinar Børve	Norway	Jul04-Jul05	100%	Ass. project
Snorre Christiansen	Norway	Nov02-Dec05	100%	Host
Håkon Dahle	Norway	Mar03-Dec06	40%	Ass. project
Hans Kristian K Eriksen	Norway	Jul06-Jun09	40%	Ass. project
Steinar Evje	Norway	Nov05-Oct07	100%	Ass.project
Tore Halsne Flåtten	Norway	Feb05-Jan07	100%	Ass. project
Boris Gudiksen	Denmark	Mar04-Mar07	40%	Ass. project
Frode K. Hansen	Norway	Feb05-Jan08	40%	Host
Runhild Aae Klausen	Norway	Oct04-Sep05	100%	Ass. project
		Oct05-Dec06		CMA
Emil Lundh	Sweden	Aug05-Jan06	100%	CMA
Cloud Makasu	Zimbabwe	Mar03-Jan05	100%	Ass. project
Thilo Meyer-Brandis	Germany	Mar05-Dec05	100%	CMA
		Jan06-Dec08		Ass. project
Sidhartha Mishra	India	Sep05-Aug07	100%	CMA
Per Christian Moan	Norway	Sep04-Aug07	100%	CMA
Daniel Muller	Germany	Apr04-Sep05	40%	Ass. project
Halvor Møll Nilsen	Norway	Dec04-Nov06	100%	CMA
Michiel van Noort	Netherlands	Mar03-Oct05	40%	Ass. project
Frank Proske	Germany	Jun04-May07	100%	CMA
Martin Reimers	Norway	Oct04-Sep07	100%	CMA
Luc Rouppe van der Voort	Netherlands	Mar03-Jun06	40%	Ass. project
Jurate Saltyte-Benth	Lithuania	Jul03-May05	100%	Ass. project
Mikael Signahl	Sweden	Feb05-Jan07	100%	Ass. project
Tatiana Surazhsky	Russia	Jul03-May05	100%	Ass. project
		Jun05-Aug05		CMA
Vitaly Surazhsky	Israel	Jul03-May05	100%	Ass. project
		Jun05-Aug05		CMA
Jan Brede Thomassen	Norway	May03-Apr05	100%	CMA
		May05-Au05		Ass. project
		Sep05-Dec05		CMA

OTHER

Name	Nationality	Position	Period	CMA share	Funding (see budget)
Njål Foldnes	Norway	Proj. researcher	Jul04-Dec05	100%	Host
Helge Galdal	Norway	Senior adviser	Mar03-Feb08	100%	CMA
Klara Hveberg	Norway	Proj. researcher	Jul05-Dec06	100%	Host
Qiya Hu	China	Researcher	Sep04-Jan05	100%	CMA
Andrew McMurry	Ireland	Scientific prog	Oct03-Feb08	100%	Host
Tore Halvorsen	Norway	Researcher	Sep05-Dec05	100%	CMA

NOTES ON ACCOUNTING 2005 AND BUDGET FIGURES 2006

1. **Accounted Revenues.** The top part of the table presents the cash income to CMA, 2005 accounted figures, and 2006 budgeted figures.
2. **RCN CoE-funding.** The original schedule is maintained, both for 2005 and 2006.
3. **Contributions from UiO.**
   - **2005** (xNOK 1000): UiO board, free: 2000, 1 Professorship: 700, 1 postdoc: 600, Project CSE: 300, Start pack KHK: 600, Researcher school: 50, Internal workshop: 50, Gender equality: 36. Total: 4336
   - **2006** (xNOK 1000): UiO board, free: 2000, 1 Professorship: 700, 1 postdoc: 657, Start pack KHK: 600, Start pack SC: 400, 1 PhD (from Jul): 250, Researcher school: 50, Gender equality: 32. Total: 4689
4. **Contributions from SINTEF.** One PhD student (full rate) from the GPU project (Johan Simon Seland. A specific contribution for an internal workshop (KNOK 26) on the 2005 figures.
5. **EU contributions.** The Marie Curie individual fellowship of postdoc Mikael Signahl provided KNOK 1221 in 2005. This also includes parts of the expected 2006-contribution. We now expect that the remaining part on this project in 2006 is KNOK 400. In 2006 we also expect that the CENS-CMA project will provide cash transfers from Estonia of approx. KNOK 200.
6. **RCN projects**
   - **2005** (xNOK 1000): YFF-project Kenneth Karlsen: 814, Individual PhD-grant An Ta Thi Kieu: 534, CMA conference on Imageprocessing: 70. Total: 1418
   - **2006** (xNOK 1000): YFF-project Kenneth Karlsen: 1384, EURYI project Snorre Christiansen: 1568, Individual PhD-grant An Ta Thi Kieu: 540, Individual Postdoc-grant Thilo Meyer-Brandis: 822, from "Mathematical Methods in Mesh-based Geometric Modelling" (Department of informatics running the project, CMA hosting the fellows): 90. Total: 4404
7. **Other, state official contributions**
   - **2005** (xNOK 1000): CIPR, Bergen, salary costs Jan-Oct for postdoc Runhild Aae Klausen: 380, Centre for Advanced Studies, Oslo, salary costs Jan-Jul for postdoc Steinar Børve: 262, Abel Memorial Fund for theatre project: 100. "Den kulturelle skolesekk", Oslo, for theatre project: 50, Utdanningsdirektoratet, for theatre project: 10, CIPR, Bergen for 3 workshops: 87, SIMULA for workshop: 30, CMA deficit/contribution on theatre project: 64. Div unspecified income: 27 Total: 1010
   - **2006** (xNOK 1000): Abel Memorial Fund, for the 2005 Abel symposium: 350. DNVA, for conference 2005: 39. Total: 389
8. **Private fuding.**
   - **2005** (xNOK 1000): "Oljeindustriens landsforening", for theatre project: 30. "NITO", for theatre project: 10, Total: 40
   - **2006** (xNOK 1000): "Rogaland Forskning", for hosting postdoc fellow Tore Halsne Flåtten (2005 and 2006): 60. Total: 60
9. **Accounted expenditures + representative revenues and expenditures.** The lower part of the table presents the accounted costs of CMA (under columns 3 and 4). In addition, since all non-accounted (representative) figures balance, we present these figures under the same headings, separated by columns to specify the contributions by funding sources.
10. **Salary costs for PhD students.** This item is covering salaries and direct costs thereof for all our PhD-students in 2005, and those confirmed for 2006. The figures reflect the man year figures in table 3.
11. **Salary costs for postdoc positions.** As 10.
12. **Salary costs for researcher positions.** As 10. By "Researcher" we mean senior scientists (including the centre manager), adjunct positions, and our two project fellows on the CSE project.

APPENDIX 2
ACCOUNTING AND BUDGET FIGURES

Item	Note	TOTAL 2005 Accounts Reven.	TOTAL 2005 Accounts Expend.	TOTAL 2006 Budget Reven.	TOTAL 2006 Budget Expend.	CMA 2005 Accounts Reven.	CMA 2005 Accounts Expend.	CMA 2006 Budget Reven.	CMA 2006 Budget Expend.	Note	UiO FUNDING 2005 Acc	UiO FUNDING 2006 Bud	SINTEF 2005 Acc	SINTEF 2006 Bud	OTHER 2005 Acc	OTHER 2006 Bud
Accounted revenues	1)									1)						
RCN CoE-funding	2)	-11.000		-11.000		-11.000		-11.000		2)						
UiO contributions	3)	-4.336		-4.689		-4.336		-4.689		3)	4.336	4.689				
Sintef contributions	4)	-600		-592		-600		-592		4)			600	592		
EU-contributions	5)	-1.221		-600		-1.221		-600		5)					1.221	600
RCN projects	6)	-1.418		-4.404		-1.418		-4.404		6)					1.418	4.404
Other, state off. projects	7)	-1.010		-389		-1.010		-389		7)					1.010	389
Private funding	8)	-40		-60		-40		-60		8)					40	60
Sum Cash Revenues		**-19.625**		**-21.734**		**-19.625**		**-21.734**			**4.336**	**4.689**	**600**	**592**	**3.689**	**5.453**
Ace exp+ repr rev&exp	9)									9)						
Salary expenses																
* PhD-positions	10)	-3.339	8.427	-2.810	8.647		5.088		5.837	10)	768	824	223	464	2.348	1.522
* postdoc positions	11)	-2.605	8.134	-1.432	6.821		5.529		5.389	11)	179	203			2.426	1.229
* Researchers	12)	-7.324	10.600	-7.360	10.826		3.276		3.466	12)	7.044	6.985	280	375		
* Guests	13)	-1.700	1.744	-1.800	1.800		44		0	13)					1.700	1.800
* Admin. And technicians	14)	-515	1.207	-536	1.234		692		698	14)	515	536				
SUM Salary Expenses		**-15.483**	**30.112**	**-13.938**	**29.328**		**14.629**		**15.390**		**8.506**	**8.548**	**503**	**839**	**6.474**	**4.551**
Indirect costs																
* Per individual, given rates	15)	-2.390	4.777	-1.967	4.417		2.387		2.450	15)	1.208	1.186	139	153	1.043	628
* Areas beyond offices	16)	-531	531	-541	541					16)	531	541				
SUM Indirect Costs		**-2.921**	**5.308**	**-2.508**	**4.958**		**2.387**		**2.450**		**1.739**	**1.727**	**139**	**153**	**1.043**	**628**
Running costs																
Conferences	17)	0	1.120	0	750		1.120		750	17)						
Guests and travelling	18)	0	1.555	0	1.550		1.555		1.550	18)						
Public Outreach, info	19)	0	334	0	300		334		300	19)						
Teaching services	20)	0	195	0	250		195		250	20)						
Various operational costs	21)	-1.878	2.647	-1.392	2.703		769		1.311	21)	77	80	350	250	1.451	1.062
Sum Running costs		**-1.878**	**5.851**	**-1.392**	**5.553**		**3.973**		**4.161**		**77**	**80**	**350**	**250**	**1.451**	**1.062**
Equipment, investments	22)	-1.110	1.354	-941	1.291		244		350	22)	531	541	0	0	579	400
Sum repr. Rev+exp											**10.853**	**10.896**	**992**	**1.242**	**9.547**	**6.641**
TOTAL SUM		**-41.017**	**42.625**	**-40.513**	**41.130**	**-19.625**	**21.233**	**-21.734**	**22.351**		**15.189**	**15.585**	**1.592**	**1.834**	**13.236**	**12.094**
Annual Result	23)	1.608		617		1.608		617		23)						
Transfers	24)	-4.799		-3.191		-4.799		-3.191		24)						
Accumulated result	25)	-3.191		-2.574		-3.191		-2.574		25)						

13. **Salary costs for guests.** As 10. By "Guests" we count official long term guests (who stay full time with us for more than 1 month). They contribute to the CMA research similarly to CMA members, and we report their results from the visiting period. Salary costs are estimated at an average level, comparative to ordinary CMA-members.

14. **Salary costs for administrative and technical personell.** As 10. Recall that a major part of the indirect costs (note 15) is dedicated to cover administrative and technical support for the centre as described in the section "Administrative support". Hence this item covers senior advisor Helge Galdal and scientific programmer Andrew McMurry.

15. **Indirect costs, per individual.** This item covers offices and infrastructure provided for each individual. In 2005 we adjusted (our own inititave) the level according to an inflation rate of 2,5% annually for 2003 – 2005. Hence the rates for 2005 were 83.000 pr man-year except for PhD-students and postdocs, for whom we have used 102.000. (Adjusted from 77.000 / 95.000). For UiO funded personell, SINTEF personell and affiliates, these figures appear equally as revenues and expenditures, but we explicitly pay our host for all CMA employees, using the same rates.

16. **Additional areas.** The amount appears in the original contract, and is specified to cover all areas beyond the offices counted in 20, meaning other offices, laboratories, seminar-rooms, meeting-rooms, lunch area, other areas. CMA has at its full disposal about 1400 square meters. In addition we have flexible solutions with our host if and when we need additional space. We maintain the original figures for this part both for the 2005 account as well as for the adjusted 2006 budget.

17. **Conferences.** Workshops and conferences are main activities of the CMA. Appendix 5 contains a full list of the 2005 events, our most active year so far. The reason why we downscale the budget for 2006, is that 2005 included two major conferences, which we do not intend in 2006.

18. **Guests and travelling.** This item reflects another main activity. Appendix 6 and 8 presents the main results of this extensive bilateral activity.

19. **Public outreach.** This item covers publicity efforts, posters, design elements for web and brochures, reports (like this) etc. We also plan to make efforts towards society in general, and children specifically. The support of www.matematikk.org is included in this item.

20. **Teaching services.** CMA members are not exempted from teaching. On the contrary, we regard it as important that we keep up with the teaching duties of the scientific community. However, in order to relieve us the most time consuming parts of teaching, we have this specific budget item.

21. **Various operational costs.** This item is meant for the daily needs and actions that are not covered by any other specific item. Operational means for PhDs and postdocs are included. For recruiting positions, common practice is to set aside some personal means for operational costs. In CMA we calculate NOK 33.000 pr year for this purpose. All affiliates have the same sum available, and we have used the same rate for the host-supported fellows.

22. **Equipment.** CMA itself mostly obtains computers and additional accessories. The centre members also make use of existing equipment, especially the astrophysisists. In the original contracted budget we estimated this to a 2005 amount of KNOK 531 (2006: 541). The activity goes on as expected, and we see no reasons to adjust this contribution to the figures.

23. **Annual Result.** We conclude the accounting year of 2005 with a deficit of MNOK 1,6. See the main report for further comments.

24. **Transfers.** The CoE-scheme of RCN allows transfers, and to us this has been necessary to manage the financial effects of the delayed entry in the premises in 2003. It has been an inevitable fact that we were totally dependent of our own locations in order to increase the speed of activities. In addition we were a totally new constellation, and it took time to employ a number of persons.

25. **Accumulated result.** Final result, to be be transferred.

APPENDIX 4
LIST OF ASSOCIATED PROJECTS

INDIVIDUAL

Name	Pos.	Source	Project #	Project leader/node	Period
Hans Kristian K Eriksen	PhD	NFR	157882/432	Per Lilje	01.07.2003 - 30.06.2006
Mari Anne Killie	PhD	NFR	153233/431	Øystein Lie-Svendsen	01.02.2003 - 31.01.2006
Rodwell Kufakunesu	PhD	Univ.of Zimbabwe		Fred Espen Benth	01.01.2004 - 30.06.2006
Thilo Meyer-Brandis	PhD	NFR	147234/432	Bernt Øksendal	- 28.02.2005
Elise Bergli	PhD	NFR+Fysikk		Morten Hjort-Jensen	- 30.07.2005
Paul C. Kettler	PhD	egenfinansiert		Fred Espen Benth	01.08.2003 - 31.07.2006
An Ta Thi Kieu	PhD	NFR	160203/V30	Bernt Øksendal	01.05.2004 - 30.04.2007
Victoria Popsueva	PhD	UiB		Morten Hjort-Jensen	01.05.2004 - 30.04.2007
Eliot Chikadze	PhD	Univ.of Zimbabwe		Bernt Øksendal	01.06.2006 - 31.12.2008
Håkon Dahle	postdoc	NFR	153218/431	Per Lilje	01.02.2003 - 31.01.2005
Steinar Børve	postdoc	SHS		Jan Trulsen	01.08.2004 - 31.07.2005
Cloud Makasu	postdoc	NFR	155115/432	Bernt Øksendal	01.02.2003 - 31.01.2005
Jurate Saltyte-Benth	postdoc	Mat.inst / NFR	155120/432	Jurate Saltyte-Benth	01.07.2003 - 31.05.2005
Runhild Aae Klausen	postdoc	CIPR / Bergen		Runhild Aae Klausen	15.10.2004 - 14.10.2005
Mikael Signahl	postdoc	EU / Marie Curie	MEIF-CT-2005-515036	Bernt Øksendal	01.02.2005 - 31.01.2007
Tore Halsne FlÂtten	postdoc	NFR /Rogalandsforskning		Kenneth Karlsen	15.02.2005 - 14.02.2007
Thilo Meyer-Brandis	postdoc	NFR	171253/V30	Thilo Meyer-Brandis	01.01.2006 - 31.12.2008
Hans Kristian K Eriksen	postdoc	NFR		Hans KK Eriksen	01.07.2006 - 30.06.2009

COLLABORATIVE

Title	Source	Project #	Proj. Leader / node	Period
ESMN	EU / RTN	HPRN-CT-2002-00313	Mats Carlsson	- 31.10.2006
TOSTISP	EU / RTN	HPRN-CT-2001-00310	Viggo Hansteen	01.03.2003 - 28.02.2006
SHP	NFR / SUP	146467/420	Mats Carlsson	- 31.12.2005
CMB-NONGA-NOR	EU		Per Lilje	01.04.2005 - 31.03.2006
Planck-project prolongated	NFR	165491/V30	Per Lilje	01.01.2005 - 31.12.2006
GAIA II (UiO-part, see also SINTEF)	EU / FET	IST-2001-35512	Tor Dokken	- 30.09.2005
HYKE	EU / RTN	HPRN-CT-2002-00282	Kenneth K. / Helge H.	- 31.07.2005
SUPREMA	NFR / SUP	154077/420	Geir E. / Ragni P.	2003 - 2006
Mathem. Methods in Mesh-based Geometric Modelling	NFR / BeMatA	154895/431	Mike Floater	01.01.2003 - 30.06.2006
Winter Schools in Computational Mathematics	NFR / BeMatA		Kenneth K. / Helge H.	2005 - 2006
Analysis and numerics for Nonlinear Waves (NonWave). BeMatA	NFR /BeMatA		Helge H / Kenneth K.	2004 - 2006
Numerical Partial Differential Equations: Theory, Numerics, and Applications	NFR/ YFF	162817/V00	Kenneth Karlsen	01.10.2004 - 30.09.2009
CENS-CMA	EU /TOK	MTKD-CT-2004-013909	Ragnar Winther	01.05.2005 - 30.04.2009
AMaMeF	ESF	170415/V30	Bernt Øksendal	2005 - 2009
Num. Analysis and sim. of geometric wave equations	ESF / EURYI	173453/V00	Snorre Christiansen	2006 - 2010

OTHER

Title	Source	Project #	Proj. Leader / node	Period
Math theatre «Prima og Nulle tar kaka»	Div.		Njål Foldnes	2005
Computers in Science Education	UiO		Knut Mørken /Morten Hjorth-Jensen	2004
International conference:PDE based Image processing	NFR++		Xue-Cheng Tai	2005

THROUGH SINTEF

Title	Source	Project #	Proj. Leader / node	Period
GAIA II (SINTEF-part, see also UiO)	EU/FET	IST-2001-35512	Tor Dokken	- 30.09.2005
AIM @ SHAPE	EU / NoE	FP6 IST NoE 506766	Ewald Quak	01.01.2004 - 31.12.2007
Graphics hardware as a high-end comp. resource	NFR / SIP	158911 / 130	Tor Dokken	2004 - 2008

APPENDIX 5
LIST OF CMA EVENTS 2005

5a. Workshops and conferences arranged at CMA

Workshop: Recent Advances in Nonlinear PDEs
- March 3-4.
- Organized by Kenneth Karlsen, CMA and Kristian Jenssen, North Carolina State University
- 29 participants: 10 international, 7 national, and 12 CMA members
- 14 talks, 8 by international guests, 3 by national guests, and 3 by CMA members

Workshop: Iterative methods for elliptic eigenproblems,
- March 8-9.
- Organized by Ragnar Winther, CMA
- 19 participants, 2 international, 3 national, and 14 CMA members
- 6 talks, 4 by international guests, 1 by national guests, and 1 by CMA members

Miniworkshop: Adjoint error control: Mathematical analysis and applications in geophysics
- April 27.
- 15 participants, 1 international, 7 national and 7 CMA members
- 3 talks, 2 by international guests and 1 by national guest

Workshop: Launch of the EU-project CENS-CMA
- May 24-25.
- Organized by Ewald Quak (Sintef, CMA and CENS) and Helge Galdal, CMA
- 15 participants, 4 international, 2 national, and 9 CMA members
- 11 talks, 4 by international guests, 2 by national guests, and 5 by CMA members

A conference celebrating Bernt Øksendal's 60th anniversary
- June 9-10.
- Organized by Fred Espen Benth, Giulia Di Nunno, Helge Galdal, and Tom Lindstrøm (CMA) Helge Holden (NTNU and CMA), and Jan Ubøe (NHH)
- 45 participants, 13 international, 15 national, and 17 CMA members
- 14 talks, 13 by international guests, and 1 by national guests

Conference: The 2005 Abel Symposium: Stochastic Analysis and Applications - A Symposium in Honor of Kiyosi Itô
- Jul 29 - August 4.
- Organized by Sergio Albeverio (University of Bonn), Fred Espen Benth, Giulia Di Nunno, Inga Baadshaug Eide, Helge Galdal, Bernt Øksendal, Tom Lindstrøm, and Tusheng Zhang (CMA)
- 76 participants, 57 international, 6 national, and 13 CMA members
- 41 talks, all by international guests

Conference: PDE-Based Image Processing and Related Inverse Problems
- August 8-12.
- Organized by Xue-Cheng Tai, Chair (University of Bergen and CMA), Helge Galdal (CMA), Knut-Andreas Lie (SINTEF/Simula), Arvid Lundervold (University of Bergen), Marius Lysaker (Simula), Hans Munthe-Kaas (University of Bergen), Ragnar Winther (CMA), Sigurd Aanonsen (CIPR)
- 94 participants, 56 international, 28 national, and 10 CMA members
- 38 talks, 35 by international guests, and 3 by national guests

Workshop: Computational Methods for Algebraic Spline Surfaces II (COMPASS II)
- September 14-16.
- Organized by Tor Dokken (Sintef/CMA) and Bert Bert Jüttler (Johannnes Kepler University, Linz)
- 35 participants, 24 international, 1 national, and 10 CMA members
- 23 talks, 18 by international guests, 2 by national guests, and 3 by CMA members

Workshop: Compatible Discretizations for Partial Differential Equations,
- September 26-28.
- Organized by Snorre Christiansen, Runhild Aae Klausen, Per Christian Moan, and Ragnar Winther, CMA
- 37 participants, 18 international, 10 national guests, and 9 CMA members
- 16 talks, 12 by international guests, 3 by national guests, and 1 by CMA members

The 12th Workshop on Mathematics and Economics: Mathematical Finance and Insurance
- September 30.
- Organized by Fred Espen Benth, Giulia Di nunno, Tom Lindstrøm, and Bernt Øksendal, CMA
- 30 participants, 1 international, 16 national, and 13 CMA members
- 7 talks, 2 by international guests, 4 by national guests, and 1 by CMA members

Workshop: Computers, Computations, and Science Education
- September 30.
- Organized by Torgeir Engeland, Njål Foldnes, John Grue, Morten Hjorth-Jensen, Hans Petter Langtangen, Knut Mørken, and Arnt Inge Vistnes
- 28 participants, 2 international, 20 national, and 6 CMA members
- 7 talks, 2 by international guests, 4 by national guests, and 1 by CMA members

Workshop: High-Performance Computing in Physics
- November 4 .
- Organized by Morten Hjorth-Jensen (CMA) and Jostein Sundet (USIT)
- 40 participants, 35 national guests and 5 CMA members
- 7 talks, 5 by national guests, and 2 by CMA members

Internal workshop at Holmen fjordhotell
- November 24-25
- Organized by Helge Galdal and Ragnar Winther
- 55 participants, all CMA members
- 9 talks, al by CMA members

5b. Seminar and Lecture Series at CMA

CMA seminar series 2005
- The series ran both spring and fall semester
- 9 seminars, 2 by international guests, 3 by national guests, and 4 by CMA members

The CMA Guest Lectures 2005
- The series ran both spring and fall semester
- 20 lectures, 19 by international guests, and 1 by national guests

Special Lectures 2005
- The series ran both spring and fall semester
- 5 lectures, 2 by national guests and 3 by CMA members

Lecture Series on Stochastic Calculus for Jump Diffusions and Applications
- Spring semester
- 40 lectures, all by CMA's Professor Bernt Øksendal

Lecture Series on Dirichlet Forms and Symmetric Markov Processes,
- Fall semester
- 40 lectures, all by CMA's Adjunct professor Tusheng Zhang

Seminar series: Nonlinear PDE for Bose-Einstein condensed gases,
- Fall semester
- 9 seminars, 1by national guest, and 8 by CMA members

PDE seminar
- Fall semester
- 9 seminars, 1by national guest, and 8 by CMA members

5c. International workshops and conferences, (co-)organized by CMA

Solar B EIS Science Meeting,
- Institute of theoretical Astrophysics, University of Oslo, Norway, January 5-6, 2005.
- Viggo Hansteen chair of local organizing committee.

24th Nordic and 1st Franco-Nordic Congress of Mathematicians,
- Reykjavik, Iceland, January 6-9, 2005.
- Ragni Piene on the Scientific Committee. Kenneth Karlsen and Snorre Christiansen organizers of a session on "Nonlinear PDEs".

Fifth Winter School in Computational Mathematics
- Geilo, Norway, February 20-25, 2005.
- Helge Holden and Kenneth Karlsen members of the organizing committee.

ECMI SIG Industry Challenges in Geometric Modeling and CAD 2005,
- Darmstadt, Germany, March 10-11, 2005.
- CMA is co-sponsor. Ewald Quak is co-organizer.

Towards Semantic Virtual Environments,
- University of Geneva, Switzerland Villars, Switzerland, March 16-18, 2005,
- Ewald Quak member of the Program Committee.

Computer Graphics and Geometric Modeling, CGGM'2005,
- Emory University, Atlanta, USA, May 22-25, 2005.
- Tor Dokken member of the organizing committee.

2005 IEEE Shape Modeling International
- MIT, USA, June 13-17, 2005.
- Michael Floater and Ewald Quak members of the program committee.

Symposium on geometry processing 2005
- Vienna, Austria, Jul 4-6, 2005.
- Michael Floater member of the scientific committee.

NSO workshop 23: Solar MHD: Theory and Observations - a High Spatial Resolution Perspective,
- Sunspot, New Mexico, USA, Jul 18-22, 2005.
- Mats Carlsson on the scientific organizing committee.

Finite Element Methods: Reliable Computation, Error Control and Mesh Adaptivity,
- University of Jyväskylä, Finland, August 25-27, 2005.
- Xue-Cheng Tai on the organizing committee.

Institut Mittag-Leffler, Fall Program 2005: Wave Motion,
- Institut Mittag-Leffler, Stockholm, Sweden, September 1 - December 31, 2005.
- Kenneth Karlsen and Helge Holden on the organizing committee.

The 5th UK Conference for Boundary Integral Methods (UK BIM 5),
- University of Liverpool, UK, September 12-13, 2005.
- Xue-Cheng Tai on the organizing committee.

11th European Solar Physics Meeting: The Dynamic Sun, Challenges for Theory and Observations,
- Leuven, Belgium, September 12-16, 2005.
- Mats Carlsson on the scientific organizing committee.

SIAM conference for Geometric Design and Computing,
- Phoenix, Arizona, USA, October 30 - November 3, 2005.
- Tom Lyche and Tor Dokken on the organizing committee.

6th Solar-B Science Meeting,
- Kyoto, Japan, November 8-11, 2005.
- Mats Carlsson on the scientific organizing committee.

Conference Communicating European Research (CER) 2005,
- Brussels, Belgium, November 14-15, 2005,
- Organized by the European Commission. Ewald Quak co-organizer of the AIM@SHAPE project stand

Astrobiology: Life in extreme conditions
- NORDITA workshop, Institute of theoretical astrophysics, University of Oslo, Norway, November 21-22, 2005,
- Håkon Dahle member of local organizing committee.

SAMSA 2005
- Blantyre, Malawi, November 26 - December 4, 2005,
- CMA co-sponsor and Bernt Øksendal on the organizing committee.

Workshop: GPU as a computational Resource,
- SINTEF, December 12, 2005.
- CMA co-sponsor, Tor Dokken organizer.

APPENDIX 6
INTERNATIONAL GUESTS OF CMA 2005

Longer research visits (> 1 month)

- Nov 21 - Feb 20 (06): Professor **Tarmo Soomere**, CENS, Estonia
- Oct 3 - Nov 30: Professor **Pawel Bielewicz**, University of Warzaw, Poland
- Jul 28 - Aug 31: PhD-student **Alessandra Cretarola**, University of Bologna, Italy
- Jul 28 - Aug 31: PhD-student **Serena Fuschini**, University of Bologna, Italy
- Jul 28 - Aug 31: Associate Professor **Francesca Biagini**, University of Bologna, Italy
- Jul 21 - Aug 31: University Lecturer **Diane Wilcox**, University of Cape Town, South Africa
- Jul 1 - Oct 15: Postdoc fellow **Oleg Yablonski**, Minsk, Belarussia
- Apr 24 - Jul 1: Dr. **Bart De Pontieu**, Lockheed Martin Solar and Astrophysics Laboratory, USA
- Apr 1 - Jun 1: PhD-student **Jorge Delgado**, University of Zaragoza, Spain
- Feb 1 - Aug 31: Professor **Sebastian Noelle**, RWTH Aachen, Germany
- Jan 10 - Feb 28: Professor **Yaozhong Hu**, University of Kansas, USA
- Jan 1 - Oct 31: Associate Professor **Giuseppe Maria Coclite**, University of Bari, Italy
- Sep 1 (04) - Jan 31: Ass Prof **Qiya Hu**, The Chinese Academy of Science, Beijing, P. R. China
- Aug 1 (04) - Feb 15: Associate Professor **Francesca Biagini**, University of Bologna, Italy

Short term guests (<1 month)

- Dec 15-22: Dr. **Daniel Muller**, NASA Goddard Space Flight Center, USA
- Dec 7-9: Professor **Helmut Pottmann**, Technical University of Vienna, Austria
- Nov 16-20: Professor **Jurgen Potthoff**, University of Mannheim, Germany
- Oct 29 - Nov 3: Professor **José Miguel Urbano**, Universidade de Coimbra, Portugal
- Oct 15: Professor **Oleg Viro**, University of Uppsala, Sweden
- Oct 1-8: **Thomas E. Holzer**, National Center for Atmospheric Research, Boulder, CO, USA
- Sep 26-30: Professor **Clas Johnsson**, Chalmers University of Technology, Sweden
- Sep 29-30: Professor **Franz Vesely**, University of Vienna, Austria
- Sep 30: Professor **Andrew Cairns**, Heriot-Watt University, Edinburgh, Scotland
- Sep 27-30: Professor **Jan Kallsen**, Tech. University of Munich, Germany
- Sep 26-28 (CMA Workshop on Compatible Discretization for Partial Differential Equations): **Douglas N. Arnold**, University of Minnesota, USA, **Pavel Bochev**, Sandia National Laboratories, USA, **Daniele Boffi**, University of Pavia, Italy, **Franco Brezzi**, University of Pavia, Italy, **Fernando Casas**, Universitat Jaume I, Spain, **Jan S. Hesthaven**, Brown University, USA, **Ruben Juanes**, Stanford University, USA, **Christian Lubich**, University of Tubingen, Germany, **Elizabeth Mansfield**, University of Kent, UK, **Donatella Marini**, University of Pavia, Italy, **Jean-Claude Nédélec**, Ecole Polytechnique, Paris, France, **Sebastian Reich**, Potsdam University, Germany, **Janis Rimshans**, University of Latvia, **Joachim Schöberl**, RICAM Linz, Austria, **Jean-Marie Thomas**, University of Paris, France
- Sep 25-29: Professor **Richard Falk**, Rutgers University, New York, USA
- Sep 25-29: Associate Professor **Ivan Yotov**, University of Pittsburgh, USA
- Sep 14-30: PhD-student **Oliver Labs**, University of Mainz, Germany
- Sep 14-16 (Workshop on Computational Methods for Algebraic Spline Surfaces II (Compass II)): **Fernando Carreras Oliver**, Universidad de Cantabria, Spain, **Andre Galligo**, l'Université de Nice Sophia Antipolis, France, **Anna Katrami-Bezirtzoglou**, European Commision (IST-FET), Belgium, **Bert Jüttler**, Johannes Kepler Universität, Austria, **Claudiu Tanasescu**, Universidad de Cantabria, Spain, **Emmanuel Briand**, Universidad de Cantabria, Spain, **Falai Chen**, University of Science and Technology of China Hefei, China, **Ibolya Szilagyi**, Research Institute for Symbolic Computation, Linz, Austria, **Ioannis Ivrissimtzis**, Max Planck Institut Informatik, Germany, **Isella Vicini**, think3, France, **Jens Gravesen**, Technical University of Denmark, **Jing-Cheng Mei**, think3, France, **Josef Schicho**, Research Institute for Symbolic Computation, Linz , Austria, **Laureano Gonzalez-Vega**, Universidad de Cantabria, Spain, **Malcolm Sabin**, Numerical Geometry Ltd, UK, **Marc Pouget**, INRIA, France, **Martin Aigner**, Johannes Kepler Universität, Austria, **Mohamed Shalaby**, Johannes Kepler Universität, Austria, **Mourrain B.**, INRIA, France, **Oliver Labs**, Johannes Gutenberg-Universität, Germany, **Rimvydas Krasauskas**, Vilnius University , Lithuania, **Stefan Schirra**, University of Magdeburg, Germany, **Stephane Chau**, l'Université de Nice Sophia Antipolis, France, **Thi Ha Le**, l'Université de Nice Sophia Antipolis, France
- Sep 12-16: Professor **Alexander Melnikov**, University of Alberta, Edmonton, Canada
- Aug 28 - Sep 10 and Dec 5-10: **Peter Tankov**, INRIA Rocquencourt, France
- Aug 22 - 27: Professor **Thorsten Rheinlander**, London School of Economics, England
- Aug 14 - 27: Professor **Boon Chye Low**, High Altitude Observatory, NCAR, Boulder Colorado USA
- Aug 5-20: **Eirik Endeve**, Oak Ridge National Laboratory, TS, USA
- Aug 8-12 (Int. conference on PDE-based Imageporcessing and related Inverse problems): **Darius Borkowski**, Nicolaus Copernicus University, Torun, Poland, **Bernhard Burgeth**, Saarland University, Germany, **Daniela Casaburi**, University of Naples, Federico II, Italy, **Raymond Chan**, Chinese University of Hong Kong, China, **Tony F. Chan,** University of California at Los Angeles, **Qianshun Chang**, Chinese Academy of Sciences, China, **Ke Chen**, University of Liverpool, UK, **Erika Cotognini**, Università "La Sapienza", Rome, Italy, **Oliver Dorn**, Universidad Carlos III de Madrid, Spain, **Paul Dufort**, Advanced Biologic Corp. USA, **Abul K. M. Fahimuddin**, TU Braunschweig, Germany, **Klaus Frick**, University of Innsbruck, Austria, **Stefan Henn**, Heinrich-Heine University Duesseldorf, Germany, **Chih-Yu Hsu**, Department of Medical Imaging Technology of CSMU, Taiwan, **Chen Hui**, Fuzhou Changxia Electronic Science & Technology Co., Ltd., Jan Hubený, Masaryk University, Czech Republic, **Vincent Israel-Jost**, IRMA, France, **Sven Kabus**, University of Luebeck, Germany, **Sung Ha Kang**, University of Kentucky, USA, **Fotini Karakatsani**, University Of Crete, **Chul-Sung Kim**, Exxon Mobil Upstream Research Company, USA, **Stacey Levine**, Duquesne University, Pittsburgh, USA, **Jacques Levy-Vehel**, INRIA, France, **Kirsi Majava**, University of Jyvaskyla, Finland, **Livia Marcellino**, University of Naples "Federico II" – Italy, **Leyden Martinez-Fonte**, Ghent University, Belgium, **Pavel Matula**, Masaryk University, Czech Republic, **Tahan Meir**, Technion, Haifa, Israel, **Stanley Osher**, University of California at Los Angeles, USA, **Niels Chr. Overgaard**, Malmö University, Sweden, **Nataliya Portman**, University of Waterloo, USA, **Tobias Preusser**, CeVis - University of Bremen, Germany, **Mihaela Pricop**, University of Goettingen, Germany, **Adam Rabcewicz,** Nicolaus Copernicus University, Torun, Poland, **Wolfgang Ring**, University of Graz, Austria, **Guo Ruiyun**, Fuzhou Changxia Electronic Science & Technology Co., Ltd. China, **Martin Rumpf**, Rheinische Friedrich-Wilhelms-Universität Bonn, Germany, **Joseph Savage**, University of Liverpool, UK, **Otmar Scherzer**, University of Innsbruck, Austria, **Svetlana Serdyukova**, Joint Institute for Nuclear Research, Dubna, Russia, **Jan Erik Solem**, Malmø University, Sweden, **Sudershan**, Centre for Machine Perception, Prague, Czech Republic, **Richard Tsai**, Princeton University, USA, **Tuomas Turpeinen**, University of Jyväskylä, Finland, **Emmanouil Vairaktaris**, University of Crete, **Martin Viscor**, Masaryk University, Czech Republic, **Joachim Weickert**, Saarland University, Germany, **Imran Zafar**, Carnegie Mellon University, Athens Campus, Greece, **Paul M. de Zeeuw**, CWI - PNA4, Amsterdam, Holland, **Hao-Min Zhou**, Georgia Institute of Technology, USA
- Jul 29 - Aug 4 (The 2005 Abel Symposium): **Luigi Accardi**, Universita' di Roma "Tor Vergata", Italy, **Sergio Albeverio**, University of Bonn, Germany, **Ernest Ampadu**, University of Cape Coast, Ghana, **Ole Barndorff-Nielsen**, University of Aarhus, Denmark, Italy, **Jose Manuel Corcuera**, University of Barcelona, Spain, **Giuseppe Da Prato**, Scuola Normale Superiore di Pisa, Italy, **Daniel Dreher**, University of Hamburg, Germany, **Eugene Dynkin**, Cornell University, USA, **David Elworthy**, University of Warwick, UK, **Hans-Juergen Engelbert**, Friedrich-Schiller-Universitaet Jena, Germany, **Marco Ferrante**, University of Padova, Italy, **Hans Föllmer**, Humboldt University, Germany, **Masatushi Fukushima**, Kansai University, Japan, **Astrid Hilbert**, Växjö Universitet, Sweden, **Ioannis Karatzas**, Columbia University, USA, **Hiroshi Kawabi**, Osaka University, Japan and University of Bonn, Germany, **Tahani Khadim**, University of Manchester, UK, **Claudia Klüppelberg**, Technical University of Munich, Germany, **Torbjørn Kolsrud**, KTH Stockholm, Sweden, **Seongsoo Lee**, School of Electronics Engineering, Soongsil University, **Song Liang**, Tohoku University, Japan and Bonn University, Germany, **Carl Lindberg**, Chalmers University, Sweden, **Arne Løkka**, King's College, London, England, **Paul Malliavin**, University of Paris VI, France, **Henry P. McKean**, Courant Institute of Mathematical Science, New York, USA, **Laura M. Morato**, University of Verona, Italy, **Kaj Nyström**, Umeå University, Sweden, **Shige Peng**, Shandong University, China,

Roger Pettersson, Växsjö Universitet, Sweden, Yuri Rozanov, CNR-IMATI, Milano, Italy, Barbara Rüdiger, Universitaet Koblenz-Landau, Germany, Paavo Salminen, Åbo Akademy University, Finland, Ricardo Castro Santis, University of Rome I, La Sapienza, Italy, Marta Sanz-Sole, Univeristy of Barcelona, Spain, Juergen Schmiegel, Aarhus University, Denmark, Martin Schweizer, ETH Zürich, Switzerland, Josep L. Sole, Universitat Autonoma de Barcelona, Spain, Anna Soos, Babes-Bolyai University, Romania, Michael Sørensen, Univeristy of Copenhagen, Denmark, Kazuyuki Takahashi, Meiji University, Japan, Peter Tankov, INRIA Rocquencourt, France, Frederic Utzet, Universitat Autonoma de Barcelona, Spain, Esko Valkeila, Helsinki University of Techno-logy, Finland, S. R. Srinivasa Varadhan, Courant Institute of Mathematical Science, New York, USA, Qinghua Wang, University of Manchester, UK, Shinzo Watanabe, Ritsumeikan University, Japan, Minoru W. Yoshida, The Univ. Electro. Communications, Tokyo, Japan, Xun-Yu Zhou, Chinese University of Hong Kong, China

- Jul 24 - Aug 5: Professor **Takeyuki Hida**, Meijo University, Nagoya, Japan
- Jul 11-15: Professor **Raimund Bürger**, Universität Stuttgart, Germany
- Jul 6-24: **David Donovan**, University of Hawaii at Manoa, USA
- Jun 26 - Jul 2: **Mario Duran Toro**, Pontificia Universidad Catolica de Chile
- Jun 11-25: PhD student **Damian Fabbian**, Mount Stromlo and Siding Spring Observatories, Australia
- Jun 11-16: Professor **Raquel Mallavibarrena**, Universidad Complutense de Madrid, Spain
- Jun 10-16: Professor **Jerome A. Goldstein**, University of Memphis, USA
- Jun 10-16: Professor **Gisele Goldstein**, University of Memphis, USA
- Jun 7-11 (Conference celebrating Bernt Øksendal's 60th anniversary): **Francesca Biagini**, University of Bologna, Italy, **Sandy Davie**, University of Edinburgh, Scotland, **Yuri Kondratiev**, University of Bielefeld, Germany, **Edward Lungu**, University of Botswana, Gaborone, Botswana, **Habib Ouerdiane**, University of Tunis El Manar Tunisia, **Jurgen Potthoff**, University of Mannheim, Germany, **Nicolas Privault**, Université de La Rochelle, France, **Marta Sanz-Solé**, University of Barcelona, Spain, **Ludwig Streit**, University of Bielefeld, Germany and University of Madeira, Portugal, **Agnes Sulem**, INRIA, France, **Ali Suleyman Ustunel**, Ecole Nat. Sup. Telecomm. Paris, France
- Jun 6-18: **John D. Towers**, MiraCosta College, San Diego, USA
- May 23-26: Professor **Jüri Engelbrecht**, CENS, Estonia
- May 23-26: Professor **Tarmo Soomere**, CENS, Estonia
- May 23-26: Professor **Jaan Kalda**, CENS, Estonia
- May 23-26: Professor **Arvi Ravasoo**, CENS, Estonia
- May 12-15: **Ofer Lahav**, University College London, UK
- May 11-15: Research Director **Annalisa Buffa**, IMATI-CNR Pavia, Italy
- May 10-21, and Jun 6-22: Professor **Robert Stein**, Michigan State University, USA
- May 5-12: Dr. **Scott McIntosh**, South-West Research Incorporated, Boulder, USA
- Apr 10-16: **Constantinos Skordis**, University of Oxford, UK
- Mar 7-11: Senior Scientist **Tom Bogdan**, High Altitude Observatory, NCAR, USA
- Mar 7-11: Professor **Klaus Neymeyr**, University of Rostock, Germany
- Mar 5-19 and May 10-25: PhD-student **Christina Steiner**, RWTH Aachen, Germany
- Mar 5-19 and May 10-25: PhD-student **Norman Pankratz**, RWTH Aachen, Germany
- Mar 2-6: Assistant Professor **Camillo De Lellis**, University of Zuerich, Switzerland
- Mar 2-6: Professor **Gui-Qiang Chen**, Northwestern University, USA
- Mar 2-6: Professor **Eduard Feireisl**, Academy of Sciences of the Czech Republic
- Mar 2-6: Professor **Philippe LeFloch**, Laboratoire Jacques-Louis Lions, France
- Mar 2-6: Professor **Michael Sever**, Hebrew University of Jerusalem, Israel
- Mar 2-6: Professor **Anders Szepessy**, Royal Institute of Technology, Stockholm, Sweden
- Mar 2-6: Professor **Mark Williams**, University of North Carolina at Chapel Hill, USA
- Mar 2-6: Professor **Kristian Jenssen**, North Carolina State University, USA
- Feb 21: Assistant Professor **Martin Burger**, Institut für Industriemathematik, Johannes Kepler Universität, Germany
- Feb 18-25: **Jitse Niesen**, Herriot Watt University, Edinburgh, Scotland
- Jan 30 - Feb 18: Professor **Jean-Louis Merrien**, INSA, Rennes, France
- Jan 18 - 28: Professor **Robert J. Rutten**, Sterrekundig Instituut, Utrecht, Netherlands
- Jan 5: Postdoc **Nahidh. H. Sharif**, Chalmers University of Technology, Sweden

APPENDIX 7
PUBLICATIONS 2005

7a. Scientific articles in refereed journals, published 2005:

1. **Bendahmane, Mostafa; Karlsen, Kenneth Hvistendahl.** *Nonlinear anisotropic elliptic and parabolic equations in R-N with advection and lower order terms and locally integrable data.* Potential Analysis 2005;22

2. **Bendahmane, Mostafa; Karlsen, Kenneth Hvistendahl**. *Uniqueness of entropy solutions for doubly nonlinear anisotropic degenerate parabolic equations.* Contemporary Mathematics 2005;371:1-27

3. **Benth, Fred Espen; Hvistendahl Karlsen, Kenneth.** *A note on Merton's portfolio selection problem for the Schwartz mean-reversion model.* Stochastic Analysis and Applications 2005;23(4):687-704

4. **Benth, Fred Espen; Hvistendahl Karlsen, Kenneth.** *A PDE representation of the density of the minimal entropy martingale measure in stochastic volatility markets.* Stochastics and Stochastics Reports 2005;77(2):109-137

5. **Benth, Fred Espen; Meyer-Brandis, Thilo.** *The density process of the minimal entropy martingale measure in a stochastic volatility model with jumps.* Finance and Stochastics 2005;9(4):563-575

6. **Benth, Fred Espen; Saltyte-Benth, Jurate.** *Stochastic modelling of temperature variations with a view towards weather derivatives.* Applied Mathematical Finance 2005;12(1):53-85

7. **Børve, Steinar;** Omang, Marianne Gjestvold; Trulsen, Jan. *Regularized smoothed particle hydrodynamics with improved multi-resolution handling.* Journal of Computational Physics 2005;208:345-367

8. Pecseli, Hans; **Børve, Steinar;** Trulsen, Jan; Longo, Savino. *Kinetic instabilities associated with injection of a plasma beam into a neutral background.* Proceedings of XXVIIth ICPIG; 2005

9. Omang, M., **Børve, Steinar.,** and Trulsen, J. *Alternative kernel functions for SPH in cylindrical symmetry Shock Waves.* 2005;14(4):293-298

10. Allred, JC; Hawley, SL; Abbett, WP; **Carlsson, Mats.** *Radiative hydrodynamic models of the optical and ultraviolet emission from solar flares.* Astrophysical Journal 2005;630:573-586

11. Fossum, Astrid; **Carlsson, Mats.** *High-frequency acoustic waves are not sufficient to heat the solar chromosphere.* Nature 2005;435(7044):919-921

12. Fossum, Astrid; **Carlsson, Mats.** *Response Functions of the Ultraviolet Filters of TRACE and the Detectability of High-Frequency Acoustic Waves.* Astrophysical Journal 2005;625(1):556-562

13. Buffa, Annalisa; **Christiansen, Snorre Harald.** *A dual finite element complex on the barycentric refinement.* Comptes Rendus Mathematique 2005;340

14. **Christiansen, Snorre Harald.** *A div-curl lemma for edge elements.* SIAM Journal on Numerical Analysis 2005;43:116-126

15. **Coclite, Giuseppe Maria; Holden, Helge; Karlsen, Kenneth Hvistendahl.** *Wellposedness for a parabolic-elliptic system.* Discrete and Continuous Dynamical Systems 2005;13(3):659-682

16. **Coclite, Giuseppe Maria; Risebro, Nils Henrik.** *Conservation laws with time dependent discontinuous coefficients.* SIAM Journal on Mathematical Analysis 2005;36(4):1293-1309

17. Ancona, Fabio; **Coclite, Giuseppe Maria.** *On the attainable set for Temple class systems with boundary controls.* SIAM J. Control Optim. 2005;43(6):2166-2190

18. **Coclite, Giuseppe Maria;** Garavello, M.; Piccoli, B. *Traffic flow on a road network.* SIAM J. Math. Anal. 2005;36(6):1862-1886

19. **Coclite, Giuseppe Maria;** Coclite, Mario Michele. *Positive solutions for an integro-differential equation with singular nonlinear term.* Differential Integral Equations 2005;18(9):1055-1080.

20. Ancona, Fabio; **Coclite, Giuseppe Maria;** *On the boundary controllability of first order hyperbolic systems, Nonlinear* Anal. 2005;63 (5-7):1955-1966.

21. **Dahl, Geir.** *A method for approximating symmetrically reciprocal matrices by transitive matrices.* Linear Algebra and its Applications 2005;403:207-215

22. **Dahl, Geir;** Brualdi, R.A. *Matrices of zeros and ones with given line sums and a zero block.* Electronic Notes in Discrete Mathematics 2005;20:83-97

23. **Dahl, Geir; Flatberg, Truls.** *A remark concerning graphical sequences.* Discrete Mathematics 2005; 304 (1-3):62-64

24. **Dahl, Geir; Flatberg, Truls.** *Optimization and Reconstruction of hv-convex (0,1)-matrices.* Discrete Applied Mathematics 2005;151:93-105

25. Mortsell, Edvard; **Dahle, Håkon;** Hannestad, Steen. *Probing Galaxy Density Profiles with Future Supernova Surveys.* Astrophysical Journal 2005;619:733-740

26. **Dahle, Håkon** et al. *The Radio Afterglow and Host Galaxy of the Dark GRB 020819.* Astrophysical Journal 2005;629:45-51

27. **Dean, David J.; Hjorth-Jensen, Morten**; et al. *Coupled Cluster Theory for Nuclei Proceedings* of International Workshop on Condensed Matter Theories CMT28, Sep27-Oct2, 2004, Nova Science Publisher; 2005

28. Barrett, BR; **Dean, David J.; Hjorth-Jensen, Morten;** Vary, JP. *Nuclear forces and the quantum many-body problem - Preface.* Journal of Physics G. Nuclear and Particle Physics 2005;31

29. **Dean, David J.; Hagen, Gaute; Hjorth-Jensen, Morten;** et al. *Nuclear structure calculations with coupled cluster methods from quantum chemistry.* Nuclear Physics A 2005;752:299-308

30. **Dean, David J.; Hjorth-Jensen, Morten.** *Ab-initio coupled-cluster study of O-16.* Physical Review Letters 2005;94(21)

31. **Dean, David J.; Hjorth-Jensen, Morten**; et al. *Ab Initio Coupled-Cluster calculations for Nuclei using Methods of Quantum Chemistry.* European Physical Journal A 2005

32. **Dean, David J.; Hjorth-Jensen, Morten**; et al. *Coupled-cluster calculations for ground and excited states of closed- and open-shell nuclei using methods of quantum chemistry.* Journal of Physics G. Nuclear and Particle Physics 2005;31:S1291-S1299

33. **Di Nunno, Giulia;** Albeverio, Sergio; Rozanov, Yuri A. *Price Operators Analysis in Lp-Spaces.* Acta applicandae mathematicae 2005

34. **Di Nunno, Giulia; Meyer-Brandis, Thilo; Øksendal, Bernt; Proske, Norbert Frank.** *Malliavin calculus and anticipative Ito formulae for Levy processes.* Infinite Dimensional Analysis Quantum Probability and Related Topics 2005;8:235-258

35. **Endeve, Eirik;** Lie-Svendsen, Øystein; **Hansteen, Viggo; Leer, Egil.** *Release of Helium from Closed-Field Regions of the Sun.* Astrophysical Journal 2005;624:402-413

36. **Engeland, Torgeir; Hjorth-Jensen, Morten**; et al. *108Sn studied with intermediate-energy Coulomb excitation.* Physical Review C, Nuclear Physics 2005;72(6)

37. Ellis, Paul; **Engeland, Torgeir; Hjorth-Jensen, Morten; Kartamyshev, Maximx; Osnes, Eivind.** *Model calculation of effective three-body forces.* Physical Review C, Nuclear Physics 2005;71:034301

38. Bielewicz, P.; **Eriksen, Hans Kristian Kamfjord;** Banday, Anthony J.; Górski, Krzysztof M.; **Lilje, Per Barth.** *Multipole Vector Anamolies in the First-Year WMAP Data: A Cut-Sky Analysis.* Astrophysical Journal 2005;635:750-760

39. **Eriksen, Hans Kristian Kamfjord;** Banday, Anthony J.; Górski, Krzysztof M.; **Lilje, Per Barth.** *The N-Point Correlation Functions of the First-Year Wilkinson Microwave Anisotropy Probe Sky Maps.* Astrophysical Journal 2005;622:58-71

40. **Eriksen, Hans Kristian Kamfjord** et al. *Cosmological parameter constraints as derived from the Wilkinson Microwave Anisotropy Probe data via Gibbs sampling and the Blackwell-Rao estimator.* Physical Review D, Particles and fields 2005;71

41. Jaffe, T. R.; Banday, Anthony J.; **Eriksen, Hans Kristian Kamfjord;** Górski, Krzysztof M.; **Hansen, Frode Kristian.** *Evidence of Vorticity and Shear at Large Angular Scales in the WMAP Data: A Violation of Cosmological Isotropy?* Astrophysical Journal 2005;629:L1-L4

42. **Floater, Michael S.** *Arc length estimation and the convergence of polynomial curve interpolation.* BIT (Lisse) 2005;45(4):679-694

43. **Floater, Michael S.** *On the convergence of derivatives of Bernstein approximation.* Journal of Approximation Theory 2005;134:130-135

44. **Floater, Michael S.;** Kos, Geza; **Reimers, Martin.** *Mean value coordinates in 3D.* Computer Aided Geometric Design 2005;22(7):623-631

45. **Gudiksen, Boris;** Nordlund, Å. *An Ab Initio Approach to the Solar Coronal Heating Problem.* Astrophysical Journal 2005;618:1020-1030

46. **Gudiksen, Boris;** Nordlund, Å. An Ab Initio Approach to Solar Coronal Loops. Astrophysical Journal 2005;618:1031-1038

47. **Hansen, Frode Kristian** et al. *Primordial non-Gaussianity: local curvature method and statistical significance of constraints on f_{NL} from WMAP data.* Monthly notices of the Royal Astronomical Society 2005;358:684-692

48. Dolag, K.; **Hansen, Frode Kristian;** Roncarelli, M.; Moscardini, L. *The imprints of local superclusters on the Sunyaev Zeldovich signals and their detectability with Planck.* Monthly notices of the Royal Astronomical Society 2005;363:29-39

49. **Hansen, Frode Kristian** et al. *HEALPix: A Framework for High-Resolution Discretization and Fast Analysis of Data Distributed on the Sphere.* Astrophysical Journal 2005;622:759-771

50. **Hansen, Frode Kristian;** Branchini, E.; Mazzotta, P.; Cabella, P.; Dolag, K. *A full-sky prediction of the Sunyaev-Zeldovich effect from diffuse hot gas in the local universe and the upper limit from the WMAP data.* Monthly notices of the Royal Astronomical Society 2005;361:753-762

51. **Hagen, G; Hjorth-Jensen, Morten;** Vaagen, JS. *State-dependent interactions for the Gamow shell model.* Journal of Physics G. Nuclear and Particle Physics 2005;31:S1337-S1348

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7c. Book chapters, in books published 2005:

1. **Dyken, Erik Christopher; Reimers, Martin.** *Real-time Linear Silhouette Enhancement,* in «Mathematical Methods for Curves and Surfaces: Tromsø 2004». Brentwood: Nashboro Press 2005. ISBN 0-9728482-4-X. s. 135-143

2. Dyn, Nira; **Floater, Michael S.;** Hormann, Kai. *A C2 four-point subdivision scheme with fourth-order accuracy and its extensions,* in «Mathematical Methods for Curves and Surfaces: Tromsø 2004» . Brentwood: Nashboro Press 2005. ISBN 0-9728482-4-X. s. 145-156

3. **Hjelmervik, Jon M.;** Hagen, Trond R. *GPU-Based Screen Space Tessellation,* in «Mathematical Methods for Curves and Surfaces: Tromsø 2004». Brentwood: Nashboro Press 2005. ISBN 0-9728482-4-X. s. 213-221

4. **Holden, Helge**. *On the Camassa-Holm and Hunter-Saxton equations,* in «European Congress of Mathematics Stockholm, June 27 - Jul 2, 2004» Zurich: European Mathematical Society 2005. ISBN 3-03719-009-4. s. 173-200

5. Burger, R; **Karlsen, Kenneth Hvistendahl; Mishra, Siddhartha;** Towers, J. D. *On conservation laws with discontinuous flux,* in «Trends in Applications of Mathematics to Mechanics» . Shaker Verlag 2005. ISBN 3-8322-3600-7. s. 75-84

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7d. Scientific reports, contributions, proceedings etc. (not refereed), published 2005:

1. Langangen, Øystein; **Carlsson, Mats; Rouppe, Van Der Voort Luc.** *The diagnostic potential of the 4571 Å Mg I line.* E S A - S P: Proceedings of the Conference Solar Wind 11 - SOHO 16 2005

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3. Vistnes, Arnt Inge; **Hjorth-Jensen, Morten.** *Numerical Methods as an Integrated Part of Physics Education.* Los Alamos National Laboratory, USA: arXiv.org, physics/0505116 2005. 7 s.

4. **Janse, Åse Marit;** Lie-Svendsen, Øystein; **Leer, Egil.** *Modeling helium in the solar wind with new gyrotropic transport equations.* E S A - S P: Proceedings of the Conference Solar Wind 11 - SOHO 16 2005:487-490

5. **Killie, Mari Anne;** Lie-Svendsen, Øystein; **Leer, Egil.** *Modeling Helium in Closed Coronal Structures.* Proceedings of the Conference Solar Wind 11 - SOHO 16 2005:147-152

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7e. The CMA collected preprint series 2005:

1. **M. Bendahmane, K. H. Karlsen:** *Renormalized solutions of an anisotropic reaction-diffusion-advection system with L1 data modeling the propagation of an epidemic disease,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 21/2005.

2. **M. Bendahmane, K. H. Karlsen:** *Analysis of a Class of Degenerate Reaction-Diffusion Systems and the Bidomain Model of cardiac Tissue,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 29/2005.

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7. **F. E. Benth,** J. Kallsen, **T. Meyer-Brandis:** *A non-Gaussian Ornstein-Uhlenbeck process for electricity spot price modeling and derivatives pricing,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 15/2005.

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9. **F. E. Benth, J. Saltyte-Benth:** *Analytical approximation for the price dynamics of spark spread options,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 17/2005.

10. **F. E. Benth,** S. Koekebakker: *Stochastic modeling of financial electricity contracts,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 24/2005.

11. **F. E. Benth, M. Groth:** *The minimal entropy martingale measure and numerical option pricing for the Barndorff-Nielsen-Shephard stochastic volatility model,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 26/2005.

12. **F. E. Benth, F. Proske:** *Arbitrage-free pricing dynamics of interest-rate guarantees based on the utility indifference method,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 34/2005.

13. A. Buffa, **S. Christiansen.** *A dual finite element complex on the barycentric refinement.* Pavia: IMATI-CNR 2005.

14. **S. Christiansen,** *A construction of spaces of differential forms on cellular complexes.* Djursholm: Institut Mittag-Leffler 2005.

15. **S. H. Christiansen:** *Stability of Hodge decompositions in finite element spaces of differential forms in arbitrary dimension,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 19/2005.

16. **G. M. Coclite, N. H. Risebro:** *Viscosity solutions of Hamilton-Jacobi equations with discontinuous coefficients,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 2/2005.

17. **G. M. Coclite, K. H. Karlsen:** *A singular limit problem for conservation laws related to the Camassa-Holm shallow water equation.* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 13/2005.

18. **G. M. Coclite, K. H. Karlsen:** *On the well-posedness of the Degasperis-Procesi equation,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 16/2005.

19. **G. M. Coclite, K. H. Karlsen:** *A semigroup of solutions for the Degasperis-Procesi equation.*

20. **G. Di Nunno,** A. Kohatsu-Higa, **T. Meyer-Brandis, B. Øksendal, F. Proske,** A. Sulem: *Optimal Portfolio for a «large» Insider in a Market driven by Lévy Processes,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 30/2005

21. **H. Holden, K. H. Karlsen, N. H. Risebro:** *Convergent difference schemes for the Hunter-Saxton equation,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 20/2005

22. E. R. Jakobsen, **K. H. Karlsen,** C. La Chioma: *Error estimates for approximate solutions to Bellman equations associated with controlled jump-diffusions,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 22/2005

23. R. Bürger, H. Frid, **K. H. Karlsen.** *On the well-posedness of entropy solutions to conservation laws with a zero-flux boundary condition.*

24. R. Bürger, F. Concha, **K. H. Karlsen,** A. Narvaez. *Numerical simulation of clarifier-thickener units treating ideal suspensions with a flux density function having two inflection points.*

25. R. Bürger, **K. H. Karlsen,** J. D. Towers. *A mathematical model of clarifier-thickener units.*

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27. **P. C. Kettler, F. Proske, A. L. Yablonski:** *Market Microstructure and Price Discovery,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 31/2005

28. **P. C. Kettler:** *The Pyramid Distribution,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 39/2005

29. **R. A. Klausen, R. Winther:** *Convergence of multi point flux approximations on quadrilateral grids.* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 3/2005

30. **R. A. Klausen, R. Winther:** *Robust Convergence of Multi Point Flux Approximation on Rough Grids,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 36/2005

31. **T. Lindstrøm:** *Nonlinear stochastic integrals for hyperfinite Lévy processes,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 25/2005

32. **S. Mataramvura, B. Øksendal:** *Risk minimizing portfolios and HJB equations for stochastic differential games,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 40/2005

33. **T. Meyer-Brandis:** *Differential Equations Driven by Lévy White Noise in Spaces of Hilbert Space Valued Stochastic Distributions.* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 9/2005

34. **M. Signahl:** *Variational Solutions of Semilinear Wave Equations Driven by Fractional Brownian Noise,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 38/2005

35. **A. T. K. Ta:** *Combined Optimal Stopping and Stochastic Harvesting,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 18/2005

36. **X-C. Tai, R. Winther:** *A discrete de Rham complex with enhanced smoothness,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 37/2005

37. **X-C. Tai,** O. Christiansen, P. Lin, I. Skjaelaan. *A remark on the MBO scheme and some piecewise constant level set methods.* UCLA Applied Mathematics CAM-report 2005(05-24)

38. O. M. Lysaker, **X-C. Tai.** *Iterative image restoration combining total variation minimization and a second order functional.* UCLA Applied Mathematics CAM-report 2005(05-25)

39. K. Chen, **X-C. Tai.** *A nonlinear multigrid method fro curvature equation related to total variation minimization.* UCLA Applied Mathematics CAM-report 2005(05-26).

40. L. Nielsen, **X-C. Tai,** S. Aanonsen, M. Espedal, *Reservoir description using a binary level set model.* UCLA Applied Mathematics CAM-report 2005(05-50)

41. L. Nielsen, **X-C. Tai,** S. Aanonsen, M. Espedal. *A binary lecvel set model for elliptic inverse problems with discontinuouse coefficient.* UCLA Applied Mathematics CAM-report 2005(05-51)

42. **X-C. Tai,** C. Yao, *Fast piecewise constant level set methods (PCLSM) with Newton updating.* UCLA Applied Mathematics CAM-report 2005(05-52)

43. **X-C. Tai,** H. Li, *A piecewise constant level set methods for elliptic inverse problems.* UCLA Applied Mathematics CAM-report 2005(05-59)

44. D. Krishnan, P. Lin, **X-C. Tai.** *Splitting method for noise removal in images.* UCLA Applied Mathematics CAM-report 2005(05-60)

45. **O. Wallin,** P. Salminen: *Perpetual integral functionals of diffusions and their numerical computations,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 35/2005

46. D. N. Arnold, R. S. Falk, **R. Winther,** *Differential complexes and stability of finite element methods I: The de Rham complex.* IMA preprint 2023 (2005)

47. D. N. Arnold, R. S. Falk, **R. Winther,** *Differential complexes and stability of finite element methods II: The elasticity complex.* IMA preprint 2024 (2005)

48. D. N. Arnold, R. S. Falk, **R. Winther,** *Mixed finite element methods for linear elasticity with weakly imposed symmetry,* IMA preprint 2075 (2005)

49. **A. Yablonski:** *The Malliavin calculus for processes with conditionally independent increments,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 23/2005

50. **B. Øksendal, F. Proske, T. Zhang:** *Backward Stochastic Partial Differential Equations with Jumps and Application to Optimal Control of Random Jump Fields.* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 10/2005

51. **B. Øksendal:** *The value of information in stochastic control and finance.* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 11/2005

52. **B. Øksendal,** A. Sulem: *Optimal stochastic impulse control with delayed reaction,* Dept. of Mathematics, University of Oslo, E-print series, ISSN 0806-2439, no 27/2005

53. **K. Aase:** *On the Consistency of the Lucas Pricing Formula,* Norwegian School of Economics and Business Administration, Discussion Paper, no 9/2005

54. **K. Aase:** *Equilibrium in Marine Mutual Insurance Markets with Convex Operating Costs,* Norwegian School of Economics and Business Administration, Discussion Paper, no 10/2005

55. **K. Aase:** *Using Option Pricing Theory to Infer About Equity Premiums,* Norwegian School of Economics and Business Administration, Discussion Paper, no 11/2005

56. **K. Aase:** *The perpetual American put option for jump-diffusions with applications,* Norwegian School of Economics and Business Administration, Discussion Paper, no 12/2005

7f. CMA texts for public outreach 2005

1. **Dokken, Tor; Lie, Knut-Andreas.** *Grafikkort som regneressurs.* NORSIGD Info 1/2005.

2. **Foldnes, Njål; Mørken, Knut Martin;** Vistnes, Arnt Inge. *En ny verden: Datamaskinen, beregninger og realfagsundervisning.* UNIPED 2005;28(3):36-43

3. **Quak, Ewald** et al. *Unleashing Mathematics - A Driving Force for Industry and Society in Europe* Smith Institute UK (for the EU NETIAM project), 2005.

APPENDIX 8
TALKS OUTSIDE CMA BY CMA MEMBERS IN 2005

### 8a. Invited Scientific talks

1. **Bendahmane, Mostafa.** *Quasilinear Degenerate Parabolic Equations,* University of Bordeaux, France, Mar 29, 2005

2. **Bendahmane, Mostafa.** *Numerical and Mathematical Analysis of degenerate reaction-diffusion systems modeling the Cardiac electric field,* University of Lisbon, Portugal, Jul 1 - 17, 2005

3. **Bendahmane, Mostafa.** *Recent progress on a theory of entropy and renormalized solutions for doubly nonlinear degenerate parabolic equations involving nonlinear convection and degenerate p-Laplace operators,* Enumath2005 conference, Santiago de Compostela, Spain, Jul 18-22

4. **Bendahmane, Mostafa.** *Regularite de la solution faible pour un mod`ele de chimiotactisme degenere.* University of Pau, France, Nov 24, 2005.

5. **Bendahmane, Mostafa.** *Holder continuity of weak solutions for a degenerate chemotaxis model.* University of Berlin, Germany, Nov 29, 2005.

6. **Benth, Fred Espen.** *A non-Gaussian volatility model, the minimal entropy martingale measure and option pricing,* University of London, King's college, London, England, Feb 3, 2005

7. **Benth, Fred Espen.** *Stochastic modeling of electricity markets, with a view towards NordPool,* Stockhom School of Economics, Sweden, Apr 7, 2005

8. **Benth, Fred Espen .** *Modelling electricity forward contracts, Modelling and Measuring Energy Risk 2005,* Erasmus University, Rotterdam, Netherlands, May 10-11, 2005

9. **Benth, Fred Espen.** *Option pricing in the stochastic volatility model of Barndorff-Nielsen and Shephard Indifference pricing and the minimal entropy martingale measure,* Workshop in Quantitative Finance, Isaac Newton Institute, Cambridge, England, Jul 8, 2005

10. **Benth, Fred Espen.** *Pricing of spark spread options,* Workshop: Modelling electricity risk, Energy Risk Management World Asia 2005, Singapore. Sep 5-8, 2005

11. **Benth, Fred Espen.** *Modelling energies using stochastic processes,* Workshop: "Nordic Trading Days", Oslo, Oct 20, 2005

12. **Benth, Fred Espen.** *Stochastic modelling of electricity markets,* Matematisk statistik seminar, Chalmers, Sweden, Nov. 17, 2005

13. **Biswas, Imran Habib.** *Error estimate for finite difference schemes for parabolic integro-PDEs associated with controlled jump-diffusions,* ISRAMA 2005, Kolkata, India, Dec 17, 2005

14. **Biswas, Imran Habib.** *Error estimate for finite difference schemes for parabolic integro-PDEs associated with controlled jump-diffusion,* TIFR Centre, Bangalore, India, Dec 22, 2005

15. **Carlsson, Mats.** *The Photosphere at 0".1 Resolution,* Palo Alto, USA, Feb 14, 2005

16. **Carlsson, Mats.** *Waves and oscillations in the chromosphere and transition region.* Royal Society Discussion Meeting, London, UK, Mar 14 - 15, 2005

17. **Carlsson, Mats.** *Multi-D Radiation MHD as a tool to understanding waves in realistic magnetic topologies of the solar chromosphere,* American Geophysical Union, Spring Meeting; New Orleans, USA, May 23 - 27, 2005

18. **Carlsson, Mats.** *Chromospheric Modelling,* NSO workshop 23: Solar MHD: Theory and Observations, Sunspot New Mexico, USA, Jul 18-22, 2005

19. **Carlsson, Mats.** *Chromospheric Waves,* Chromospheric and Coronal Magnetic Fields, Max-Planck Institute, Lindau, Germany Aug 30 - Sep 2, 2005

20. **Carlsson, Mats.** *Chromospheric and Coronal Magnetic Fields,* 11th European Solar Physics Meeting, Leuven, Belgium, Sep 12-16, 2005

21. **Carlsson, Mats.** *Non-LTE modelling,* Workshop on NLTE modelling, Kyoto, Japan, Nov 15, 2005

22. **Carlsson, Mats.** *Radiation Magneto-Hydrodynamics Modelling of the Solar Chromosphere,* Kyoto, Japan, Nov 16, 2005

23. **Christiansen, Snorre H.** *On numerical simulation of Yang-Mills equations,* 24th Nordic and 1st Franco-Nordic Congress of Mathematicians, Reykjavik, Iceland, Jan 6-9, 2005

24. **Christiansen, Snorre H.** *On constraint preservation in numerical simulations of Yang-Mills equations,* Numerical relativity, BANFF International Reseach Station, Canada, Apr 16-21, 2005

25. **Christiansen, Snorre H.** *On constraint preservation in finite element discretizations of Yang-Mills equations Foundations of Computational Mathematics Conference,* Santander, Spain, Jul 7-9, 2005

26. **Christiansen, Snorre H.** *On divergence control in numerical simulations of Yang-Mills equations,* Wave motion; Mittag-Leffler, Stockholm, Sweden, Sep 1 - Dec 17, 2005

27. **Coclite, Giuseppe Maria.** *Diffusive - Dispersive Limits for Shallow Water Equations,* Workshop on PDE and Harmonic Analysis, Trondheim, Norway, Jun 1-3, 2005

28. **Coclite, Giuseppe Maria.** *On a Generalized Hyperelastic-Rod Wave Equation,* Fourth meeting on Hyperbolic Conservation Laws: Recent results and Research perspectives, Trieste, Italy, Jun 13-14, 2005

29. **Coclite, Giuseppe Maria.** *On a Generalized Hyperelastic-Rod Wave Equation",* Joint Summer Research Conference on Control Methods in PDE-Dynamical Systems, Snowbird, Utah, USA, Jul 3-7, 2005

30. **Coclite, Giuseppe Maria.** *Global Weak Solutions to a Generalized Hyperelastic-Rod Wave Equation,* University of Bergen, Norway, Sep 22, 2005

31. **Coclite, Giuseppe Maria.** *Global Weak Solutions to a Generalized Hyperelastic-Rod Wave Equation,* University of Zurich, Switzerland, Oct 27, 2005

32. **Dahl, Geir;** Brualdi, R.A. . *Matrices of zeros and ones and a zero block,* Workshop on Discrete Tomography, City University, New York, USA, Jun 13-15, 2005

33. **Dahle, Håkon.** *Cosmology with clusters of galaxies ESO Seminar,* Santiago, Chile, Mar 23, 2005

34. **Dahle, Håkon.** *The K2K Shear Estimator Shear Testing Programme workshop,* NASA Jet Propulsion Laboratory, Pasadena, CA, USA, Jul 25-27, 2005

35. **Di Nunno, Giulia.** *Elements of Malliavin Calculus for Levy random fields,* University of Bonn, Germany, Feb 3, 2005

36. **Di Nunno, Giulia. On minimal variance hedging and a non-anticipating stochastic derivative,** Atelier on analyse, theorie des Probabilites et Mathematiques Financieres", Univerity of Yaounde I, Cameroon, Mar 1-6, 2005.

37. **Di Nunno, Giulia.** *Random fields: Skorohod integral and Malliavin derivative,* International conference on modern problems and new trends in probability theory, Chernivtsi, Ukraine Jun 19-26, 2005

38. **Di Nunno, Giulia.** *Fourier methods in non-anticipating stochastic calculus,* International conference on Mathematical Analysis of Random Phenomena Hammamet, Tunisia Sep 12-17, 2005

39. **Di Nunno, Giulia.** *Random fields: elements of stochastic differentiation and integration,* University of Barcelona, Spain Oct 17-21, 2005

40. **Di Nunno, Giulia; Meyer-Brandis, Thilo; Proske, Frank Norbert; Øksendal, Bernt;** Kohatsu-Higa, Arturo; Sulem, Agnès . *Optimal portfolio for a "large" insider in a market driven by Levy processes NHH-Workshop in Mathematical Finance,* Bergen, Norway, Nov 3-5, 2005

41. **Di Nunno, Giulia ; Meyer-Brandis, Thilo ; Proske, Frank Norbert ; Øksendal, Bernt ;** Kohatsu-Higa, Arturo ; Sulem, Agnès . *Optimal portfolio for a "small" and a "large" insider in a market driven by Levy processes,* SAMSA Conference, Blantyre, Malawi, Nov 28- Dec 4, 2005

42. **Di Nunno, Giulia.** *Information, stochastic calculus, honest trading, insider trading.* Dept. of Mathematics, University of Oslo, Norway, Dec 9, 2005

43. **Dokken, Tor ;** Hagen, Trond R ; **Hjelmervik, Jon Mikkelsen.** *The GPU as a high performance computational resource* Conference on Computer Graphics 2005, Bratislava, Slovakia, May 12-14 2005

44. **Floater, Michael S.** *The effect of parameterization on the approximation order of curve fitting,* Geometric Modeling, Dagstuhl, Germany May 29 - Jun 3, 2005

45. **Floater, Michael S.** *How parameterization affects the approximation order of parametric curve fitting,* Foundations of computational mathematics, Santander, Spain, Jun 30 - Jul 19, 2005

46. **Floater, Michael S.** *Mathematical methods in geometric modelling.* A bemata project. Bemata programseminar, Hurdal, Norway, Oct 24-25, 2005

47. **Floater, Michael S.** *Cubic spline interpolation, arc length estimation, and divided differences,* SIAM Conference on Geometric Design, Phoenix, USA, Oct 31 - Nov 3, 2005

48. **Floater, Michael S.** *Geometric curve interpolation,* Radial Basis Functions and Beyond; Goettingen, Germany, Nov 25-26, 2005

49. **Floater, Michael S.** *Spline interpolation, arc length estimation, and divided differences,* Guest lecture, Uppsala, Sweden Dec 9, 2005

50. **Gudiksen, Boris.** *DC-Heating - Is it enough?* Solar Wind 11 / SOHO 16, Whistler, Canada, Jun 12-17, 2005

51. **Gudiksen, Boris.** *Connections: Photosphere - Chromosphere - Corona,* Solar MHD: Theory and Observations, Kit Peak, New Mexico, USA, Jul 18-22, 2005

52. **Gudiksen, Boris.** *Topological dissipation and the Solar Corona,* The 6th Solar-B Science Meeting, Kyoto, Japan Nov 8-11, 2005

53. **Hansteen, Viggo.** *Models for the Solar Atmosphere.* Turbulence and Fine Scale Structure in Solar and Astrophysical Plasmas, 3d summer school, Montegufoni, Italy, Oct 3-7, 2005

54. **Hansteen, Viggo.** *Waves and Shocks,* The 6th Solar-B Science Meeting, Kyoto, Japan, Nov 8, 2005

55. **Hansteen, Viggo.** *Numerical Modelling of Waves and Shocks in the Solar Atmosphere,* Workshop Kyoto University, Japan, Nov 15-17, 2005

56. **Hansteen, Viggo.** *Transition region and Coronal Modelling,* Grand Challange Problems in Computational Astrophysics, UCLA, USA; Mar 28, 2005

57. **Hjorth-Jensen, Morten.** *Ab Initio nuclear structure methods: Monte Carlo methods and no-core shell model approaches* ISOLDE Physics Group Seminar; CERN, Switzerland, Mar 14, 2005

58. **Hjorth-Jensen, Morten.** *Challenges for nuclear structure: from stable to weakly bound nuclei,* International Symposium on Correlation Dynamics in Nuclei, Tokyo, Japan, Jan 31 - Feb 5, 2005

59. **Hjorth-Jensen, Morten.** *Computational Environment for Nuclear Structure: CENS.* Lecture Series at Michigan State University, USA, Apr 11-12, 2005

60. **Hjorth-Jensen, Morten.** *From the nucleon-nucleon interaction to a renormalized interaction for nuclear systems.* Lecture series at Michigan State University, USA, Apr 7-8, 2005

61. **Hjorth-Jensen, Morten.** *Large Scale Shell Model and Coupled Cluster Calculations,* Workshop on Microscopic Approaches to Many-Body Theories, University of Manchester, UK, Aug 30 - Sep 3, 2005

62. **Hjorth-Jensen, Morten.** *Shell model approaches,* 2nd VISTARS Workshop in Russbach, Austria; Mar 5-12, 2005

63. **Hjorth-Jensen, Morten ;** et.al. *Effective Interactions for nuclei with A=50-100 and Gamow-Teller properties* International Symposium on Correlation Dynamics in Nuclei; Tokyo, JApan, Jan 31 - Feb 5, 2005

64. **Holden, Helge.** *On the Hunter-Saxton and Camassa-Holm equations University of Missouri,* USA, Mar 10, 2005

65. **Holden, Helge.** *The Hunter-Saxton equation,* SISSA, Trieste, Italy, Oct 27, 2005

66. **Holden, Helge.** *The Hunter-Saxton equation,* KTH, Stockholm, Sweden, Nov 16, 2005

67. **Karlsen, Kenneth H.** *Recent progress on a theory of entropy solutions for quasilinear degenerate parabolic equations,* 24th Nordic/1st Franco-Nordic Congress of Mathematicians, Reykjavik, Iceland, Jan 6-9, 2005.

68. **Klausen, Runhild Aae.** *Numerical methods for elliptic equations with discontinuous coefficients,* MPFA and relationship to the finite element framework, CIPR, Bergen, Norway, May 7, 2005.

69. **Klausen, Runhild Aae.** *A Theoretical Analysis of MPFA; Connection to MFEM,* 2005 SIAM Conference on Mathematical and Computational Issues in the Geosciences, Avignon, France, Jun 6-10, 2005

70. **Klausen, Runhild Aae.** *Multi Point Flux Approximation Control Volume Methods,* Friedrich-Alexander University, Erlangen-Nürnberg, Germany, Jul 12, 2005.

71. **Klausen, Runhild Aae.** *Multi Point Flux Approximation Control Volume Methods,* Part II, Friedrich-Alexander University, Erlangen-Nürnberg, Germany, Jul 14, 2005.

72. **Lie, Knut-Andreas ;** et al. . *Multiscale methods for flow in porous media,* 18th Nordic Seminar on Computational Mechanics; Stockholm, Sweden, Nov 27-30, 2005

73. **Lilje, Per Barth.** *EGSE for Planck LFI: The Norwegian contribution,* Planck LFI/HFI Consortium Meeting; Max Planck Institut fur Astrophysic, Germany, Jan 26-28, 2005

74. **Lilje, Per Barth.** *Institute of Theoretical Astrophysics,* University of Oslo, Norwegian Space Science Meeting 2005, Oslo, Norway, Feb 2, 2005

75. **Lyche, Tom.** *Chain rules for divided differences and Faa di Bruno's formula International conference on multivariate approximation;* Dortmund, Germany Sep 25-30, 2005

76. **Lyche, Tom.** *Constrained curve and surface design SIAM conference on geometric design & computing;* Phoenix, Arizona, USA, Oct 30 - Nov 3, 2005

77. **Lyche, Tom.** *Differences divisees des fontions composees Workshop Association Francais d'Approximation,* Paris, France, Nov 18, 2005

78. **Lyche, Tom.** *Hermite Subdivision with Shape Constraints Guest Lecture University Tor Vergata,* Rome, Italy, Apr 6, 2005

79. **Lyche, Tom.** *Hermite Subdivision with Shape Constraints Guest Lecture University of Firenze,* Italy, Apr 13, 2005

80. **Lyche, Tom.** *Hermite subdivison and total positivity Foundation of Computational Mathematics;* Santander, Spain, Jun 30 - Jul 9, 2005

81. **Lyche, Tom.** *On a Class of Weak Tchebycheff Systems Dagstuhl seminar on geometric modelling;* Wadern, Germany, May 29 - Jun 6, 2005

82. **Lyche, Tom.** *Shape preserving Hermite subdivision International conference on the interactions between wavelets and splines;* Athens, Georgia, USA, May16-19, 2005

83. **Lyche, Tom.** *Subdivision with shape constraints Boeing Company,* Seattle, USA, Nov 9, 2005

84. **Lyche, Tom.** *The chain rule for divided differences Radial Basis Functions and Beyond;* Goettingen, Germany, Nov 25-26, 2005

85. **Meyer-Brandis, Thilo.** *White noise approach to evolution equations driven by Hilbert space valued Levy white noise Workshop Stochastic Analysis and Applications in Finance,* Planck Institute, Leipzig, Germany, Apr 20-22, 2005

86. **Moan, Per Christian.** *On convergence of averaging methods for differential equations,* Magic 2005, Ustadoset, Norway, Feb 14-18, 2005

87. **Moan, Per Christian.** *Backward error analysis for time-discretization schemes,* a new view and further improvements Computing laboratory seminar, University of Oxford, UK, Mar 10, 2005

88. **Moan, Per Christian.** *Backward error analysis,* SciCade 2005, Nagoya, University, Japan, May 23-27, 2005

89. **Mørken, Knut Martin ; Reimers, Martin ;** Scherer, K. . *Computations with the control polygon,* Foundations of Computational Mathematics 2005, Santander, Spain, Jun 30 - Jul 9, 2005

90. **Noelle, Sebastian.** *High-order well-balanced schemes and adjoint error control,* Workshop on Stiff Sources and Numerical Methods for Conservation Laws, American Institute of Mathematics (AIM), Palo Alto, USA, Apr 4-8, 2005.

91. **Noelle, Sebastian.** *Well-balanced schemes of arbitrary order of accuracy for geophysical flows,* Center for Atmospheric and Ocean Sciences (CAOS), Courant Institute, New York University, USA, Apr 12, 2005

92. **Noelle, Sebastian.** *Systems of Conservation Laws,* Abel lecture in honor of Peter D. Lax, Oslo, May 25, 2005.

93. **Ovrum, Eirik.** *Finding bound entanglement numerically.* Finding the shortest distance to a separable state II. Guest Lecture at the Erwin Schroedinger Institute, Vienna, Austria, Dec 6, 2005

94. **Piene, Ragni.** The curve counting problem - or: when algebraic geometry met string theory, Tata Institute of Fundamental Research, Mumbai, India, Feb 10, 2005.

95. **Piene, Ragni.** *The curve counting problem,* Workshop on Contemporary Mathematics, IMPA, Rio de Janeiro, Brazil, Apr 26, 2005

96. **Piene, Ragni.** *The curve counting problem,* Universidad Federal de Minas Gerais, Belo Horizonte, Brazil, Apr 27, 2005

97. **Piene, Ragni.** *Counting curves on a surface,* Algebraic geometry, Symplectic gepmetry, and Theoretical physics, University of Pennsylvania, Philadelphia, USA, May 6, 2005

98. **Piene, Ragni.** *Bell polynomials and enumerative geometry,* Algebraic geometry, KTH, Stockholm, Sweden, May 19, 2005

99. **Piene, Ragni.** *Generating functions and enumerative geometry Colloquium Lecture,* KTH, Stockholm, Sweden, Oct 26, 2005

100. **Proske, Frank Norbert.** *Stochastic differential equations- some new ideas Conference on Analysis,* Geometry and Applications, University of Cameroon, Yaounde, Cameroon, Mar 1-4, 2005

101. **Proske, Frank Norbert.** *Stochastic partial differential equations with application to partial observation control,* Habilitation lecture, University of Ulm, Germany, Jul 13, 2005

102. **Proske, Frank Norbert.** *Stochastic differential equations from the perspective of white noise analysis University of Mannheim,* Germany, Nov 7-9, 2005

103. **Risebro, Nils Henrik.** *Entropy solutions and difference schemes for the Degasperis-Procesi equation,* Mittag-Leffler, Stockholm, Sweden, Dec 1-17, 2005

104. **Soomere, Tarmo.** *Interaction of shallow-water solitons as a possible model for freak waves,* Workshop on Rogue Waves 2005, The International Centre for Mathematical Sciences (ICMS), Edinburgh, Scotland, Dec 12, 2005

105. **Tai, Xue-Cheng.** *Inverse Problems and Parameter Identification for PDE Models,* Fifth Winter School in Computational Mathematics, Geilo, Norway, Feb 20-25, 2005.

106. **Tai, Xue-Cheng.** *A Remark on MBO scheme and some Piecewise Constant Level Set Methods.* International Conference on Scientific Computing (ICSC05), Nanjing, China, Jun 4 - 8, 2005.

107. **Tai, Xue-Cheng.** *Multiphase piecewise constant level set methods for shape identification.* International Conference Free boundary problems: Theory and Applications University of Coimbra, Portugal, Jul 7-12, 2005.

108. **Tai, Xue-Cheng.** *Multiphase Piecewise Constant Level Set Methods For Shape Identification.* SIAM Annual Meeting, New Orleans, LA, USA, Jul 11-15, 2005.

109. **Tai, Xue-Cheng.** *Multiphase piecewise constant level set methods for shape identification.* International Workshop on Computational Science and its Education, Beijing, China. Aug 29 - Sep 2, 2005.

110. **Winther, Ragnar.** *Mixed finite elements for elasticity, a constructive approach,* Finite element methods with applications, Oberwolfach, Germany, Jan 30 - Feb 5, 2005

111. **Winther, Ragnar.** *A discrete de Rham complex with enhanced smoothness,* US National Congress on Computational Mechanics, Austin, Texas, USA, Jul 22-30, 2005

112. **Winther, Ragnar.** *Exact sequences and mixed finite elements for elasticity,* Direct and inverse field computations in mechanics, Linz, Austria, Nov 7, 2005

113. **Øksendal, Bernt.** *Optimal portfolio for an insider in a market driven by Lévy processes,* 4th Conference on Lévy Processes, University of Manchester, England, Jan 10-14, 2005

114. **Øksendal, Bernt.** intensive course on Stochastic Analysis and it Applications (12 lectures + tutorials), African Institute of Mathematic Sciences (AIMS), Muizenberg, South Africa Jan 24 - Feb 2, 2005

115. **Øksendal, Bernt.** *An Introduction to Malliavin calculus and its applications to finance,* University of Cape Town, South Africa, Feb 2, 2005

116. **Øksendal, Bernt.** Lecture series (4 lectures): An introduction to optimal control of jump diffusions and applications to finance, Conference on Analysis, Geometry and Applications, University of Cameroon, Yaounde, Cameroon, Mar 1-4, 2005

117. **Øksendal, Bernt.** *The value of information in stochastic control and finance,* Fifth Seminar on Stochastic Analysis, Random Fields and Applications and Minisymposium on Stochastic Methods in Financial Models, Monte Verita Research Center, Ascona, Switzerland, May 30 - Jun 3, 2005

118. **Øksendal, Bernt.** *Lecture Series (20 lectures+20 tutorials) Stochastic Partial Differential Equations and Environmental and Geophysical Modeling,* University of Wyoming, Laramie, Wyoming, USA, Jun 20 - Jul 2.

119. **Øksendal, Bernt.** *Optimal control of SPDEs and applications to partial observation control,* Workshop PDE and Mathematical Finance, KTH, Stockholm, Sweden, Aug 15-18, 2005.

120. **Øksendal, Bernt.** *Optimal control of stochastic partial differential equations,* International Conference on Mathematical Analysis and Random Phenomena. Hammamet, Tunisia, Sep 12-17, 2005

121. **Øksendal, Bernt.** *Lecture Series (15 Lectures) Minicourse in Stochastic Analysis and Applications,* University of Tunis, Tunisia, Oct 17-21, 2005

122. **Øksendal, Bernt.** *Risk minimizing portfolios and HJB equations for stochastic differential games,* NHH, Bergen, Norway, Nov 3-5, 2005

123. **Øksendal, Bernt.** *Risk minimizing portfolios and HJB equations for stochastic differential games,* AMaMeF Workshop on Stochastic Analysis and Computational Finance, Imperial College, London. Nov 10-12, 2005

124. **Øksendal, Bernt.** *Risk minimizing portfolios and HJB equations for stochastic differential games* SAMSA 2005 Conference, Malawi. Nov 28 - Dec 2, 2005

125. **Øksendal, Bernt.** *Optimal portfolio for large insider trader in a market driven by Lévy processes,* Quantitative Methods in Finance (QMF) 2005, Sydney, Australia. Dec 14-17, 2005

126. **Aase, Knut.** *The Perpetual American Put Option for Jump-diffusions: Implications for Equity Premiums,* FIBE XII, Bergen, Norway, Jan 6, 2005

127. **Aase, Knut.** *Using Option Pricing Theory to Infer about Equity Premia,* SAMSA 2005 Conference, Malawi. Nov 28 - Dec 2, 2005

128. **Aase, Knut.** *Using Option Pricing Theory to Infer about Equity Premia,* Quantitative Methods in Finance (QMF) 2005, Sydney, Australia. Dec 14-17, 2005

8b. Contributed scientific talks, posters etc

1. Pecseli, Hans ; **Børve, Steinar ;** Trulsen, Jan ; Longo, Savino. *Kinetic instabilities associated with injection of a plasma beam into a neutral background.* XXVII International Conference on Phenomena in Ionized Gases, Eidhoven, Netherlands, Jul 18-22, 2005.

2. Omang, Marianne ; **Børve, Steinar ; Trulsen, Jan.** *SPH for Spherical and Cylindrical Symmetric Systems* SIAM, Orlando, USA, Feb 12-15, 2005

3. **Børve, S.,** Omang, M., and Trulsen, J. *Regularized Smoothed Particle Magnetohydrodynamics IPAM program "Grand Challenge Problems in Computational Astrophysics",* UCLA, Los Angeles, USA, Apr 3-15, 2005

4. Langangen, Øystein ; **Carlsson, Mats ; Rouppe, Van Der Voort Luc.** *The diagnostic potential of the 4571 Å Mg I line,* SPM-11, Leuven, Belgium, Sep 11-16, 2005

5. **Coclite, Giuseppe Maria.** *On a Generalized Hyperelastic-Rod Wave Equation,* XIII International Conference on Waves and Stability in Continuous Media WASCOM-2005, Acireale, Catania, Italy, Jun 19-25, 2005

6. **Dahle, Håkon.** *The Cluster Mass Function from Weak Lensing,* The Future of Cosmology with Clusters of Galaxies, Kona, Hawaii, USA, Feb 26 - Mar 3, 2005

7. **Di Nunno, Giulia.** *Stochastic differentiation and application to minimal variance hedging.* 4th Symposium on Levy Processes: Theory and Applications University of Manchester, UK, Mar 10-14, 2005

8. **Dokken, Tor.** *The challenge of singular and near singular intersections of CAD-type surfaces,* Industry Challenges in Geometric Modeling in CAD - 2005, Darmstadt, Germany, Mar 17-18, 2005

9. **Dokken, Tor.** *The GPU as a high performance computational resource - Solving Partial Differential Equations on GPUs Industry Challenges in Geometric Modeling in CAD - 2005,* Darmstadt, Germany, Mar 17-18, 2005

10. **Dokken, Tor.** *Singular and Near Singular Intersections of CAD-type Surfaces SIAM Conference on Geometric Design and Computing,* Phoenix, USA, Oct 30 - Nov 3, 2005

11. **Dokken, Tor; Hagen, Trond R.** *Short Course: Graphics Hardware as a High-end Computational Resource* SIAM Conference on Geometric Design and Computing, Phoenix, USA, Oct 30 - Nov 3, 2005

12. **Dokken, Tor ; Hagen, Trond R.** *The GPU as a Computation Resource in Surface Intersections* SIAM Conference on Geometric Design and Computing, Phoenix, USA, Oct 30 - Nov 3, 2005

13. **Eide, Inga Baadshaug ; Di Nunno, Giulia.** *Insurance pricing in a financial framework,* Modern Problems and new Trends in Probability Theory, Chernivtsi, Ukraine Jun 19-26, 2005

14. **Eriksen, Hans Kristian Kamfjord** et al. *Cosmological Parameter Constraints as Derived from the Wilkinson Microwave Anisotropy Probe Data via Gibbs Sampling and the Blackwell-Rao Estimator,* American Astronomical Society Meeting, San Diego, USA, Jan 9-13, 2005

15. **Eriksen, Hans Kristian Kamfjord ; Lilje, Per Barth;** et. al. *Bayesian Power Spectrum Analysis of the First-Year WMAP data,* Planck LFI/HFI Consortium Meeting; Max Planck Institut fur Astrophysic, Germany, Jan 26-28, 2005

16. **Groth, Martin.** *Numerical option pricing in the Barndorff-Nielsen - Shephard stochastic volatility model,* SAMSI Program on Financial Mathematics, Statistics and Econometrics Kickoff Workshop, Research Triangle Park, NC, USA, Sep 18-21, 2005

17. **Groth, Martin.** *Option pricing in the Barndorff-Nielsen - Shepard model,* Workshop on Stochastic Analysis, Hankasalmi, Finland, May 18-21, 2005

18. **Hansteen, Viggo ; Gudiksen, Boris.** *3d Numerical Models of Quiet Sun Coronal Heating,* Solar Wind 11/SOHO 16 Connecting Sun and Heliosphere; Whistler, Canada, Jun 12-17, 2005

19. **Janse, Åse Marit ;** Lie-Svendsen, Øystein ; **Leer, Egil.** *Modeling the solar wind with new transport equations,* Solar Wind 11 / SOHO 16, Whistler, Canada, Jun 12-17, 2005

20. **Johansen, Pål Hermunn.** *Solving a closest point problem by subdivision,* MEGA 2005 - Effective Methods in Algebraic Geometry; Porto Conte, Alghero, Sardinia, May 27 - Jun 1, 2005

21. **Killie, Mari Anne ;** Lie-Svendsen, Øystein ; **Leer, Egil.** *Modeling Helium in Closed Coronal Structures,* Solar Wind 11/SOHO 16, Whistler, Canada, Jun 12 - 17, 2005

22. **Lindstrøm, Tom Louis ; Hveberg, Klara.** *Self-homeomorphic fractals - a suitable framework for harmonic analysis on fractals?* Second Conference on Analysis and Probability on Fractals, Cornell University, USA, May 31 - Jun 4, 2005

23. **Lindstrøm, Tom Louis.** *Sum and product formulas for hyperfinite Lévy prosesses,* SAMSA 05 conference, Blantyre, Malawi, Nov 28 - Dec 2, 2005

24. **Mørken, Knut Martin ; Reimers, Martin ;** Scherer, K. . *Computations with the control polygon* SIAM Conference on Geometric Design and Computing; Phoenix, Arizona, USA, Oct 30 - Nov 3, 2005

25. **Noort, Michiel Jan van ; Rouppe, Van Der Voort Luc ;** Löfdahl, M.G. . *Solar image restoration by use of Multi-Object Multi-Frame Blind Deconvolution.* NSO workshop 23: Solar MHD: Theory and Observations, Sunspot, USA, Jul 18-22, 2005

26. **Ovrum, Eirik.** *Finding bound entanglement numerically. Finding the shortest distance separable state.* 2nd NordForsk Network Meeting on Low-dimensional physics, Oslo, Norway, Nov 17-19, 2005

27. **Ovrum, Eirik ;** Leinaas, Jon Magne ; et al. *The Geometry of Entanglement. Visualizations and calculation of distances.* Quantum Physics of Nature, Vienna, Austria, May 20 - 26, 2005

28. **Ovrum, Eirik ;** Leinaas, Jon Magne ; et al. *The Geometry of Entanglement. Visualizations and calculation of distances II.* New Trends in Quantum Mechanics: Fundamental Aspects and Applications, Palermo, Italy, Nov 11 - 13, 2005

29. **Popsueva, Victoria.** *Structure and dynamics of quantum dots. (A Monte Carlo simulation)* NANOMAT-Birkeland 2005, Trondheim, Norway, Jun 2-3, 2005

30. **Popsueva, Victoria ;** Førre, Morten . Structure and Dynamics of Quantum Dots, EGAS37, Dublin, Ireland, Aug 5-6, 2005

31. **Popsueva, Victoria.** *Structure and Dynamics of Quantum Dots* Nettverksmøte "Quantum transport in nanoscale systems", Trondheim, Norway, Sep 15-16, 2005

32. **Quak, Ewald.** *Presentation of the EU AIM@SHAPE Network of Excellence, Official EU Project Review,* Genova, Italy, Mar 14, 2005.

33. **Quak, Ewald.** *Presentation of the EU AIM@SHAPE and CENS-CMA projects,* Nokia Research Center, Helsinki, Finland, Jun 9, 2005.

34. **Quak, Ewald.** *Contributions to a round of strategy discussions concerning the future of industrial mathematics in Europe,* Strategy workshop of the EU NETIAM project, Oxford, UK, Jul 4-5, 2005.

35. **Quak, Ewald.** *Presenting the AIM@SHAPE project and shape modelling in general,* Communicating European Research (CER) 2005, Brussels, Belgium, Nov 14-15, 2005.

36. **Rasmussen, Atgeirr Flø ; Floater, Michael S.** . *Point-Based Methods for Estimating Length and Area* SIAM Conference on Geometric Design and Computing; Phoenix, Arizona, USA, Oct 30 - Nov 3, 2005

37. **Reimers, Martin ; Mørken, Knut Martin.** *Computing Zeros of polynomials and Splines,* SIAM Conference on Geometric Design and Computing; Phoenix, Arizona, USA, Oct 30 - Nov 3, 2005

38. **Rouppe, Van Der Voort Luc.** *High spatial resolution observations of solar magnetic structures,* NSO workshop 23: Solar MHD: Theory and Observations, Sunspot, USA, Jul 18-22, 2005

39. Lie, Johan ; Lysaker, Marius ; **Tai, Xue-Cheng.** *Piecewise constant level set methods and image segmentation.* Scale Space 2005, Hofgeismar, Germany, Apr 6-10, 2005

40. **Tai, Xue-Cheng.** *Using Navier-Stokes equations for digital image denoising and restoration,* Development in Navier-Stokes equations and Turbulence research, University of Singapore, Dec 13-17, 2005
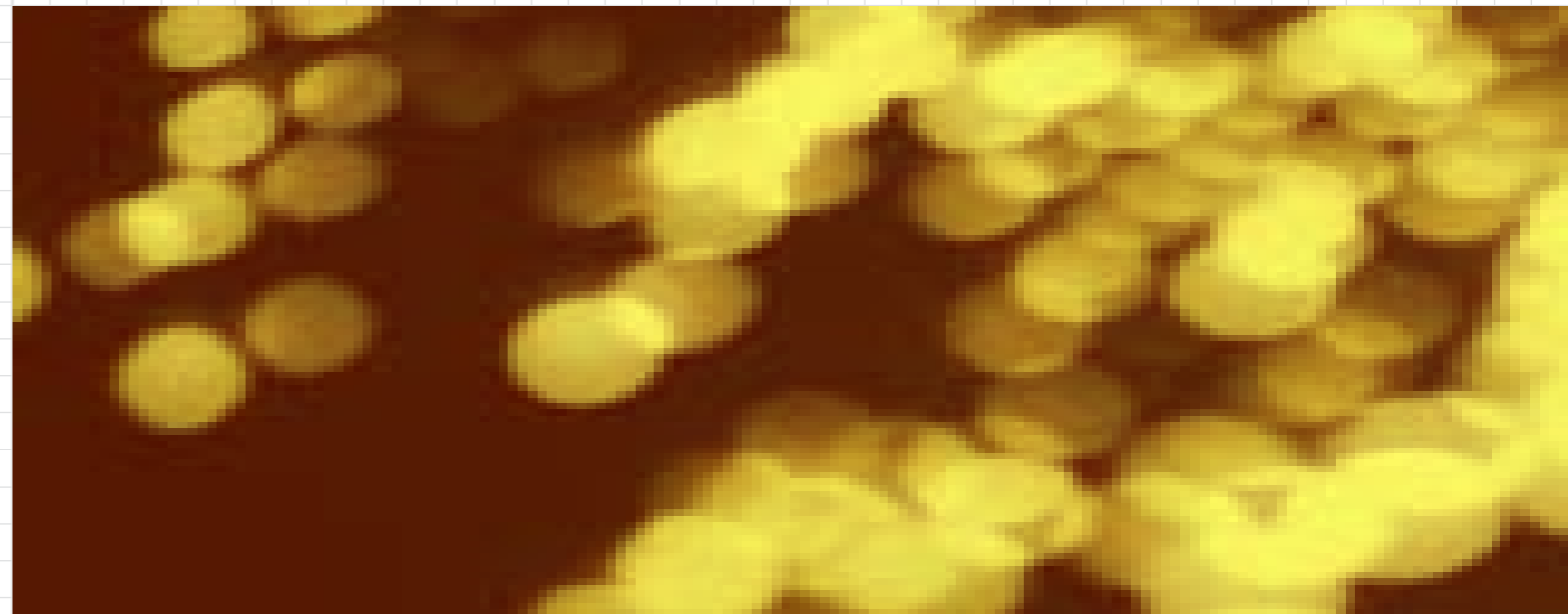
8c. Talks for general audiences, public outreach

1. **Bergli, Elise.** *Einstein 1905: Brownske bevegelser og fotoelektrisk effekt,* Faglig-pedagogisk dag, University of Oslo, Norway, Jan 4, 2005
2. **Bergli, Elise.** *Kvantenes forunderlige verden,* Åpen dag, University of Oslo, Norway, Mar 8, 2005
3. **Bergli, Elise.** Kvantenes forunderlige verden Forskningsdagene, Kongsberg, Norway, Sep 29, 2005
4. **Carlsson, Mats.** *Solen - vår nærmeste stjerne* Fysikkforeningen, University of Oslo, Norway, Nov 2, 2005
5. **Carlsson, Mats.** *10 years with SOHO, some highlights* SOHO 10 år, Norsk Romsenter, Oslo, Norway, Dec 16, 2005
6. **Hansteen, Viggo.** *Framtidsvyer for norsk solfysikk,* Norsk Romsenter, Oslo, Norway, Dec 16, 2005
7. **Hjorth-Jensen, Morten.** *Kvalitetsreformen, nye Muligheter for Samarbeid mellom Universitet og Næringsliv* Industridag, rom for muligheter; University of Oslo, Norway, Sep 16, 2005
8. **Holden, Helge.** *The Abel Laureate 2005* The official announcement ceremony of the 2005 Abel laureate, Oslo, Norway, Mar 17, 2005
9. **Holden, Helge.** *Abelprisvinneren 2005,* Årsmøte Norsk matematisk forening, NTNU, Trondheim, Norway, Mar 17, 2005
10. **Holden, Helge.** *Peter Lax – Abelprisvinner 2005* Lektorutdanningen, NTNU, Trondheim, Norway, Apr 20, 2005
11. **Holden, Helge.** *Peter Lax – Abelprisvinner 2005* Student seminar, NTNU, Trondheim, Norway, May 11, 2005
12. **Holden, Helge.** *Peter Lax – Abel Laureate 2005* Colloqium, NTNU, Trondheim, Norway, May 20, 2005
13. **Holden, Helge.** *Peter Lax – Abelprisvinner 2005* Årsmøte Norsk matematikkråd, Bodø, Norway, Sep 23, 2005
14. **Holden, Helge.** *Peter Lax – Abel Laureate 2005* Colloqium, KTH, Stockholm, Sweden, Oct 12, 2005
15. **Holden, Helge.** *Peter Lax – Abelprisvinner 2005* BeMatA conference, Losby gods, Norway, Oct 25, 2005
16. **Holden, Helge.** *Peter Lax – Abelprisvinner* 2005 ExFac-lecture, NTNU, Trondheim, Norway, Oct 31, 2005
17. **Holden, Helge.** *Peter Lax – Abelprisvinner 200*5 Faglig-pedagogisk dag, NTNU, Trondheim, Norway, Nov 25, 2005
18. **Killie, Mari Anne.** *Solstråle - mer enn til å bli brun av!,* Forskningsdagene, Kongsberg, Norway, Sep 29, 2005
19. **Lilje, Per Barth.** *Skjedde Big Bang?,* Faglig-Pedagogisk Dag, University of Oslo, Norway, Jan 4, 2005
20. **Lilje, Per Barth.** *Skjønnheten i Universet,* Institutt for kreftforskning, Oslo, Norway, Feb 11, 2005
21. **Mcmurry, Andrew.** *Simulating the Universe.* Intercon 2005, Oslo, Norway, Jul 28-31, 2005
22. **Seland, Johan Simon.** *General Processing on GPUs - Supercomputing on the desktop,* Dagen@Ifi, University of Oslo, Norway, Oct 27, 2005

APPENDIX 9
MEDIA APPEARANCES 2005

9a. TV

1. NRK TV "Frokost-TV" (Mar 3, 2005): **Njål Foldnes** in a studio interview on packing as a general mathematical problem motivated from the everyday experience on f.ex. knapsack packing.
2. NRK TV "Schroedingers katt" (Mar 27, 2005): **Helge Holden** interviewed on and presenting this year's Abel Laureate Peter D. Lax.
3. NRK TV "Frokost-TV" (May 3, 2005): CMA project: "Prima og Nulle tar kaka" - a mathematical theatre on tour in Oslos primary schools.
4. NRK TV "Schroedingers katt" (Nov 17, 2005): **Viggo Hansteen** interviewed on the Norwegian contribution to the Japanese Solar B satellite.

9b. Radio

1. National Radio of Cameroon (Mar 4, 2005): **Giulia Di Nunno** interviewed on the conference: "Atelier on analyse, theorie des Probabilites et Mathematiques Financieres", Univerity of Yaounde I.
2. NRK P2 "Verdt å vite" (Mar 17, 2005): **Helge Holden**. Abelprisvinneren 2005.
3. NRK P1 "Nitimen" (Mar 18, 2005): **Njål Foldnes** in a studio interview on packing as a general mathematical problem motivated from the everyday experience on f.ex. knapsack packing.
4. NRK Østlandssendingen (Mar 18, 2005). **Njål Foldnes** in a studio interview (topic, see above).
5. NRK P1 "Reiseradioen" (Jun 23, 2005): **Njål Foldnes** in a studio interview (topic, see above).
6. NRK P2 "Verdt å vite" (Nov 18, 2005): **Snorre Christiansen**, interviewed on the EURYI award.
7. NRK P1 "Kulturbeitet" (Dec 16, 2005): **Tom Lindstrøm** interviewed on the Danish poet and scientist Piet Hein.

9c. Newspapers

1. Dagbladet, add-in: "Friluftsliv" (Feb 2, 2005). **Njål Foldnes** interviewed on packing as a general mathematical problem motivated from the everyday experience on f.ex. knapsack packing.
2. Cameroon Tribune (Mar 4, 2005) Bernt **Øksendal** presented in article: "Les bons calculs de l'UYI"
3. Dagsavisen (Apr 28, 2005). CMA project: "Prima og Nulle tar kaka" - a mathematical theatre on tour in Oslos primary schools
4. Aftenposten, feature article (May 24, 2005): **Helge Holden**. "Matematikkens bidrag til Olje-Norge".
5. Aftenposten, article (Aug 3, 2005): **Snorre Christiansen**. "10 millioner til ung forsker".
6. VG, article (Aug 3, 2005): **Snorre Christiansen**. "Ung, norsk forsker fikk 10 millioner kroner".
7. Stavanger Aftenblad, article (Aug 3, 2005): **Snorre Christiansen**. "Ung, norsk forsker fikk 10 millioner kroner".
8. Dagsavisen, article (Aug 3, 2005): **Snorre Christiansen**. "Millionstipend til norsk forsker",

9d. Magazines

1. Dine Penger (No 5/2005, May). **Fred Espen Benth** commenting on article about "emerging markets"
2. Økonomisk Rapport (June 2005). **Kenneth Karlsen** presented as one among 25 young and promising individuals in Norway.
3. Forskning, reader's letter (No 4/2005): **Per Barth Lilje**: "Astrofysikk i Norge - finnes det?"
4. Computerworld (Aug 3, 2005): **Snorre Christiansen**. "Stort EU-stipend til nordmann"
5. PCWorld (Aug 3, 2005): **Snorre Christiansen**. "Stort EU-stipend til nordmann"
6. Uniforum (Aug 3, 2005): **Snorre Christiansen**. "Ung UiO-matematiker fikk mega-stipend"
7. Vi Menn (No 42/2005, October), **Snorre Christiansen**. "Snorre vant 10 millioner".
8. Apollon (Nr. 4/2005, December), **Snorre Christiansen**. "I verdensklasse".

9e. Internet

1. www.abelprisen.no (Mar 17, 2005) **Holden, Helge.** "Peter D. Lax. Eksempler fra hans bidrag til matematikken". Abelprisen
2. www.nrk.no (Mar 18, 2005) **Njål Foldnes** "Problematisk påskepakking"
3. www.forskning.no (Apr 27, 2005): **Snorre Christiansen** "Norske matematikere fremragende"
4. NTB (Aug 3, 2005): **Snorre Christiansen** "Ung norsk forsker fikk gigant-stipend"
5. nrk.no (Aug 3, 2005): **Snorre Christiansen**, "Forsker fikk superstipend"
6. www.utdanning.ws (Aug 3, 2005): **Snorre Christiansen**, "10 millioner til norsk forsker"
7. www.forskningsradet.no (Aug 3, 2005): **Snorre Christiansen**, "Matematiker nådde helt til topps"
8. www.magasinett.no (Aug 3, 2005): **Snorre Christiansen**, "Nordmann fekk 10 millionar i stipend"
9. www.hardware.no (Sep 5, 2005). **Johan Seland**. "Rapport fra Eurographics 2005"
10. ScienceCareers.org (Nov 18, 2005): **Snorre Christiansen**, "Using Maths to Predict Physical Phenomenon".
11. bulletins-electroniques.com (Dec 16, 2005) : "Snorre H. Christiansen : des mathématiques pures pour simuler les équations d'Einstein"