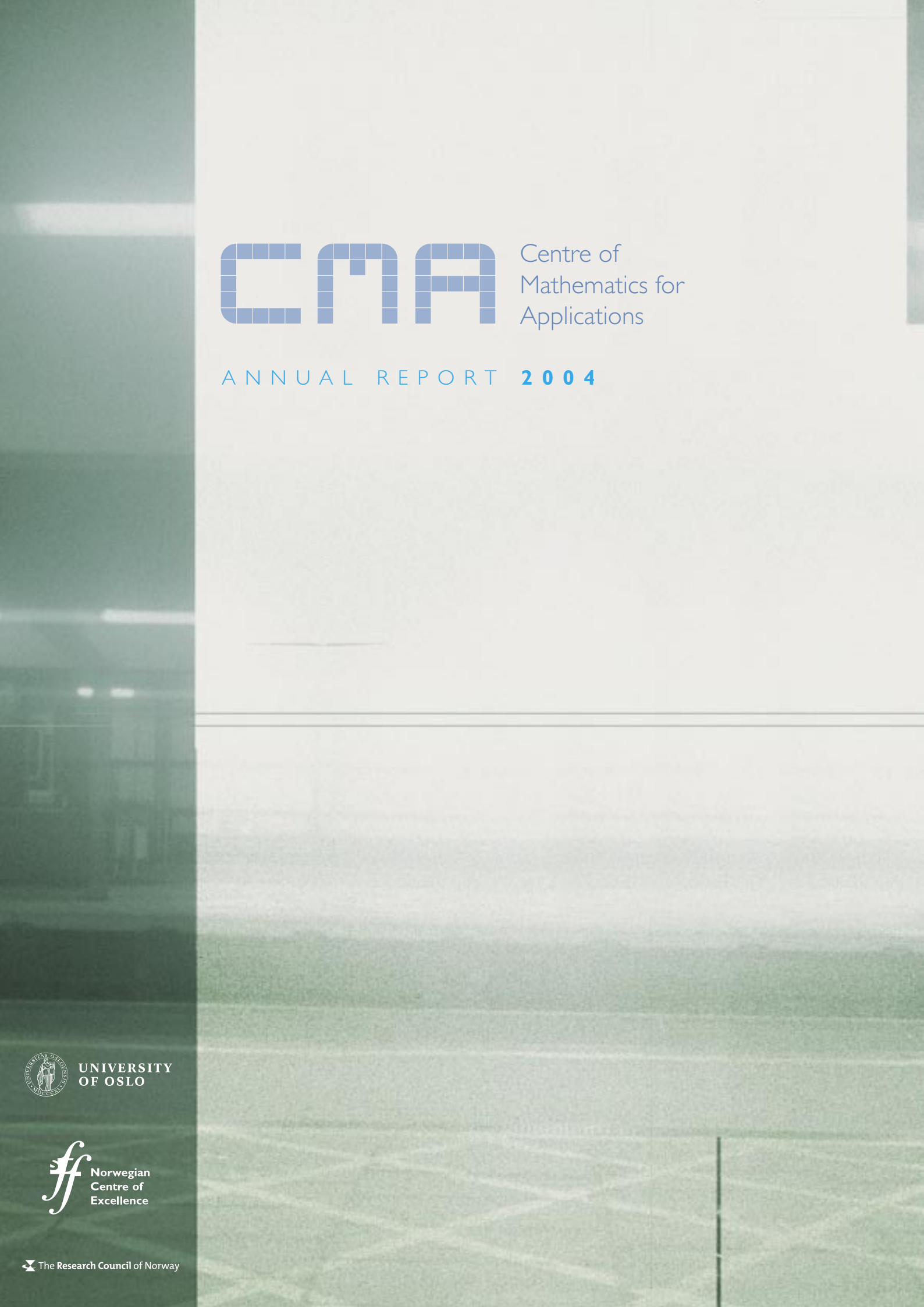


CMA

Centre of Mathematics for Applications

ANNUAL REPORT 2004

UNIVERSITY OF OSLO

Norwegian Centre of Excellence

The Research Council of Norway

CMA IN BRIEF – facts and figures of the 2004 activities

In 2004, CMA counted 84 members (51,75 man year). On Dec 31, we count

- 78 members (27 senior scientists , 27 PhD-students, 20 postdocs, 2 longterm guests, and 2 tech/adm)
- 5 PhD-students finished their degrees in 2004

CMA received

- 6 long term international visitors (stays of more than 3 months), and 82 different international guests on short-time (less than 3 months) visits (some of them twice or more). These 88 international guests represent 20 different countries
- more than 300 different Norwegian guests (short-time), many of them several times, participating in our events (workshops, conferences, and seminar series) or collaborating with our members.

Total revenues of 2004 were MNOK 38,5 (RCN main funding: 10,5 , UiO: 14,3, SINTEF: 1,1, RCN other: 8,0, EU: 2,0, Other public: 2,0, Private: 0,6)

CMA members published:

- 89 refereed articles in international journals,
- 6 books
- 13 book chapters
- 58 scientific reports, preprints, contributions, proceedings etc (not refereed),

CMA members gave

- 15 scientific talks in Norway outside CMA,
- 139 scientific talks abroad, in 24 different countries

CMA arranged

- 11 conferences/workshops with 356 participants (57 international, 113 national, and 186 CMA-members), in which 134 scientific talks were given:
  - 50 by CMA members,
  - 34 by national guests,
  - 50 by international guests,
- 8 seminar series, in which 75 scientific talks were given:
  - 32 by CMA members,
  - 16 by national guests,
  - 27 by international guests.
- 4 lecture series on selected topics, in which 96 lectures were given, all by CMA-members

Finally CMA also co-arranged 11 other international workshops and conferences.

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SUMMARY

Overall remarks and main impressions of 2004

2004 was the first full year of centre activity. CMA was established on March 1, 2003, but entered the new centre premises half a year later. Although we reported on enthusiasm and a good start in the 2003 report, we particularly emphasized the increased activity level at the end of the year. The co-localization was vital to us, and in 2004 we have constantly grown, both with respect to all possible key figures as well as in research quality. We are as enthusiastic as ever, and we are grateful to the Research Council of Norway (RCN) and to our host, the University of Oslo, for providing excellent conditions so that we may continue to perform important research and research training.

We choose to emphasize the following as a main summary of 2004:

- We have obtained outstanding research results on many parts of our research plan. Our experience is that the plan is well founded, and still serves as intended with challenging, but realistic goals.
- Since the very beginning we have focused on establishing new research relations, and throughout the whole 2004 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 is well adjusted to the the plan.
- Several seminar series and workshops have been arranged with extensive external participation. Numerous guests have been received. CMA members have participated and contributed to research events in all parts of the world. We have entered national and international binding cooperation. Hence we regard ourselves highly active and visible on the national and international scene of mathematics and its applications.
- The cooperation with SINTEF as active partner on more industrial related research is well established and fruitful to both parts.
- 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 outperform all financial estimates of the original plan, and we have reached a revenue/cost balance in 2004. Total revenues in 2004 were MNOK 38,5 compared to 31,8 in the original budgets. Conservatively estimated revenues for 2005 are adjusted to MNOK 40,0 (compared to 33,5 in the original budget).
- Several successes in generating new activity/projects are described in this report. We will specifically highlight the YFF-grant of our Professor Kenneth Karlsen, and the «Transfer of Knowledge»-project «CENS-CMA» (within EU's framework programme 6) in cooperation with Centre of Nonlinear Studies in Estonia.

Selected research highlights

The paper «Mean value coordinates» by Michael Floater, published in the March 2003 issue of CAGD (mentioned in last year's report) was selected by International Science Indicators as a «Fast Breaking Paper» in the field of Computer Science in December 2004. Every two months the ISI select one highly cited paper from each of 22 scientific fields out of the articles in their database of over 6,500 journals. The paper offers a fast and safe method – a simple, but truly novel discovery - for computing a parametric representation of a surface initially given as a mesh of triangles. This is a crucial step in, for example, reverse engineering (converting a cloud of measured sample points to a CAD model) and in texture mapping for visualization in computer graphics. Other researchers use it either directly or as the start point for more sophisticated methods.

Professor Bernt Øksendal and the stochastic analysis group of CMA have developed several new results in the theory of mathematical finance, and thereby received a lot of international attention. Of particular interest has been new knowledge on insider trading in financial markets. We now know that even a small amount of information about, say, the future values of a stock can be used to obtain a huge profit for a trader with access to such information (an insider, for short). Moreover, in some cases the optimal portfolio for an insider can be computed explicitly, and often it turns out to deviate dramatically from the optimal portfolio for a trader without such information about the future (an honest trader, for short). Thus the trading strategy of an insider is often quite conspicuous if the insider trades optimally. This knowledge makes it easier to detect and prove when insider trading has taken place.

Continuously operated clarifier-thickener units for the solid-liquid separation of suspensions are widely used in chemical engineering, mineral processing, the pulp-and paper and food industries, and wastewater treatment. Professor Kenneth Karlsen is involved in an ongoing program related to the formulation and analysis of new mathematical models for continuous sedimentation-consolidation processes of flocculated suspensions in clarifier thickener units. Many results have already been obtained and will appear in various international journals, and in time they will be integrated in real industry activities.

Postdoc fellow Snorre Christiansen has established a close connection between the finite element spaces used in electromagnetics and the Regge calculus proposed for approximations of Einstein's equations of general relativity. Computational relativity is one of the most challenging numerical problems of our time. Christiansen's paper makes an unexpected connection between Regge calculus and the much better understood theory of Whitney forms. The use of Whitney forms in computational electromagnetics has revolutionized the field. There is reason to hope that the connection Christiansen has obtained will be an important step towards a similar revolution in computational relativity.

Main challenges at the beginning of 2005

The main challenge and first priority is to implement 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.

A main concern is the renewal of our project portfolio, especially with respect to individual grants. Presently such grants seem to become harder to obtain within the RCN-system, and the academic profile of CMA hardly fits the larger programmes of RCN. We have joined forces with the rest of the mathematical community of Norway in order to work towards the establishment of a national programme dedicated to mathematics and its numerous applications.

Furthermore we are constantly working towards the EU system and its different Marie Curie instruments, which also may provide training positions. Training of new researchers is a main goal of CMA, and does not interfere with the core research of the centre. On the contrary, the more fellows entering the CMA community, the more research will be carried out.

In 2004 we have improved on media visibility with appearances in radio, newspapers, and magazines, but still these efforts need more focus.



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 around computational astrophysics and computational quantum mechanics. However, in addition to preserving 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 interdisciplinary research activities where we focus on the interplay between

i) computational geometry and algebraic/differential geometry
ii) computational geometry and differential equations
iii) stochastic analysis (specifically mathematical finance) and differential equations
iv) stochastic analysis (specifically mathematical finance) and physical sciences
v) differential equations and computational quantum mechanics.
vi) differential equations and astrophysics

During 2003 and 2004 we have carried out a number of actions to stimulate such activity. First of all, in the announcements for new PhD and postdoc positions, we have given candidates with an academic profile and interests in the directions of such combined topics high priority. Based on the same reasoning we have also encouraged the PhD fellows to select their two supervisors from different research groups. As a consequence, most of the candidates which have been hired for these positions are working on 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. Examples are workshops on numerical astrophysics, computational finance and physics, multiscale modeling, and a workshop covering the interface between mathematical properties of the Schroedinger equation and quantum mechanics. In addition we have run a weekly seminar, the CMA seminar, were we have focused on possible interdisciplinary research problems. All these events are further described in the sections below

Of course not all the scientific results reported below reflect the CMA focus on interdisciplinary research. It takes time to build new research activity, and at the same time it is important that activity in well established fields is maintained. However, especially on i), iii), and v) in the list above we see a significant increased activity, and the first real research results have appeared. Also for ii) and iv) collaborations are established, events have taken place, or fellows are engaged, but results and reports are still premature. In 2005 we will pursue initiatives towards establishing real new activity in vi), in addition to the continued focus on the areas above.

Main scientific results

Geometry

The activity in geometry is focused around 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.

Together with representatives from the European network in algebraic geometry, EAGER, Ragni Piene and the Nice partners from the EU-funded IST-FET GAIA II project organized the conference Algebraic Geometry and Algebraic Modeling that took place in Nice in September. The aim of the conference was to present new results, algorithms, developments and applications of effective algebraic geometry in geometric modelling. The proceedings from the conference will be published in 2005.

Piene, her PhD students Pål Hermunn Johansen and Heidi Mork, and her two master degree students, have all been continuing the study of the topology and singularities of real algebraic curves and surfaces, with an eye towards applications in CAGD. Preliminary results have been presented at workshops and in lectures, and as deliverables to the GAIA II project.

Piene spent one month at MSRI in Berkeley, participating in the programs Differential Geometry and Topological Aspects of Real Algebraic Geometry.

Tor Dokken has continued the work on approximate algebraic methods within the GAIA II project. The original approach to approximate implicitization was based on products of polynomials represented in bases that are a partition of unity over the domain of interest. The theory has now been extended by Jan B. Thomassen and Dokken to include a sampling based approach and weak approximate implicitization based on integration over the domain of interest. Together with Pål Hermunn Johansen, Dokken has also developed a theory for foot point calculations for rational parametric surfaces by moving algebraic surfaces. This is a result where insight from algebraic geometry aids both understanding and development of new and promising approaches to challenging CAGD-problems.

SINTEF has been granted funding by The Research Council of Norway for the strategic research project «Graphics Hardware as a High-End Computational Resource» under contract number 158911/I30 for the period 2004-2007. Tor Dokken is the project leader, and Michael Floater supervises two PhD students that are funded by the project. Results from the first year of the project are very promising with speed-up factors of 20 for typical algorithms implementing forward difference schemes for partial differential equations. A 2 day workshop on the potential of the GPU took place at CMA in November 2004 with 40 participants representing both academia and industry.

Michael Floater has begun an investigation of the effect of parameterization on parametric curve fitting. Roughly speaking, the main result is that chord lengths are fine for low degrees, but not accurate enough for higher degrees. More precisely, the chordal parameterization gives full approximation order when fitting polynomials of degree at most three. This result has been extended in two different ways: (1) the result for cubic polynomials extends to C2 cubic spline interpolation, i.e., chordal parameterization gives fourth order accuracy; and (2) using an iterative algorithm, a parameterization can be computed which supports polynomial interpolation of any degree.

The paper «Mean value coordinates» by Michael Floater, published in the March 2003 issue of CAGD (mentioned in last year's report), was selected by International Science Indicators as the «Fast Breaking Paper» in the field of Computer Science in December 2004. For further information and a «mini-interview», see www.esi-topics.com/fbp/fbp-december2004.html

The two postdocs Tatiana and Vitaly Surazhsky have continued their work in geometric modelling. They have developed a new method for sampling planar curves based on an analysis of curvature and an exact method for computing geodesic curves on triangular meshes. The latter is being published jointly with Hugues Hoppe and Steven Gortler.

Atgeirr Flø Rasmussen and Michael Floater have jointly explored the use of PDE's to compute surface parameterizations with certain desirable properties. They have also developed a general algorithm for estimating the length of a parametric curve using only point evaluations, which would be an advantage if derivatives were expensive or impossible to compute.

Regarding mesh-based modelling, Christopher Dyken and Michael Floater have written a preprint about their discovery of a simple method of determining a unique choice among all possible Delaunay triangulations of a given set of points in the plane. This method could potentially have several applications, but one at least is to triangulation-based methods for compressing digital images in which the uniqueness of triangulations is critical to minimizing the amount of data needed to represent the approximate image.

The research activity of Tom Lyche has been on condition numbers for the Bernstein-Bézier basis using mixed norms, and Hermite Subdivision for constructing curves and surfaces with prescribed shapes.

Lyche and Floater organized the CMA-sponsored workshop on Subdivision Curves and Surfaces during 2-3 Dec. 2004, with about 40 participants from Norway and abroad.

Tom Lyche was co-editor of «From Object-Orientation to Formal Methods, Essays in Memory of Ole-Johan Dahl» published by Springer. This book was reviewed in the February 2005 issue of «The Times Higher Education Supplement».

Trond Brenna defended his PhD dissertation «Data Reduction on Cubical and Spherical Domains Using High Dimensional Tensor Splines».

An important research topic for Knut Mørken in 2004 was zeros of spline functions. Together with PhD-student (now post. doc.) Martin Reimers, he developed a new method for finding zeros of univariate spline functions, and gave a detailed analysis of its convergence. The method may be viewed as a discrete version of Newton's method. It converges just as quickly as (and often more quickly than) the classical Newton's method, but requires no starting values. Since polynomials are special cases of splines, this also provides a new method for finding real zeros of polynomials. Work continues to try and exploit this method for finding zeros of tensor product spline surfaces.

Reimers defended his PhD dissertation «Topics in Mesh Based modelling» in September. In addition to the work on zeros of splines, the thesis covered a variety of topics including wavelets, parameterization, simulations of airflow in the nose and a new algorithm for estimating geodesic distance on triangular meshes.

In 2004, Mørken has also started collaboration with the Interventional Centre at the National Hospital in Oslo. The aim of the project is to develop new techniques for visualising human organs which can aid in developing new surgery techniques. A major challenge is to efficiently unite data from different sources like MR, CT, X-ray and video to provide a better view of an organ than each one of these sources can provide on their own.

Together with Morten Dæhlen from the Department of Informatics, Marie-Laurence Mazure from Université Joseph Fourier (Grenoble, France) and Larry Schumaker from Vanderbilt University (USA), Mørken organised the Sixth International Conference on Mathematical Methods in CAGD that took place in Tromsø in July. The conference was attended by 140 scientists from all over the world and was also a celebration of Tom Lyche's sixtieth birthday.

The research activity in Linear algebra and optimization is led by Geir Dahl and falls into the two areas Combinatorial matrix theory (A), and Discrete optimization (B). In area A, Truls Flatberg defended his PhD thesis «Majorization and optimization related to graphs and (0,1)-matrices». The thesis, and some joint papers with Dahl, focus on combinatorial optimization problems in discrete tomography, an active research area related to the analysis of digitized images. Flatberg and Dahl have also simplified a proof of some results for graphical sequences. Dahl has studied properties of certain classes of doubly stochastic matrices and related polytopes, as well as the notion of majorization in connection with distances in trees.

In area B, Njål Foldnes defended his PhD thesis «Polyhedra and algorithms for some knapsack problems and hop-constrained paths». The thesis contains a study of classes of knapsack polytopes and is motivated by applications in mobile communication systems. One of the published papers, which is joint work with Dahl and L.Gouveia, presents new completeness results for hop-constrained walk polytopes. Dahl has also co-authored a survey paper on hop-constrained spanning tree problems.

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.

The stochastic analysis group,
(i) organized the 11th Workshop on Mathematics and Economics in Oslo in
(ii) co-organized the workshop «New Techniques in Stochastic Analysis» held in Espoo, Finland 16-18 August 2004 and of the
(iii) co-organized the SAMSA Conference 2004, held in Polokwane, South Africa 29 November-2 December 2004.

The research of CMA in stochastic analysis has been focused on stochastic partial differential equations, various types of stochastic control and Malliavin calculus for Lévy processes, and their applications, especially to finance.

Fred Espen Benth and Jurate Saltyte-Benth have analyzed temperature data collected from several Norwegian cities, and propose a mean-reverting stochastic process with a seasonal volatility to model the dynamics. The suggested model is simple enough to provide explicit expression for interesting forwards and options written on temperature like CAT-forwards and European call and put options on these. At the same time, the model is able to capture most of the observed stylized facts, most notably, the seasonality in the squared residuals after regressing the temperatures. The work is now under generalization to include pricing of HDD and CDD forwards and options on these. A spatial version of the model is also under investigation. The work was accepted for presentation on the 3rd World Bachelier Conference on Mathematical Finance.

Fred Espen Benth and Thilo Meyer-Brandis have calculated explicitly the density process for the minimal entropy martingale measure in a non-Gaussian Ornstein-Uhlenbeck stochastic volatility model proposed by Barndorff-Nielsen and Shephard. An integro-Black & Scholes equations is derived yielding the price of options. To solve this equation, one needs to resort to numerical methods, currently under investigation by Groth.

Fred Espen Benth and Kenneth Hvistendahl Karlsen have considered a stochastic portfolio problem of the classical Merton type, where the risky asset follows an exponential mean-reversion process rather than a geometric Brownian motion. A classical solution of the portfolio problem is obtained and verified for a time interval depending on the parameters. Outside this interval, there is not enough regularity to verify the solution.

Giulia Di Nunno has been working on stochastic anticipating Malliavin/Skorohod calculus for Levy random fields on a general topological space. Levy random fields are a very general set up which includes as special cases the Brownian sheet and Levy processes (and thus both the Brownian motion and the compensated Poisson random measures), all widely used in applications to finance and to physics. She has introduced a class of orthogonal polynomials, studied their properties and used them in the construction of the integral and derivative operators. Particularly interesting and completely innovative are two suggested versions of these operators in which,on one side, the structure of the Skorohod integral can be recognized as limit of certain Riemann sums and, on the other side, the anticipative structure of the Malliavin derivative is shown.

Giulia Di Nunno, Thilo Meyer-Brandis, Bernt Øksendal and Frank Proske have worked on the modeling of insider trading via forward integration. In particular they have extended the techniques of forward calculus, which were originally designed for Brownian motion, to Levy processes.

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.

Tom Lindstrm has worked on Levy processes from a nonstandard point of view. He has shown how to construct a hyperfinite Levy process as an infinitesimal random walk and developed the basic theory for such processes. The standard parts of the hyperfinite Levy processes are the classical Levy processes.

Klara Hveberg has been working on self-homeomorphic fractals. She has shown that a number of seemingly different separation properties actually coincide, and she has also developed several methods for constructing self-homeomorphic fractals.

Bernt Øksendal, Francesca Biagini, Agnés Sulem and Naomi Wallner have studied the Malliavin calculus and white noise theory for fractional Brownian motion. Such processes are interesting because of their many applications in finance (weather derivatives, electricity pricing) and other areas (e.g. turbulence).

Bernt Øksendal and Agnés Sulem have continued their cooperation on two research areas:
(i) The use of anticipative calculus and Malliavin calculus in problems of optimal stochastic control with partial information in an anticipating environment (e.g. a market influenced by insiders) and
(ii) various types of stochastic control problems (including optimal stopping, impulse control and singular control) for jump diffusions and their applications, mainly to finance.

Giulia Di Nunno, Bernt Øksendal and Frank Proske have developed a white noise theory for Levy processes and for compensated Poisson random measures. The results are applied to minimal variance hedging in the incomplete markets driven by Levy processes.

Nils Christian Framstad, Bernt Øksendal and AgnésSulem have obtained a maximum principle for optimal control for jump diffusions. The results are applied to solve mean-variance hedging problems in finance.

Arne Løkka, Yaozhong Hu, Bernt Øksendal, Frank Proske and Tusheng Zhang have studied two different types of stochastic partial differential equations:
(i) Those driven by Levy space-time white noise [LØP] and
(ii) those driven by multi-parameter fractional white noise [HØZ]
In both cases the theory is used to solve certain stochastic partial differential equations explicitly.

Sure Mataramvura, Bernt Øksendal and Frank Proske have studied the Donsker delta function for Levy processes and used it to obtain the chaos expansion of local time for such processes. The local time often appears in the solution of singular stochastic control problems.

The big European research project «Advanced Mathematical Methods in Finance» (AmMaMeF), involving 15 European countries, was approved by the European Science Foundation (ESF) in 2004 and it will start in 2005. The stochastic analysis group at CMA is heavily involved in this project, in which Bernt Øksendal og Giulia Di Nunno are elected project Chair and project co-Chair, respectively.

Differential Equations
Mathematical modelling and numerical simulations have 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.

A common theme of the work of Snorre Christiansen, Runhild Klausen, and Ragnar Winther is numerical methods for partial differential equations, in particular finite element methods, mixed methods and finite volume schemes. As a continuation of his earlier work, Christiansen has developed a discrete Fredholm theory to obtain convergence estimates for approximations of the integral equations from electromagnetics close to resonant frequencies. In another fascinating paper he has established a close connection between finite element spaces design for electromagnetics, i.e. the Nedelec spaces, and the Regge calculus developed for discretizing the Einstein's equations of general relativity. Another link to Einstein's equations can be found in Christiansen's joint work with Winther on the Yang-Mills system, where approximate constraint preservation for various discrete schemes is studied.

Runhild Klausen holds a joint post.doc. position at CMA and another Norwegian centre of excellence, Centre for Integrated Petroleum Research (CIPR), at the University of Bergen. The idea behind the cooperation between the two centres is to join forces on problems related to partial differential equations in the petroleum activity. Klausen's research, partly joint with researchers at CIPR and with Tom Russel, University of Colorado, Denver, has lead to improved understanding of some of the locally conservative discretization schemes developed by the oil industry.

Xue-Cheng Tai's work work has been focused on the use of partial differential equations and level set methods for image processing and inverse problems. For example, in joint papers with Tony Chan and Stanley Osher, UCLA, Los Angeles, and others, he has performed various studies of the effect of nonlinear regularization procedures for these problems. Per Christian Moan is working on a time averaging theory for discrete dynamical systems. In particular, he has studied the relation between geometry preservation of discrete schemes and their conservation properties.

Currently we can divide the research activity of H. Holden, K. H. Karlsen, and N. H. Risebro, together with G. M. Coclite and M. Bendahmane, into 6 main themes.

Degenerate parabolic equations:
Bendahmane and Karlsen have introduced a new notion of entropy solution and proved an existence and uniqueness result for doubly nonlinear anisotropic degenerate parabolic equations, supplemented with an initial condition and a homogeneous Dirichlet boundary condition. Because of the considered generality, solutions will in general develop discontinuities, even when the initial date are smooth. Hence it becomes necessary to interpret the equation in the weak sense. However, an additional selection criterion, a so-called entropy condition, is needed to single out a unique weak solution. .

With G.-Q. Chen at Northwestern University, Karlsen has studied the existence and uniqueness of discontinuous entropy solutions to quasilinear anisotropic degenerate parabolic equations with explicit (t, x)–dependence. A well-posedness theory for the Cauchy problem for such degenerate equations has been established via Kruˇzkov's device of doubling variables. Moreover, we have established a continuous dependence estimate for perturbations of the diffusion and convection functions. This is the first time such a well-posedness theory (in classes of discontinuous functions) is obtained when the second order operator contains an explicit spatial dependence.

With Coclite, Holden has studied stability of solutions of quasilinear parabolic equations. The goal is to obtain explicit norm estimates of differences between two solutions when one varies the initial data as well as the parameters in the equations. Partial results have existed, but Coclite and Holden provide explicit bounds in the general quasilinear, multidimensional case.

Discontinuous flux problems/sedimentation models:
Continuously operated clarifier-thickener units for the solid-liquid separation of suspensions are widely used in chemical engineering, mineral processing, the pulp-and-paper and food industries, and wastewater treatment. With R. Bürger at the University of Stuttgart and J. D. Towers at Mira Costa College (San Diego), Karlsen has formulated and analyzed a new mathematical model for continuous sedimentation-consolidation processes of flocculated suspensions in clarifier-thickener units. The model consists of scalar, strongly degenerate parabolic equation in which both the convective and diffusion fluxes depend on parameters that are discontinuous functions of the depth variable. The initial value problem for this equation is analyzed. We have also introduced a simple finite-difference scheme and proved its convergence to a weak solution that satisfies a certain entropy condition.

Shallow water equations of Camassa-Holm type:
Coclite, Holden, and Karlsen have studied existence and uniqueness of solutions of the so-called generalized hyperelastic-rod equation. This equation can be considered a generalization of the Camassa-Holm equation. The Camassa-Holm equation has many special properties, for instance it is completely integrable, that do not carry over to the hyperelastic-rod equation. In a special case, the equation has been used by Dai as a model for small amplitude radial deformation waves in cylindrical compressible hyperelastic rods. Coclite, Holden, and Karlsen introduce a regularized version of the generalized equation, and show existence and uniqueness of solutions of the regularized equation. Furthermore, they show that the solution is stable when the regularization vanishes.

Holden has with X. Raynaud of the Norwegian University of Science and Technology showed how to obtain solutions of the Camassa-Holm equation as limits of a particular finite difference scheme. Their result covers the period case when the initial data gives a global solution. No rigorous numerical methods have been known for this equation prior to this result. Raynaud and Holden have also shown how solutions of the Camassa-Holm equation can be obtained as limits of multipeakon solutions when the number of peakons increase. This result also provides an efficient numerical method to compute the solution, and is valid in the case where a global solution exists.

Nonlinear Hammerstein type equations:
In collaboration with Prof M. M. Coclite (University of Bari-Italy), Coclite worked on Dirichlet problems for integrodifferential equations of elliptic type with singular nonlinear term in the origin. These problems can be rewritten as integral nonlinear equations of Hammerstein type.These ones arise, more or less directly, in a variety of settings: semilinear boundary value problems with a nonlinear term depending on the reciprocal of the solution, mathematical models of signal theory, ecological models, continuous extension of the results on double stochastic matrices, and Boussinesq's equation in filtration theory.

Integro-partial differential equations/stochastic control theory/finance:
With E. R. Jakobsen of the Norwegian University of Science and Technology, Karlsen has developed a very general framework for deriving continuous dependence estimates for possibly polynomially growing viscosity solutions of fully nonlinear degenerate parabolic integro-PDEs. This framework has been used to provide explicit estimates for the continuous dependence on the coefficients and the «Levy measure» in the Bellman/Isaacs integro-PDEs arising in stochastic control/differential games. Moreover, these explicit estimates are used to prove regularity results and rates of convergence for some singular perturbation problems. The results have also been applied to some integro PDEs arising when pricing European/American options in an incomplete stock market driven by a geometric Levy process. Many of the results obtained are completely new, even in the convex case where stochastic control theory probably provides an alternative to our pure PDE methods.

With E. R. Jakobsen, Karlsen has also proved error estimates for a commonly used operator splitting method for degenerate parabolic equations with source terms, which are equations that are related to Bellman's equation from optimal stochastic control theory. The error estimates are derived within the framework of viscosity solutions, are thus robust with respect to the (lack of) regularity of the solutions.

Benth and Karlsen have studied Merton's classical portfolio optimization problem for an investor who can invest in a risk-free bond and a stock, so that expected utility from terminal wealth is maximized. The special feature of the problem studied is the use of Schwartz mean-reversion model for the dynamics of the risky asset. This gives raise to a Bellman equation which we solve to obtain the explicit trading strategy and an expression for the value function.

With L. Holden of the Norwegian Computing Center and S. Holden of the Dept. of Economy at the University of Oslo, H. Holden has completed a study of a model in differential games. The system can be considered as a model for contract adjustment under uncertainty between two players. At each point in time of the players can demand a contract negotation, readjusting the payment according to an underlying stochastic process. Adjusting the payment carries an exogenous fee to both players. The existence of Nash equilibria is discussed, and numerical calculations are included.

Harmonic maps:
Bendahmane and Karlsen have studied anisotropic nonlinear elliptic systems with measure data and anisotropic harmonic maps into spheres. Existence results for distributional solutions of anisotropic nonlinear elliptic systems with a measure valued right-hand side are provided. The functional setting involves anisotropic Sobolev spaces and weak Lebesgue (Marcinkiewicz) spaces. Some maximal regularity and uniqueness results are proved as well. The obtained results are applied, along with an anisotropic variant of the div-curl lemma in the Hardy one space, to prove that the space of anisotropic harmonic maps into spheres is compact in the weak topology of the relevant anisotropic Sobolev space.

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.

In total CMA has organized four different workshops and meetings during 2004 related to computational aspects of quantum mechanics. Last year marked also the establishment of a large collaboration on computational many-body physics between CMA and the department of Physics in Oslo and Oak Ridge National Lab (ORNL) and Michigan State University (MSU) in the USA. This collaboration counts at presently 15 researchers in Norway and the USA, with several PhD students and master students and spans from quantum chemistry, to 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 since june 2004. More detailed information on these activities are summarized below.

The methods we study are
1) Variational and diffusional Monte Carlo methods.
2) The solution of the time-dependent Schroedinger equation using finite element methods.
3) New algorithms for many-body systems based on concepts from quantum computing and quantum information theory.
4) Non-perturbative resummation of large classes of diagrams in many-body physics, especially coupled cluster and parquet diagrams techniques.
5) Large scale diagonalization techniques, with special emphasis on the nuclear many-body problem.
6) Many-body perturbative approaches to weakly bound systems.

The three first research areas given here are all partly new activities in Oslo, where several master students and CMA fellows so far are doing a major part of the work. Focusing on these research fields at the boarder line between physics, mathematics, and partly chemistry, reflects the research plan of the CMA, and represents a joint activity between the quantum mechanics group and the CMA groups in stochastic analysis and differential equations.

Variational (VMC) and diffusional (DMC) Monte Carlo methods
Four students obatined their master degrees last year and all four have continued with PhD studies in Oslo or Bergen. Topics which has been studied include ground state of atoms with charge $Z < 40$, ground state properties of quantum dots with up to 20 electrons, Bose-Einstein condensation of dilute atomic gases with the inclusion of vortices, and ground state of light nuclei. Of interest for our research program is development of Monte Carlo codes in order to handle systems of interest for applications in materials science and nano-technology. A workshop on Computational finance and physics, with an emphasis on Monte Carlo methods was held at CMA in march 2004.

The solution of the time-dependent Schroedinger equation using finite element methods.
Simen Kvaal (master thesis march 2004) started as a PhD student at the CMA in may 2004. The focus of his thesis is on studies of finite element methods applied to the solution of the time-dependent Schroedinger equation. This is currently of great interest due to the developments in ion-trap experiments and the capability to isolate electrons (quantum dots) or atoms in small confined regions of space. This field has important consequences for future development of quantum circuits and our basic understanding of the quantum dynamics of single trapped particles.

New algorithms for many-body systems based on concepts from quantum computing and quantum information theory.
Eirik Ovrum is a PhD student at CMA. The topic of his thesis is to implement algorithms from quantum information theory in order to study their suitability for dealing with many-body systems. This is a collaboration with the Jon Magne Leinaas at theory group at the Department of Physics at the UiO.

Non-perturbative resummation of large classes of diagrams in many-body physics
This project defines the collaboration between Oak-Ridge national laboratory, the UiO and Michigan State University at East Lansing.

This project has already resulted in several articles and invited contributions to conferences and workshops, amongst these the International Nuclear Physics conference held in Gothenburg in 2004 (INPC2004) and the international conference on Exotic Nuclei and Atomic Masses (ENAM04) held in Pine Mountain, Georgia, USA. The project centers on the coupled cluster method and the people involved are

1) ORNL : Prof. David Dean (also adjunct professor at CMA), Drs. Thomas Papenbrock, David Bernholt (Computer Science division) and Robert Harrison (Computational Chemistry)
2) Michigan State University, Department of Chemistry: Prof. Piotr Piecuch and Drs. Karol Kowalski and Marta Wloch and graduate student Jeffry Grour.
3) UiO: Profs Torgeir Engeland, Morten Hjorth-Jensen and Eivind Osnes (UiO/CMA), PhD students Elise Bergli, Maxim Kartamychev (UiO/CMA) and Gaute Hagen (UiB/CMA).

The project was started in the fall of 2003 to spring 2004, and we do expect several years of fruitful scientific collaborations with an emphasis on the nuclear many-body problem and related topics. 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 and finally
c) extend these methods to studies of infinite matter. Maxim Kartamychev is involved with studies of three-body forces, Gaute Hagen has worked on weakly bound systems, while Elise Bergli works on related many-body topics for infinite matter.

We have recently performed the very first coupled cluster calculation of nuclear systems with valence particles. These results are to be published in a forthcoming Physical Review Letters article. The ab initio coupled cluster theory is a particularly promising candidate for studies of nuclei due to its enormous success in quantum chemistry. Our two recent 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. Our codes have now been extended so that we can deal with more than 800 active single-particle states.

A workshop on Advances in computational aspects in the nuclear many-body problem was held march 2004 at CMA. David Dean (ORNL/CMA) and Morten Hjorth-Jensen (CMA) organized also a three month workshop at the Institute of Nuclear Theory, University of Seattle, Washington, from september 27 till december 3. The other two co-organizers were Bruce Barrett (UA, Arizona) and James Vary (Iowa State).

Large scale diagonalization techniques, with special emphasis on the nuclear many-body problem.
Here we have continued the development of our shell-model code for diagonalizations of large systems using the Lanczos iteration scheme, of special mention is our recent parallel version of the shell-model code developed in Oslo. Many of the applications are done in close collaboration with experimentalists and theorists in the USA and in Europe. Dean, Engeland, Hjorth-Jensen, Kartamychev and Osnes published in 2004 a long review article in Progress of Particle and Nuclear physics, see also the previous point. Maxim Kartamychev was employed in 2004 as a PhD student at the Department of Physics and works on this project as well. His thesis project deals with the implementation of three-body interactions in our shell-model code and studies of such interactions for the coupled cluster method mentioned above. He is associated with CMA.

Many-body perturbative approaches to weakly bound systems.
Due to the forthcoming large investments in the USA on the Rare Isotope facilities there is a strong need for developing techniques for handling weakly bound systems. The last year, together with PhD student Gaute Hagen from the University of Bergen and associated with CMA, we have developed tools for studying effective interactions for weakly bound systems based on many-body perturbative approaches. These interactions will also be used in our applications of the coupled cluster method discussed above. He defends his thesis april 2005 and begins as a post-doc at Oak Ridge National Lab in june 2005.

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 estimating correlation-functions of stochastic fields.

The dynamics of the outer Solar atmosphere is driven by the interaction of magnetic fields with convection in the outer one third of the Sun. We have studied the diagnostics of these processes by performing detailed magnetoconvection simulations. The results were presented at meetings and in a paper in Astrophysical Journal Letters, «Observational Manifestations of Solar Magnetoconvection: Center-to-Limb Variation».

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 2004.

While we concentrated attention on modeling of wave propagation in the Sun's chromosphere in 2003, 2004 has seen our efforts extend to the more realistic physical processes needed to model the Solar atmosphere, from convection zone to corona, as a single dynamical unit. This requires that both radiative processes and thermal conduction be included in the evolving models.

Another, time consuming, prerequisite is the construction of proper initial models of the Solar atmosphere on which physical and numerical experiments may be performed. In June some of these models were presented at IAU's Symposium 223 in St Petersburg. Viggo Hansteen and post doc Boris Gudiksen are currently 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 Eirik Endeve's PhD thesis «Helmet Streamers Gone Unstable» numerical studies of the expanding corona, both open and closed, were made using a version of the 3D code described above. The understanding gained from this thesis, as well as from our studies of the transport processes in plasmas described below was in 2004 incorporated into a numerical study of the expulsion of the element Helium from the Sun in the Solar Wind. This work, «Helium release from closed field regions of the Sun» has been accepted for publication by the Astrophysical Journal. 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.

Finally, a new set of transport equations for fully ionized gases that was partially developed last year has been completed and implemented in a numerical code by PhD students Marit Janse and Mari Anne Killie under the guidance of Egil Leer. This has resulted in a paper, «Describing the flow of fully ionized, magnetized gases: Improved gyrotropic transport equations», that has been accepted by the Journal of Plasma Physics.

In cosmology, the important results by Eriksen, Hansen, Banday, Gorski& Lilje (2004) showing an anisotropy between hemispheres in theWilkinson Microwave Anisotropy Probe (WMAP) data that were reported inthe annual report of 2003 have been supported by several studies andhave cought widespread interest. In a more detailed study of N-pointcorrelation functions, Eriksen, Banday, Gorski & Lilje (2005, in press) 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. Also, the results of Eriksen, Novikov, Lilje, Banday & Gorski (2004) that the Minkowski functions of the WMAP first year data show significant non-gaussianities have been comfirmed by others. Eriksen, Banday, Gorski & Lilje (2004) studied a method (called the ILC method) for foreground subtraction in CMB maps that been used by the WMAP team and found that it easily could be very significantly improved by the use of Lagrangian multipliers. This method is found to have strong limitations, but we also confirmed that several multipoles of the WMAPmaps have a very peculiar behaviour.

The main reason for the future Planck satellite is to measure the power spectrum of fluctuations in the universe and from them determining the cmain cosmological parametres. So far, all methods to acheive 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 indeeed feasible. Together with M. Chu and other collaborators, Eriksen has also improved these Gibbs sampling methods by using the Blackwell-Rao estimator. Such modern statistical methods seem to be most useful in astrophysical data analysis.

Main events

Workshop: Computational advances in the nuclear many-body problem
The aim of this workshop was to focus on recent advances in computational aspects of the nuclear many-body problem, emphasizing algorithms, and challenges from experiments, from weakly bound systems to heavy-ion physics and dense matter.

The main topics were
- no-core effective interactions and effective interactions for intermediate nuclei
- Ab initio calculations, GFMC, no-core shell-model diagonalization,
- coupled-cluster theory.
- Shell-model studies for intermediate nuclei
- Dense matter studies, from relativistic heavy-ion collisions to neutron stars
- Weakly bound systems
- Topics from other fields, many-body methods in quantum chemistry
- Recent experimental advances
- Computers in Science education

Within this context we also celebrated Torgeir Engeland's 70th birthday and more than 40 years of work in theoretical nuclear physics, spanning from collective models to large-scale shell-model calculations. During the last 15 years, Torgeir has been pivotal in the development of the Oslo shell-model code. He is a dedicated computational physicists with an interest in essentially all aspects of computations, from computing and educational topics to the nuclear many-body problem.

Workshop: Computational Finance and Physics
The workshop focused on computational methods and their analysis for problems arising in finance and physics. Particular emphasis was put on the development and application of various types of Monte Carlo methods. The speakers had background in physics, statistics, probability, finance, and partial differential equations, and the main purpose of the workshop is to promote discussion across these disciplines.

Topics addressed included
- American options and Monte Carlo methods
- Quasi-Monte Carlo methods in finance
- Spatial random fields and insurance
- Modeling errors versus Monte Carlo uncertainty in finance
- Numerical methods for Hamilton-Jacobi-Bellman (integro) partial differential equations and their convergence analysis.
- Variational and diffusion Monte Carlo methods in quantum physics with applications to many-body problems
- Path integral methods in quantum physics
- Monte Carlo methods in statistical physics
- Monte Carlo simulations in heavy-ion collisions

Workshop: Nonlinear PDEs: Theory, Numerics, and Applications
The workshop focused on theoretical and computational aspects as well as applications related to various types of nonlinear partial differential equations. Topics covered:
- Recent advances in linear transport equations with discontinuous coefficients.
- Derivation of the Vlasov Poisson system from Dirac-Maxwell.
- Numerical schemes for an asymptotic equation describing the director field of a nematic liquid crystal.
- The art of reconstruction: Trading accuracy against variation.
- Restoration and Segmentation of Images by using the Topological Gradient.
- Compensated Compactness property of some Finite Element spaces. Hyperbolic systems with relaxation: asymptotic stability of traveling waves.
- Some variants of the level set methods and applications to image segmentation and some other medical imaging problems.
- From the De Rham sequence to mixed finite elements for elasticity.
- Applications of strongly degenerate parabolic equations with discontinuous coefficients.
- Removability of a level set for solutions of quasilinear equations.
- Error bounds for monotone approximation schemes for Hamilton-Jacobi Bellman equations.

Workshop: Camassa-Holm and other nonlinear dispersive equations
In recent years the so-called Camassa-Holm equation has caught a great deal of attention. It is a nonlinear dispersive wave equation that models the propagation of unidirectional shallow water waves on a flat bottom. In another interpretation it models finite length, small amplitude radial deformation waves in cylindrical compressible hyperelastic rods. Also relatated is the so-called Hunter Saxton equation describing the director field of a nematic liquid crystal. The Camassa-Holm equation possesses many remarkable properties. To mention a few, it has a bi-Hamiltonian structure (an infinite number of conservation laws), is completely integrable, and has an infinite number of solitary wave solutions, called peakons due to the discontinuity of their first derivatives at the wave peak, interacting like solitons. The workshop focused on theoretical (existence, uniqueness, regularity, etc.) and numerical aspects of the Camassa-Holm and other related nonlinear dispersive equations.

Miniworkshop: Mathematical Aspects of the Schroedinger Equation
The aim of this miniworkshop was to spark off a seminar series on mathematical aspects of various quantum mechanical problems, spanning from time-dependent partial differential equations and few-body problems to methods for treating many interacting particles. The seminar series starts was given in the fall semester (Computational Quantum Mechanics, see below)

Internal seminar/workshop: Focusing the postdocs and PhDs of CMA
This two-day seminar focused on the research activity of the PhD-students and postdocs of CMA. The centre is fast-growing, not least with respect to the number of fellows. This is a pleasant situation. We clearly demonstrate an active and attractive research environment. However we see a clear demand for consolidating our activity, and to present to ourselves some representative parts of it. What research is actually conducted at the CMA? The seminar then presented a diversity of 16 representative presentations of the research activity conducted by CMA fellows. Socializing

and «teambuilding» were other aspects to the seminar, and these efforts are shortly presented under the Health, Environment and Safety section

Workshop: Mathematical Finance and Copulas - 11th Workshop in Mathematics & Economics
Topics covered included
- Modelling dependence of multidimensional Lévy processes
- Optimal strategic allocation under estimation risk
- Endogenous regimes in the real term structure of interest rates
- Stock Return Predictability in a Production Economy
- Applications of Lévy copulas
- The Pyramid distribution, its copula and Lévy process
- Patient ownership
- Insurance and opportunities: the welfare analysis of wage inequality with flexible labor supply

Workshop: Multiscale modeling, and applications in fluid flow and material science
Despite the capabilities of modern multi-processor computers, it is currently not possible to model physical processes with conventional numerical methods at the continuum scale and at the same time respect the constitutive laws at e.g., the atomistic scale. A new type of multiscale mathematical methods have therefore emerged which attempt to incorporate fine scale dynamics into the continuum models. These methods seek reduced computational complexity compared with microstructure models, and offer new insight into the impact of fine scale features on the large scale dynamics. Today, multiscale modeling and computation is one of the most active research areas in applied science. The aim of this workshop was to discuss various approaches to mathematical modeling of physical multiscale phenomena with weight on fluid flow and material science. The talks ranged from methodological developments to the use of multiscale methods in specific real-world applications. An application of special interest to the organizers is porous media flow, an area where we believe multiscale methods have reached a stage where they can be promoted to the industry. The final day of the workshop was therefore devoted to multiscale methods in petroleum engineering. The purpose was to create an arena where the Norwegian oil-industry can meet with representatives from the international research community working on multiscale issues of relevance for the oil-industry.

Industry Day: Modeling and analysis of risk in electricity markets - recent research results
Trading electricity is a volatile business. The CMA Industry Day guided the participants through the highlights of recent research on risk modeling and analysis of electricity markets, with a particular view towards the Nordpool market. The focus was on specifying stochastic models for the spot and forward/futures price dynamics, how to estimate these and techniques for pricing and hedging elctricity options. Through the day the participants learned advanced analytical and numerical techniques, including the Heath-Jarrow-Morton (HJM) approach, Monte Carlo simulations, risk measuring, currency risk, and copulas in multivariate modeling.

The CMA Industry Day also had an intended and clear public outreach profile, since we sought to create an arena where recent academia research results could be adapted quickly by relevant market actors. See a separate description on these aspects of the arrangement under a separate heading later in this report.

Industrial Workshop: GPU as a computational resource
The workshop was arranged as a part of the Strategic Institute Progamme «Graphics cards as a high-end computational resource», http://www.math.sintef.no/gpu/. The first day (Nov. 10) we will concentrate on the abilities of the GPU. The second day (Nov. 11) is devoted to aspects of GPU-programming. Topics covered include:
- The development of the GPU - From graphics card to programmable stream processor
- GPU-programming, high level overview
- Solving differential equations on the GPU
- Image processing and computer vision applications
- Geometry processing on the GPU
- Image inpainting using Navier-Stakes equations and surface fitting

Workshop: Subdivision curves and surfaces
Subdivision curves and surfaces are a generalization of the well-known spline representation of curve and surface models. They have been used extensively in computer graphics and have the potential to enhance current CAD systems. The purpose of this workshop was both to introduce the basic mathematical concepts to a general audience and to exchange ideas which could nurture future research collaboration. Topics covered include:
- Introduction to subdivision surfaces
- Local Corner Cutting
- Continuity analysis of univariate subdivision
- Shape analysis near extraordinary vertices
- Subdivision with transfinite boundary conditions
- Survey of Hermite interpolation using subdivision
- Hermite subdivision with shape constraints
- Factorization of spline subdivision matrices
- Approximation by subdivision curves: the role of parameterization

The CMA seminar Series 2004
This is the official seminar series of CMA It is intended for a rather broad audience with interests in mathematics and its applications. The activity of the seminar aims at keeping a balance between theory, computation, and applications. The seminar brings speakers from inside and outside of the centre, raising issues and exchanging ideas on topics of current interest, mainly connected to the research plan of the CMA. A goal of the seminar is to foster working relationships among mathematicians, computational mathematicians, and scientists from the applied fields and industry.

CMA Guest Lectures, 2004
This seminar at CMA is organized on a non-regular basis, and each speaker is announced here on the web page and by e-mail. The seminar features speakers that are guests of the members of the centre. A presentation, which may be specialized, is usually related to the research plan of CMA.

In addition to what has been mentioned above, ordinary weekly seminars and lecture series on selected topics have taken place at the CMA, covering topics like:
- Large Deviation Theory
- Computational Quantum Mechanics
- Informal seminar on Geometry and PDEs
- Symplectic Geometry
- Weak Convergence Methods and Recent Mathematical Theory for the Compressible Navier-Stokes Equations
- Nonstandard Stochastic Analysis and Applications to Finance
- Dynamic Asset Pricing theory

Appendix 5 provides the full list of workshops, seminar series, lecture series, and coorganized external workshops with details on talks, organizers, and participants.

MANAGEMENT AND ADMINISTRATION

Management philosophy

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.

However, we have chosen an angle of attack which we feel covers all three perspectives. We believe that our strategy, which we so far regard as successful, also contributes to increased research quality. In the Work environment survey conducted in the fall semester (see separate section), the CMA members were very satisfied with the research management of CMA. The strategy can be summarized as follows:

- 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

CMA is on the daily basis run by the manager, Professor Ragnar Winther, the deputy manager, Professor Geir Ellingsrud, and senior adviser and administrative leader Helge Galdal. These three constitute the leading group who have the power of attorney to make running decisions on practical matters, financial transactions, research activities within the frames of the budget and the research plan.

At the beginning of 2005 we have started the process of finding a new deputy manager, as Geir Ellingsrud will become vice dean of the faculty from 2006. On the advice from the principal investigator group (see below) we have asked Professor Fred Espen Benth to become the new deputy manager. He has accepted the «nomination». The CMA Board approved the decition in the meeting on March 10, 2005. We expect that he will start his duties on July 1, 2005.

For more principal decisions and commitments, the leading group 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, Fred Espen Benth, Helge Holden, Morten Hjorth-Jenen, and Mats Carlsson. This group has meetings when necessary, typically every second month. The group have 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:

- Descriptions 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

The Board

The board of CMA has for 2004 consisted of the following members:

- **Kjell Bendiksen**, chair, Managing Director of Institute of Energy Tecnology
- **Suzanne Lacasse**, co-chair, Managing Director of Norwegian Geotechnical Institute
- **Trygve U. Helgaker**, Professor at the Department of Chemistry, UiO
- **Birger Kruse**, Managing Director of the Faculty of Mathematics and Natural Sciences, UiO
- **Svein Longva**, Managing Director of Statistics Norway (until 2004), from 2005: State mediator of Norway

The CMA-board aims at being a professional administrative board, emphasizing strategic and control functions, and with clear instruction to handle budgets, accounts, and annual reports. 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 twice in 2004, on March 16 and June 16. According to original plans one more meeting was scheduled, in the autumn, but this was cancelled due to limited agenda items. For 2005 two 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 businesslike 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 any power to pass resolutions.

The main subject for the advisory board will be 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).

The group will play a crucial role when we revise the research plan in connection with the 2006 midterm evaluation process.

Administrative Support

CMA has one administrative employee, senior adviser Helge Galdal. He is a member of the centre management, 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» as follows:

- The «first line services», meaning incoming telephones, faxes, mail, reception etc are provided by the secretaries of The Department of Mathematics. They also cover CMA with accessories, minor equipment and so on, and CMA uses the channels and customer relations of the department for more extensive purchases and consultancies.

- All financial transactions are authorized by Ragnar Winther and Helge Galdal in common. The resolutions are executed by the secretary of economy at the Department of Mathematics, and he also provides help with budget and accounting analysis, reports etc.
- IT-support is essential, and CMA again share the resources of our host department
- The Department of Mathematics has employed one person dedicated to deal with non-scientific matters for guest researchers, exchange students and international doctoral or post doctoral fellows. She helps with housing, contact with bureaucracy, kindergarten arrangements and so on.
- PhD-students must apply and be admitted to the official PhD-program of the Faculty of Mathematics and Natural Sciences. During the three-year training period they regularly have to report on the progress. Upon dissertation there are several needs, appointing and organizing the evaluation committee as well as executing the event itself. All this requires administrative support, which are fully covered by the «closest» department in each case (Mathematics, Informatics, Physics, or Astrophysics).
- In order to provide secure and efficient handling of personnel matters (contracts, payment routines etc), we are totally dependent of the professional personnel administration provided by The Faculty administration. They have dedicated one person who is responsible for all CMA-matters.
- CMA is also covered by the Faculty administration to ensure a secure archive system.

All together it is our experience that we have established an effective administrative organization, not least with respect to cost issues. 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.

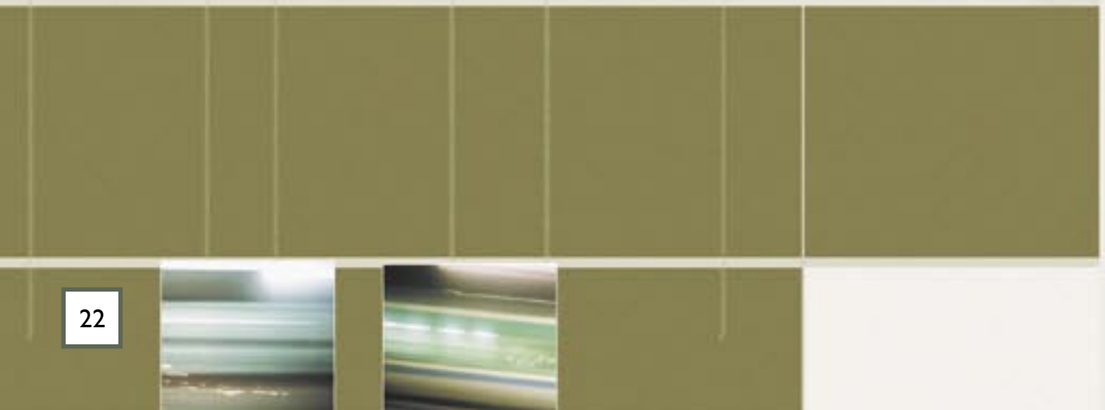
ECONOMY

Statement 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.

Total revenue and expenditure figures

Below the main figures are presented. The elements in this presentation are based on the original financial and cost plan of the CoE-contract. Hence we distinguish between the funding sources according to the guidelines of RCN. Furthermore we present the expenditures as salary costs (meaning wages and costs thereof), indirect costs, teaching services, equipment, and operational costs. More details, together with all notes, are presented in appendix 2 and 3.



Revenues	Contract Budget 2004	Adjusted Budget 2004	Final Accounts 2004	Contract Budget 2005	Adjusted Budget 2005
RCN	10 500	10 500	10 500	11 000	11 000
UiO funding	12 133	13 108	14 280	12 872	14 494
SINTEF	530	770	1 062	541	1 711
EU-contributions	8 637	10 923	2 052	9 087	2 133
Other RCN-funding			7 965		7 805
Other public funding			2 046		2 365
Private funding			625		574
Total revenues	31 800	35 301	38 530	33 500	40 082
Expenditures					
Salary Costs	15 490	23 129	26 638	16 999	30 189
Indirect costs	2 925	4 431	4 551	3 255	4 932
Teaching Services	216	200	69	225	200
Equipment	7 140	1 720	2 115	6 980	2 201
Travelling and guests	2 550	2 550	978	2 601	1 850
Conferences and seminars	612	600	557	624	1 000
Public Outreach	408	410	252	416	300
Running costs	2 459	1 311	2 614	2 400	2 828
Collab. Projects *		3 122			

Table 1. The main figures of revenues and expenditures, 2004 accounts and 2005 budget (x1000). The 1st and 4th columns give the figures from the official RCN-contract on which the centre is established. Column 2 gives the figures from the adjusted budget presented in the 2003 Annual Report. Column 3 and 5 are updated figures for this report.

** See the notes in appendix 3 of the Annual Report 2003 for this item. Last year we had a long-lasting job consolidating our project portfolio, and even by the time of the first annual report this job was not fully surveyable. We now have a more precise overview on the real connections and contributions these projects represent to the CMA research. Hence the item has vanished into the different other items.*

We are pleased to conclude that
- we during 2004 reached a revenue / expenditure balance (at least close to).
- the activity, in terms of costs, is at the budgeted and expected level.
- we have outperformed our estimates in the financial plan for 2004.

Changes in the cost plan

The total sum of expenditures indicates that we have managed to maintain the expected activity level in terms of the cost plan, despite some obvious underestimates in some of the different items. The travelling and workshop activity together with the guest frequency have been approximately as expected in 2004, although not at the cost level we had in our budgets. However we regard it as a pleasant surprise that CMA personnel and incoming guests very often are (partly) covered from other sources. In 2005 we will be even more active than in 2004 – even more workshops and long term guests etc. Still we carefully downscale these budgeted expenses with respect to the 2004 figures.

We have also experienced that planned employments have had delayed starting dates, and that successful proposals and applications gave income in 2004, whilst part of the activity will be conducted in 2005 (The Start pack of Professor Kenneth Karlsen, and the educational reformation project «Computers in Science Education» are typical examples).

The most important resolution made in order to oppose the effects of such unexpected savings, has been to advance the scheduled employment plan. We now engage more fellows by our own means than ever expected, even at full scale. These resolutions will take full effect in 2005. We also further intensify the efforts on conferences, workshops, incoming guests and outgoing travels. We will focus on even more long term research visits, and we are prepared to invest in order to attract top profiles.

Hence we are comfortable with the presented budget for 2005.

Changes in the financial plan

Recall that our budget philosophy is based on a really conservative strategy, meaning that we only state already confirmed incomes, even though we are constantly working on new proposals and applications in order to strengthen the conducted research at CMA. In this way the real impact of the specific effort each year is very transparent: The difference between budgeted figures one year and the corresponding accounted figures one year later then represent the annual additional results. For 2004 specifically, table 1 shows that we have raised MNOK 3, and certainly some of these projects have deep impact also for the coming years. These incomes are of course included in the 2005 budget, and we can conclude that we already have confirmed income that is MNOK 10 above the initial commitment made in the contract negotiations with RCN when the centre was established. And that is for 2005 only. In the following subsections we will comment on the most important new achievements.

UiO funding: Changes

The «Centre of Excellence» construction heavily rests on a solid contribution own funding from the host institution. The main items are ordinary wages and indirect costs for all the senior scientists, and the centre contract commits the host institution with a certain number of participating researchers and contributors. CMA has experienced that its host actually goes beyond initial commitments. Some of these changes were commented upon in the 2003 Report, and will not be repeated here. Since then, the following items represent the changes in the host contribution:

- One more full position (tenured) is allocated to the CMA-community (actually from November 2003). The Department of informatics has employed Professor Michael Floater in a tenured position, and he is tied to CMA on the same basis as all internal researchers of UiO.
- The Department of informatics also provided CMA with one additional 4-year PhD-position in 2004. Starting on November 1, PhD-student Christian Schulz represents an increased host funding.
- Together the boards of the bachelor programmes «Physics, Astronomy, and Metheorology» and «Mathematics, Informatics, and Technology», CMA applied for internal financial support in order to establish an educational reform project «Computers in Science Education» (see separate chapter on «Basic Education» for more details). The proposal was successful, and CMA has the project management and also hosts the project employee, Dr. Njål Foldnes.
- When Professor Kenneth Karlsen was employed in the new CMA-professorship from July 1, 2004, CMA applied for a «start pack» on his behalf. The application was successful, and has brought CMA one two-year postdoc position (Mostafa Bendamahne started on Nov. 1, 2004), and one three-year PhD-student (Imran Habib Biswas will start on Apr. 15, 2005).
- Finally, several minor (internationalization) items add to the estimated budgets.

SINTEF contributions: status, changes

Originally, the SINTEF personnel contribution was based on three persons from the Applied Geometry section, Research Director Tor Dokken, Senior researcher Ewald Quak, and Senior researcher Michael Floater. However Floater entered the full position at Dept of informatics in Nov. 2003 as stated above, and his specific SINTEF-contribution to the CMA has not been replaced.

Despite this, we still see that the total SINTEF contributions have increased during 2004, both with respect to initial level as well as the adjusted ambitions for 2004, presented in the 2003 Report.

The main reason is that more project activity of SINTEF is included in the CMA activity. Especially the project «Graphics Hardware as a High-End Computational Resource» contributes significally, since two PhD-students are included in the CMA-community. Also some of SINTEF's collaborative activities like workshops take place at the CMA.

Project portfolio: status, development through 2004, outlook on the future

We reported last year that the creation of CMA led to a consolidation of existing projects in the nearby scientific sphere. We boosted our estimated original figures. Both economically and by counting man-years this had a significant impact on CMA. At the same time we shed some worries for the outlook on especially individual RCN-grants.

In 2004 these worries turned out to be relevant. Only one new PhD-student with an individual grant from RCN has entered the CMA community in 2004, and she was already known to us one year ago as the last report was written (and hence reported then).

However we have achieved success in other proposal and application processes, and several new fellows have entered during 2004 or will be coming in 2005. The full list of projects is presented in appendix 4, but we will highlight two achievements with considerable economic impact for CMA:

- Through EU's FP6 we competed with success in the Marie Curie «Transfer of Knowledge»-scheme. Together with «Centre for Nonlinear Studies (CENS)» in Estonia (appointed as an Estonian Centre of Excellence) we will run the CENS-CMA project from May 1, 2005. The funding is up to € 850.000 over four years, divided approximately equally on the two partners.
- Professor Kenneth Karlsen of CMA was successful in the YFF-call by the RCN. His project also had a considerable own funding through his start pack from UiO, but the exclusive RCN-part is granted with MNOK 7 over 5 years, and started on Oct 1, 2004.

In addition, several other new activities have been granted or old ones prolongated with new funding. Among the contributors are

- FP6 Individual Marie Curie postdoc fellowship – Mikael Signahl two years from Feb.1 2005
- Centre for Advanced Study, one postdoc fellow for one year (Aug 1, 2004 – Jul.31, 2005)
- «Rogaland Forskning», one postdoc fellow for two years, starting in Feb. 15, 2005
- The «Norwegian Participation in the Planck LFI instrument and cosmology with NOT»-project is prolongated with two more years 2005-06, including one postdoc for two years
- The European Science Foundation has granted the AMaMeF-proposal with participation from 15 countries. CMA-professor Brnt Øksendal will chair the project.

All together, we outplay our own figures and estimates for the total figures of 2004. However we only stated confirmed activities in our last report, so the positive difference represents the net income raised during the last year.

Despite several successes in 2004 we are still concerned by the lack of possibilities in the RCN-system. We have mentioned the individual grants, and we continue to be worried about this. Such projects seem to become more rare

in RCN. It seems as if there is a tendency towards larger and more compound programmes. We will compete on every relevant area, and we hope to succeed. But we also have to be realistic. The centre activity itself is (and must be) the dominating project activity of the senior scientists themselves. However, we have the capacity to do training activities, which is why individual RCN-grants fit perfectly.

But also the expiring BeMatA-programme, which has served the mathematical communities in Norway with important possibilities during the last few years, causes some concern. Together with all four mathematical university communities, we last year submitted a proposal to the RCN, in which we argue for a new, broad mathematical research programme in mathematics.

We again strongly emphasize the importance of a success for this initiative. When this annual report is being written, this proposal has been tied to the larger eVITA proposal, and is brought to a national hearing process. We somehow feel that there is a chance that the methodology part, which we represent, will drown in the ocean of super computing research – in a wide sense – that dominates the eVITA proposal. eVITA at least needs a kernel of methodology to avoid fragmentation. The mathematics may constitute this glue.

Balance

Due to starting efficiency, and not least a 6 months delay when entering our new premises, we accumulated a MNOK 4 surplus in 2003. The «Centre of Excellence»-scheme allows transfer of surplus, which was the natural resolution in last year's annual report. As a state official activity, we are not interested in accumulating further surplus, and as described in the previous sections, we have now just finished our first full year, gained more experience on the cost level of our activity, and we have geared the 2005-activity towards a moderate deficit. Further activity acceleration does not seem plausible. Further employment commitments would cause too little space of action, or even a negative balance, in the coming years. We have calculated (without argumentation in this report) the subsequent budget figures for the following years, reaching a zero balance between estimated budgets and accounts at the end of 2006.

The following table shows estimated financial result of the CMA by the end of 2005.

Table 2. Resolution on the 2004 financials and estimated result 2005 (x1000)

		REVENUES	EXPENDITURES
2003	Transferred	4 011	
2004	From table 1	38 530	37 774
2005	From table 1	40 082	43 500
2005	Estimated result	1 348	

THE PEOPLE

Status and some statistics, employments 2004

On January 1, 2005, CMA consists of 77 people. They are all presented in appendix 1. In addition, appendix 1 contains CMA members who completed their mission with CMA in 2004 (7), and also new employments with confirmed starting dates early 2005 (4). Hence the presented lists include a total of 88 names (though if we restrict ourselves to count heads, the final number is 85, since three persons appear twice, under different categories).

Only counting 2004-members (i.e. 88 - 4 =84) we may present the following statistical details on 2004-distributions:

- 19 senior scientists in full positions, 32 PhD-students, 20 postdocs, 8 adjunct positions, 2 in researcher positions, 1 scientific programmer, 1 project coordinator, and 1 administrative officer
- 71 men and 13 women
- 51 native Norwegians and 33 with foreign nationalities (representing 17 different countries)
- 35 employed by CMA, 30 by the host, 4 by SINTEF, and 33 through affiliated projects.

Man Year «production» 2004 and estimates for 2005

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 2004 and new estimates for 2005. As in all budget presentations, we use conservative figures; only confirmed new positions, and known contributions are taken into consideration.

Table 3. Calculation of man year production in CMA, taking the funding source into account

	CMA	UiO funded	SINTEF	Other	Total
2004 (Real)					
Phd	7,44	1,93	0,92	9,56	19,85
Postdocs, sal	5,11	1,50		6,21	12,82
Senior scientists	3,78	10,65	0,40		14,83
Guests	0,33			1,92	2,25
Tech / Adm	1,00	1,00			2,00
Sum	**17,66**	**15,08**	**1,32**	**17,69**	**51,75**
2005 (Estimates)					
Phd	11,04	1,40	2,00	6,85	21,29
Postdocs, sal	8,67			8,50	17,17
Senior scientists	3,40	11,65	0,40		15,45
Guests	0,08			2,13	2,21
Tech / Adm	1,25	1,00			2,25
Sum	**24,44**	**14,05**	**2,40**	**17,48**	**58,37**

As stated above, the CMA-community counted 77 «heads» on January 1, 2005. We also indicated that 4 new persons with starting dates in 2005 are named in appendix 1 (specifically: postdoc Mikael Signahl starting on Feb 1, postdoc Tore Halsne Flåtten starting on Feb 15, PhD-student Imran Habib Biswas starting on April 15, and postdoc Thilo Meyer-Brandis starting on May 1). Furthermore, the budget of 2005 include 3 more postdoc fellows (starting May 1 x2 and July 1) and 1 PhD-student (starting July 1). These positions are all included in the table 3 estimates for 2005.

However, we have not estimated any other possible positions that we might receive through new projects or agreements. Obviously several fellows, particularly among the PhD-students, finished or will finish their periods with CMA during 2004/2005. Our efforts to address these challenges are described in another section.

Other contributors

As described in the Statements on the centre establishment, 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 secretary **Anita Smeby** at the reception desk of Department of Mathematics
- Senior executive officer **Diana Holand** of Department of Mathematics, providing 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 who are responsible for technical support
- Senior executive officer **Grete Andresen** of The Faculty of Mathematics and Natural Sciences is handling all formalities wrt. 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 group. In 2004, we have received the following international long-term guests (by long-term we have defined more than 3 months):

- Sep 1 - Jan 31 (05): Associate Professor **Qiya Hu**, The Chinese Academy of Science, Beijing, P. R. China
- Aug 20 - Dec 31: PhD-student **Anders Christian Hansen**, Berkeley, USA
- Aug 1 - Feb 15 (05): Associate Professor **Francesca Biagini**, University of Bologna, Italy
- Apr 1 - Jul 1: Postdoc fellow **Oleg Yablonski**, Minsk, Belarussia
- Apr 1 - Jul 1: Professor **Zoran Popovic**, University of Washington, USA
- Mar 1 - Aug 31: Postdoc fellow **Claudia La Chioma**, HYKE postdoc, University of Rome, Italy.

In addition, we have welcomed 82 different international guests for periods of 1 day up to 3 months, some of them twice or more. Appendix 6 contains the full list. Finally, we estimate that around 300 different national guests have been received, many of them several times.

RESEARCH EDUCATION

A main goal of CMA is the training of new rearchers. With now more than 40 PhD-students and postdocs among us in our quite active research environment with several training activities, we believe that CMA has a significant chance of being successful in this matter. However, as earlier stated, we are concerned about the possibilities of relevant programmes and actions within the RCN system in the future.

In 2004, five members of CMA defended their doctoral theses, which is exactly the number that we estimated in last year's report. The five are:

- **Njål Foldnes** defended his thesis: *«Polyhedra and Algorithms for some Knapsack Problems and Hop-constrained Paths»* for the dr. scient.-degree on March 31, 2004. He has been working under the supervision of Professor Geir Dahl. Njål is, after short time, back with us at the CMA as the project coordinator of CMAs educational project; «Computers in Science Education» – see separate description.
- **Truls Flatberg** defended his thesis: *«Majorization and optimization related to graphs and (0,1)-matrices»* for the dr. scient.-degree on April 1, 2004. He has been working under the supervision of Professor Geir Dahl. Truls is now employed in a researcher position at SINTEF.
- **Trond Brenna** defended his thesis *«Data Reduction on Cubical and Spherical Domains Using High Dimensional Tensor Splines»* for the dr. scient.-degree on May 27, 2004. He has been working under the supervision of Professor Tom Lyche.
- **Alberto Lanconelli** defended his thesis: *«White Noise Analysis and Stochastic Differential Equations»* for the dr. scient.-degree on September 16, 2004. He has been working under the supervision of Professor Bernt Øksendal. Short after his defence he received a postdoc position at University of Lisbon, Portugal. Later in 2005 he will enter a tenured position in Bari, Italy.
- **Martin Reimers** defended his thesis: *«Topics in Mesh-based Modeling»* for the dr. scient.-degree on September 24, 2004. He has been working under the supervision of Professor Knut Mørken. Already on October 1, Martin entered a postdoc position at CMA.

Together with the three defences in 2003, eight doctoral candidates have so far successfully finished their PhDs at CMA. In 2005, we expect that we will have another five new PhD defences in CMA. For comparison, our ambitions were that 10 PhD-students should defend their work during the first five years of CMA, and 25 during all 10 years (see the research plan).

Researcher school
On the request of the Ministry of Educational Affairs, «The Norwegian Council for Higher Education» has discussed guidelines for a future system of «Researcher Schools» in Norway. The formal foundations for such a system still seem unclear, but the University of Oslo has established a preliminary system, and in early 2004 they invited internal applications. CMA was appointed, and hence is to be considered as a researcher school.

However the resources are very limited, CMA has received NOK 15.000 for 2004, and NOK 50.000 for 2005, and these means do not make the big difference from our normal situation. We have though decided to arrange a national intensive one-week researcher course in the fall semester. The topic will be PDEs and quantum mechanics, a central and so far successful area for CMA itself, and also with many potential participants in other scientific communities, especially within the nanotech physics / material science environments.

Finally, we regard the signalling effect as the most important feature of being identified as a formal researcher school. We are visible on this arena, and in a good position if new efforts and resources are allocated to such a system.

Cotutelle agreements
Cotutelle (or joint) supervision and common PhD-degrees are important political signals in the educational Europe. Many European institutions have established routines and some have also entered the first agreements. The University of Oslo is not yet among these, but political emphasis has been put on this issue, and some frameworks are established wrt formalities in agreements texts etc.

We are pleased to report that CMA will become pivotal in the University of Oslo, and probably in Norway at all. The CMA associate Jon Mikkelsen Hjelmervik, who formally is employed at the SINTEF-driven Strategic Program «Graphics hardware as a high-end computational resource», started his PhD-work on July 1, 2004. The GPU-activity is fully included in the CMA-activity (CMA hosting the project's second PhD-student Johan Simon Seland). Mr. Hjelmervik will early 2005 enter a cotutelle agreement established between with University of Oslo/CMA and University of Grenoble. In short, the agreement outlines the conditions on which he will alternate between the two institutions, supervisional responsibility, formal titles and agreements upon the defence and so on.

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
A fundamental prerequisite for good research in the CMA's focused areas, is a supply of good candidates with a modern education in mathematics and physics, supplemented with a firm basis in programming and computing. Traditionally, programming and computing have been completely absent in the elementary syllabus of mathematics and physics. On the other hand, research in a growing part of mathematics and physics makes heavy use of computations. We believe that it is therefore time that the computational perspective is presented to the students in the mathematics and physics courses even on the elementary level. Moreover, the CMA with its emphasis on computational science, has a special responsibility to support the development of this kind of teaching.

CMA is contributing in this direction by hosting a project aimed at making the computational aspect of modern science more visible in the University's bachelor programs in the mathematically oriented sciences. The project coordinator is Njål Foldnes, but Morten Hiorth-Jensen and Knut Mørken from CMA are also involved together with staff from the Departments of Physics and Mathematics. The goal is to supplement the traditional undergraduate syllabus with computer programming and numerical solution techniques from the very start. This is taught in two specialized courses in the first term and will then be incorporated in the traditional mathematics and physics courses in later terms. In this way, the students will be enabled to study realistic scientific problems right from the start of their studies.

The project was initiated in 2004, but makes extensive use of earlier uncoordinated work in the Departments of Physics, Mathematics, and Informatics. A computational perspective is already present in the first year, but work is currently focused on unifying this across the different courses throughout the relevant bachelor programs.

Master level:
We are aware that other Centres of Excellence have chosen to establish separate master studies. CMA has been firm on the opposite solution; we rather want to influence on the existing programs by our ordinary and frequent teaching duties. Also this leads us to be able to recruit from more than one specific program. This is obviously a more cost effective strategy, and we may concentrate on our main objects in the researcher education. Of course, this strategy is based on a confidence that the existing programs suit, and will continue to do so, our research profile. We do receive qualified applications for our positions, both from international and national candidates.

We have though chosen two strategic actions with respect to master students:

- First, we have dedicated a reading room in our premises for master students, and this was completed in the summer 2004. From the fall semester, the room housed 12 master students. They are included in our mailing lists, they share the kitchen and lunch area with us, and they are being invited 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). We are pleased to report that during 2004 there has been increasing cooperation in the daily work, and in terms of resources, we outperform the estimates. In fact the estmates for 2005 shows a 200% increase compared with contracted commitment. From CMAs point of view, we regard the cooperation so far as very constructive and fruitful, and most important: the cooperation seems to imply really mutual benefits. We can list the main cooperative items in 2004 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.
- 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. Two PhDs are associated to CMA, Johan Simon Seland and Jon Mikkelsen Hjelmervik. Seland is intended to do his full PhD with us, and he sits permanently in our premises. Hjelmervik will also become CMAs (and UiOs) first cotutelle student, see description in a separate section.
- We arranged two workshops in close and successful cooperation in 2004: The «Multiscale Modeling …» and «GPU as a computational resource». Two new commonly arranged workshops are planned in 2005.
- CMA also benefits from other project activity of SINTEF. In 2004 this was especially applied to GAIA II and AIM@SHAPE. 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 these projects.
- Finally, we would also like to mention that Dr. Ewald Quak has been very helpful with EU-proposals of ours. His extensive experience with the EU-system is inestimable. He has advised and revised on a couple of occasions. With his main effort, we explicitly succeeded with a proposal for a Transfer of Knowledge program towards an Estonian Centre of Excellence. The CENS-CMA project will incept on May 1, 2005.

National cooperation

In the research plan of CMA, we state «As a national centre in applied mathematics our intention is to cooperate with a variety of research groups in Norway which are in need of such expertise». The cooperation with SINTEF Applied mathematics has proved to provide the centre with an open channel to industrial problems. If our capacity permits, the centre may also be involved in other joint projects, for example in basic petroleum research or neuroscience.

The relation to SINTEF is outlined above. Another important goal was to hire some of the best researchers of other institutions in Norway, who are closely related to our research. So we have done, and

- Helge Holden, Norwegian University of Science and Technology,
- Knut Aase, Norwegian School of Economy and Business Administration,
- Xue-Cheng Tai, University of Bergen and CIPR (see below), and
- Stein Arild Strømme, University of Bergen,

have all been employed by CMA in adjunct positions throughout 2004.

Together with another Centre of Excellence, Centre for Integrated Petroleum Research (CIPR), we entered a formal agreement of cooperation in 2003. The intention is to cooperate on certain projects where the two centres have complementary competence. One instrument is to use joint positions, and Runhild Klausen is now working in a two-year postdoc position, one year paid by CMA, the next by CIPR. Her project within this CMA-CIPR alliance is related to mathematical problems in reservoir simulation, in particular analysis of discretization methods which are well adopted to reservoir problems.

As listed above, Professor Xue-Cheng Tai is also included by the agreement. He, however, was an intended member of CMA in any case, from the proposal process and forward. But when both CIPR and CMA were appointed, this was a very natural consequence. At CIPR Professor Tai is mostly responsible for the activity on inverse problems, while his research towards CMA covers several central areas of partial differential equations such as finite element methods, discrete solution algorithms, and level set methods.

In addition to the CIPR agreement, we late in 2004 entered the second national agreement, this time with Rogaland Forskning in Stavanger. Postdoc fellow Tore Halsne Flåtten will in 2005-06 run his project «Pressure-based hybrid flux splitting schemes for compressible flows» at CMA in collaboration with Professor Kenneth Karlsen of CMA.

Finally, during 2004, CMA has received more than 300 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 2004 we received 88 unique international guests (see appendix 6), of which 6 stayed with us for more than 3 months. For comparison, we received 73 in 2003. 9 out of 11 research events had international participation (and the last two were not intended to have) (Appendix 5a). CMA-members have been (co)organiser of 11 international conferences in addition to those at CMA (Appendix 5c). Among the 89 published papers in refereed journals, 59 were written together with international partners (Appendix 7a). Out of 154 scientific talks outside CMA (Appendix 8a and 8b), 139 were given abroad. 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.

- We prepared an EU FP6 / Transfer of Knowledge proposal together with «Centre of Nonlinear Studies» a Centre of Excellence in Estonia. The proposal was successful, and the project incepts on May 1, 2005, and will run for 4 years.
- 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.
- CMA, mainly 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 50 Masters 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 2 PhD-students are associated to CMA through this project (Mataramvura 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 biannual workshops in mathematical finance in the Southern African region (since 1997). The next such workshop (number 5) will be held in Malawi in December 2005. For this we are seeking support from IMU. Finally they 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.

HEALTH, ENVIRONMENT AND SAFETY

CMA does not store chemicals or other possibly dangerous materials etc. No work-related accidents are reported in 2004.

Work Environment Survey 2004
The main effort on the HES-area in 2004 was a comprehensive work environment survey which was conducted in the fall semester. The survey was anonymous, internet based, and led by the professional HES-section at the University. The questions were adjusted according to local CMA-needs and -conditions in close cooperation with the CMA-management. The survey gave representative feedback, as 100% among the CMA employees answered (71% total). The HES-section initiated the investigation with a goal for at least 50% response, which they regard as necessary. Full report is available on reqest. The main results of the investigations may shortly be summarized as follows:

CMA members regard their work environment as good / very good. There are several positive «results»:
- Friendly, safe, supportive, stimulating, flexible environment
- Good management, flexible economy administration, satisfactory administrative and technical support functions.

Our main challenges are described as follows:
- Some uncertainties exist on who is formally responsible for their work at CMA (Department vs. Centre)
- More than 50% of PhDs and postdocs would prefer systematic appraisals (almost none among the senior staff members…)
- Some dissatisfaction exist on
  - Physical environment (ventilation and cleaning)
  - Computer infrastructure and support
  - Estetics and art

The results were presented to us in December 2004, and the CMA management decided to initiate the following immediate actions:
- Appraisals to be held in January/February 2005 with all PhDs and postdocs who are located in the premises of CMA.
- Strengthen the budget for IT-support
- Establish a wireless network for guests, plus generate easier routines for account allocations
- Estetics: Arts and some posters on the walls
- Health: Engage an ergonomist to suggest individual solutions on solvable problems

As this is being written (Feb05), most of these actions are already put into effect, but we will describe actions and consequences more extensively in next year's annual report.

Internal seminar and social events
On September 22-23, CMA arranged an internal seminar, focusing the research activity of the PhDs and postdocs. 55 members were able to participate, and we had 16 scientific presentations by our own fellows. The motivation was clearly to consolidate a fast-growing activity. 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 were positive, and we regard the arrangement as successful, both with respect to the scientific content as well as the social outcome.

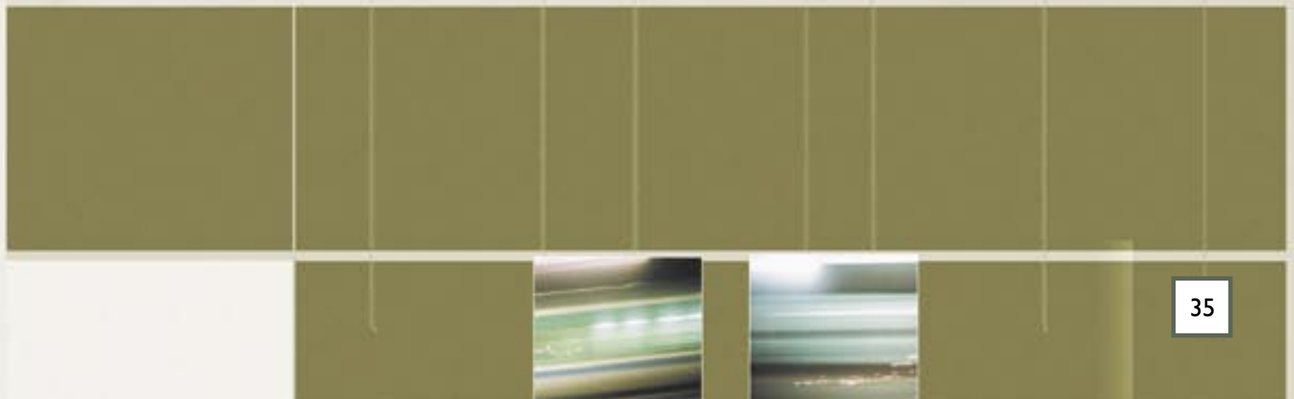
We also arranged a common dinner in June, in addition to several smaller social events in the centre premises.

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 2004 we significantly increased the efforts and results:

- We have registered 13 media appearances, among these both national radio NRK P1 and P2 as well as a feature article in a main national newspaper «Dagbladet». The full list is presented in appendix 9
- Appendix 8c presents a list of talks, given in 2004 which were meant for a general audience.
- CMA has agreed with the organization www.matematikk.org to contribute as a five-year sponsor from 2003 -2007. This organization aims at being a national net-resource for children, teachers, and parents, and was established in the autumn 2001. During these years, they have constantly extended and improved their content, and in 2003 they won the «Rosing Prize» for internet based information. They have thousands of users, and aims at being the top national mathematics online resource for mathematics in the school. For CMA we regard this sponsorship as a safe bet. Our contribution will reach much further here than if we established something similar on our own.

Finally we would like to give a few comments upon one of the scientific events; the CMA Industry Day on November 8 (scientifically described in the Scientific Activity Report – section). Here the main motivation was to establish an open channel to recent research results for industry actors (specifically this year: for traders and analysts in the electricity power market). 16 external participants registered, and by written evaluation we learned that we had hit the bull's eye: The participants had received valuable inputs for their daily work. We hope to establish this as an annual event.



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APPENDIX 1: CMA-members

The following tables give a total overview of all CMA-members in 2004 and in the foreseeable future. Some positions will be announced by CMA itself during 2005, 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 2005 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	CMASHARE	FUNDING (see budget)
Fred Espen Benth	Norway	Professor	Mar03-Feb08	75%	Host
Mats Carlsson	Sweden	Professor	Mar03-Feb08	40%	Host
Geir Dahl	Norway	Professor	Mar03-Feb08	75%	Host
David Dean	USA	Professor II	Jan04-Feb08	10%	CMA
Giulia Di Nunno	Italy	Assoc. Prof.	Mar03-Feb08	75%	Host
Tor Dokken	Norway	Research Dir	Mar03-Feb08	20%	SINTEF
		Professor II	May03-Feb08	20%	CMA
Geir Ellingsrud	Norway	Professor	Mar03-Feb08	75%	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	Professor II	May03-Feb08	20%	CMA
Kenneth Karlsen	Norway	Professor	Oct03-Jun04	100%	CMA
			Jul04-Feb08		Host
Egil Leer	Norway	Professor	Mar03-Feb08	40%	Host
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	Res. scientist	Mar03-Feb08	20%	SINTEF
		Professor II	Aug03-Feb08	20%	CMA
Nils Henrik Risebro	Norway	Professor	Sep04-Feb08	75%	Host
Stein Arild Strømme	Norway	Professor II	Oct03-Feb08	10%	CMA
Xue-Cheng Tai	China	Professor II	Nov03-Feb08	20%	CMA
Ragnar Winther	Norway	CMA-director	Mar03-Feb08	100%	CMA
Tusheng Zhang	China	Professor II	Aug04-Jul07	20%	CMA
Bernt Øksendal	Norway	Professor	Mar03-Feb08	75%	Host
Knut Aase	Norway	Professor 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	40%	Host
Imran Habib Biswas	India	Apr05-Mar08	100%	Host
Trond Brenna	Norway	Mar03-Jan04	100%	Ass. project
		Feb04-May04		Host
Erik Christopher Dyken	Norway	Jul03-Jun06	100%	Ass. project
Inga Baadshaug Eide	Norway	Feb04-Jan07	100%	CMA
Eirik Endeve	Norway	Mar03-Jun04	40%	Ass. project
Hans Kristian Kamfjord Eriksen	Norway	Jul03-Jun06	40%	Ass. project
Truls Flatberg	Norway	Mar03-Mar04	100%	Ass. project
Njål Foldnes	Norway	Mar03-Mar04	100%	Ass. project
Martin Groth	Sweden	Jan05-Dec07	100%	CMA
Gaute Hagen	Norway	Mar03-Aug04	40%	Ass. project
		Sep04-Dec04	100%	CMA
Jon M. Hjelmervik	Norway	Jul04-Jun05 + Jan06-Dec07	100%	SINTEF
		Jul05-Dec05 + Jan08-Jun08	100%	CMA
Klara Hveberg	Norway	Mar03-Oct04	100%	Ass. project
		Nov04-Dec04		Host
		Jan05-Apr05		CMA
Åse Marit Janse	Norway	Feb04-Jan08	40%	Host
Pål Hermunn Johansen	Norway	Mar03-Jun05	100%	Ass. project
Maxim Kartamyshev	Russia	Jan04-Dec07	40%	Host
Paul Kettler	USA	Aug03-Jul06	100%	Ass. project
Mari Anne Killie	Norway	Mar03-Jan06	40%	Ass. project
Rodwell Kufakunesu	Zimbabwe	Jan04-Jun06	100%	Ass. project
Simen Kvaal	Norway	May04-Apr07	100%	CMA
Alberto Lanconelli	Italy	Mar03-Oct03	100%	Ass. project
		Nov03-Oct04		CMA
Sure Mataramvura	Zimbabwe	Mar03-Jul04	100%	Ass. project
Thilo Meyer-Brandis	Germany	Mar03-Feb05	100%	Ass. project
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
Martin Reimers	Norway	Mar03-Dec03	100%	Ass. project
		Jan04-Jun04		Host
Christian Schulz	Germany	Nov04-Oct08	100%	Host
Johan Simon Seland	Norway	Aug04-Jul07	100%	SINTEF
An Ta Thi Kieu	Vietnam	May04-Apr07	100%	Ass. project
Olli Wallin	Finland	Jul04-Jun07	100%	CMA
Knut Waagan	Norway	May03-Apr06	100%	CMA

Postdocs

NAME	NATIONALITY	PERIOD	CMA-SHARE	FUNDING (SEE BUDGET)
Mostafa Bendamahne	Morocco	Sep04-Aug06	100%	Host
Steinar Børve	Norway	Jan04-Jun04	100%	CMA
		Jul04-Jul05	100%	Ass. project
Snorre Christiansen	Norway	Nov02-Oct06	100%	Host
Giuseppe Maria Coclite	Italy	Nov03-Dec04	100%	CMA
		Jan05-Oct05	100%	Ass. project
Håkon Dahle	Norway	Mar03-Dec06	40%	Ass. Project
Tore Halsne Flåtten	Norway	Feb05-Jan07	100%	Ass. Project
Boris Gudiksen	Denmark	Mar04-Mar07	40%	Ass. Project
Runhild Aae Klausen	Norway	Oct03-Sep04	100%	CMA
		Oct04-Sep05		Ass. Project
Roman Kozlov	Russia	Mar03-Feb04	100%	Ass. Project
		Mar04-Jun04		CMA
Cloud Makasu	Zimbabwe	Mar03-Jan05	100%	Ass. Project
Thilo Meyer-Brandis	Germany	Mar05-Aug05	100%	CMA
Per Christian Moan	Norway	Sep03-Aug04	75%	Host
		Sep04-Aug05	100%	CMA
Daniel Muller	Germany	Apr04-Feb06	40%	Ass. Project
Halvor Møll Nilsen	Norway	Dec04-Nov06	100%	CMA
Michiel van Noort	Netherlands	Mar03-Dec05	40%	Ass. Project
Frank Proske	Germany	Mar03-May04	100%	Ass. Project
		Jun04-May06		CMA
Martin Reimers	Norway	Oct04-Sep05	100%	CMA
Luc Rouppe van der Voort	Netherlands	Mar03-Dec05	40%	Ass. Project
Jurate Saltyte-Benth	Lithuania	Jul03-Jun06	100%	Ass. Project
Mikael Signahl	Sweden	Feb05-Jan07	100%	Ass.project
Tatiana Surazhsky	Russia	Jul03-Jun05	100%	Ass. Project
Vitaly Surazhsky	Israel	Jul03-Jun05	100%	Ass. Project
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
Qiya Hu	China	Researcher	Sep04-Jan05	100%	CMA
Andrew McMurry	Ireland	Scientific prog	Oct03-Feb08	100%	Host
Evgeny Zabrodin	Russia	Researcher	Nov03-Jun04	100%	CMA

	Note	Total 1)				CMA Disposals 2)			
		2004 Accounts		2005 Budget		2004 Accounts		2005 Budget	
		Revenues	Expenditures	Revenues	Expenditures	Revenues	Expenditures	Revenues	Expenditures
CASH REVENUES									
RCN-funding	6)	-10.500		-11.000		-10.500		-11.000	
UiO board, free disposals	7)	-2.000		-2.000		-2.000		-2.000	
1 postdoc, 1 Professor	8)	-950		-1.300		-950		-1.300	
Internationalization	9)	-25				-25		0	
Researcher school	10)	-15		-50		-15		-50	
Start pack	11)	-391		-600		-391		-600	
Project CSE	12)	-400		0		-400		0	
FORNY	13)	-100		0		-100		0	
Project CIPR, Bergen	14)	-103		-388		-103		-388	
Project CAS, Oslo	14)	-184		-281		-184		-281	
Project GPU	14)	-231		-574		-231		-574	
Poject Vaxsjø	15)	-19		0		-19		0	
Project "Mesh-based..."	15)	-117		-117		-117		-117	
Rogaland Forskning	15)			-34				-34	
Prosjekt An Ta Kieu	16)	-370		-574		-370		-574	
Div. income	17)	-70		-59		-70		-59	
		0							
Sum Cash Revenues		**-15.475**		**-16.977**		**-15.475**		**-16.977**	
EXPENSES									
Salary expenses									
* PhD-positions	18)	-4.780	7.805	-3.617	8.153		3.025		
* postdoc positions	19)	-3.270	6.644	-3.659	8.967		3.374		
* Researchers	20)	-6.979	9.833	-7.548	10.534		2.854		
* Guests	21)	-967	1.145	-1.159	1.200		178		
* Admin. And technicians	22)	-516	1.211	-536	1.335		695		
SUM Salary Expenses		**-16.512**	**26.638**	**-16.519**	**30.189**		**10.126**		
Indirect costs									
* Per individual, given rates	23)	-2.596	4.031	-2.401	4.401		1.435		
* Areas beyond offices	24)	-520	520	-531	531				
SUM Indirect Costs		-3.116	4.551	-2.932	4.932		1.435		
Running costs									
Conferences	25)	0	557	0	1.000		557		
Guests and travelling	26)	-62	978	0	1.850		916		
Public Outreach, info	27)	0	252	0	300		252		
Teaching services	28)	0	69	0	200		69		
Various operational costs	29)	-1.995	2.614	-2.203	2.828		619		
SUM Running costs		**-2.057**	**4.470**	**-2.203**	**6.178**		**2.413**		
Equipment, investments	**30)**	**-1.370**	**2.115**	**-1.451**	**2.201**		**745**		
TOTAL SUM		**-38.530**	**37.774**	**-40.082**	**43.500**	**-15.475**	**14.719**	**-16.977**	
Annual Result	31)	-756		3.418		-756		3.418	
Transfers	32)	-4.010		-4.766		-4.010		-4.766	
Accumulated result	33)	-4.766		-1.348		-4.766		-1.348	

	Note	UiO FUNDING 3)				SINTEF FUNDING 4)				OTHER FUNDING 5)			
		2004 Acc		2005 Budget		2004 Acc		2005 Budget		2004 Acc		2005 Budget	
		Revenues	Expenditures	Revenues	Expenditures	Revenues	Expenditures	Revenues	Expenditures	Revenues	Expenditures	Revenues	Expenditures
CASH REVENUES													
RCN-funding	6)												
UiO board, free disposals	7)	2.000		2.000									
1 postdoc, 1 Professor	8)	950		1.300									
Internationalization	9)	25											
Researcher school	10)	15		50									
Start pack	11)	391		600									
Project CSE	12)	400		0									
FORNY	13)									100		100	
Project CIPR, Bergen	14)									103		103	388
Project CAS, Oslo	14)									184		184	281
Project GPU	14)					231		574					
Poject Vaxsjø	15)									19		19	0
Project "Mesh-based..."	15)									117		117	117
Rogaland Forskning	15)												34
Prosjekt An Ta Kieu	16)									370		370	574
Div. income	17)							26		70		70	33
Sum Cash Revenues		**3.781**		**3.950**		**231**		**600**		**963**		**1.427**	
EXPENSES													
Salary expenses													
* PhD-positions	18)	769	4.536	562		214		446		3.797	2.609		
* postdoc positions	19)	244	5.308	0						3.026	3.659		
* Researchers	20)	6.739	2.986	7.308		240		240					
* Guests	21)		41							967	1.159		
* Admin. And technicians	22)	516	799	536									
SUM Salary Expenses		**8.268**	**13.670**	**8.406**		**454**		**686**		**7.790**	**7.427**		
Indirect costs													
* Per individual, given rates	23)	1.049	2.000	1.030		77		125		1.470	1.246		
* Areas beyond offices	24)	520		531									
SUM Indirect Costs		1.569	2.000	1.561		77		125		1.470	1.246		
Running costs													
Conferences	25)		1.000										
Guests and travelling	26)	62	1.850	0									
Public Outreach, info	27)		300										
Teaching services	28)		200										
Various operational costs	29)	80	625	46		300		300		1.615	1.857		
SUM Running costs		**142**	**3.975**	**46**		**300**		**300**		**1.615**	**1.857**		
Equipment, investments	**30)**	**520**	**750**	**531**						**850**	**920**		
TOTAL SUM		**14.280**	**20.395**	**14.494**		**1.062**		**1.711**		**12.688**	**12.877**		
Annual Result	31)		418										
Transfers	32)		2.766										
Accumulated result	33)		3.348										

APPENDIX 3 – Notes on accounting 2004 and budget figures 2005

1. Total revenues and expenditures. The expenditure figures are the foundation for table 1 in this report. The revenues, however, are here calculated regardless of the funding source (see notes 3,4,5,6 for details on the different revenue items in table 1). All sums are obtained by adding the corresponding CMA Disposal figures with the contributions from UiO, SINTEF and Other.

2. The CMA disposals. These figures represent the CMA operating account – means that are provided to our credit (notes 6-17), and which are resolved by the authorization of ours (notes 18-30).

3. UiO funding. The column sums represent the total contributions from the host, and hence those figures also appear in the financial plan in table 1 in the report. The content of this contribution is described in the report. So are the deviations from earlier estimates. The contributions in this column are divided in two groups: the means placed to our credit by specification, subjected to our resolutions (notes 7-12), and the representative funding, mainly in terms of salaries, indirect costs, infrastructure (notes 18 and forward)

4. Contribution from active partner SINTEF. As 3 (but with reference to other notes). Comments on the increased funding are provided in the main report.

5. Other funding. As 4.

6. RCN funding. There are no changes in the plans for the RCN-funded financial income. The original schedule is maintained, also for 2005.

7. Cash funding from UiO. MNOK 2 have generously been guaranteed by the University board each year from 2004-2007.

8. 1 postdoc, 1 Professor. When invited for the final Centre of Excellence competition, the Faculty of Mathematics and Natural Sciences guaranteed one four year postdoc position (Snorre Christiansen Nov 02 – Oct 06) and one permanent professorship (Kenneth Karlsen Jul 04 ->)

9. Internationalization support from UiO. NOK 25.000 was granted from UiO regarding one long-term guest (Francesca Biagini, Aug 04 – Jan 05). In fact UiO provided further 62K (se note 26), but this item's 25K were transferred to our account. No similar contributions are yet confirmed for 2005.

10. Researcher School. See description in the main report.

11. Start Pack. UiO granted CMA a start pack, total contribution MNOK 1,8 over 3 years in connection with the employment of Professor Kenneth Karlsen. With additional CMA-funding we chose to employ one postdoc (Mostafa Bendamahne, Oct 04 – Sep 06) and one PhD-student (Imran Habib Biswas Apr 05 – Mar 08) in Professor Karlsen's research area.

12. Project CSE. The one-year project "Computers in Science Education" is described in a separate section under «Basic Education» in the report. We also intend to apply for further funding, but CMA has guaranteed the project throughout 2005.

13. FORNY. CMA was granted NOK 100.000 from RCNs FORNY-program to run a survey in order to find possible commercializable projects at CMA. The survey was completed, and has preliminary led to the Industry Day concept.

14. Projects refunded, first category. These three projects include fellows fully paid by CMA, but the real project responsibility belongs to:

- Centre of Integrated Petroleum Research (CIPR), Bergen (part of our established cooperation where CMA paid one year for a postdoc fellow, Runhild Aae Klausen, CIPR the second), salary costs transferred to CMA for the second year in order to avoid a new employment process)
- Centre for Advanced Studies (CAS) has granted a one-year postdoc position for Steinar Børve, he remains employed with CMA, but all salary costs are transferred to CMA
- SINTEF runs the RCN project «Graphics Hardware as a High-End Computational Resource». One PhD-student, Johan Simon Seland, is allocated full time to CMA, and a full PhD rate is transferred to CMA

15. Projects refunded, second category. For these projects, CMA does not have the employer's duties, the centre simply provides the working environment for

- PhD-student Martin Groth (University of Vaxsjø, Sweden),
- PhD-student Erik Christopher Dyken, postdoc fellows Tatiana and Vitaly Surazhsky (Department of Informatics, UiO), and
- Postdoc fellow Tore Halsne Flåtten (Rogaland Forskning)

For this service, and based on individual contracts, CMA invoices the project owners. The rest of the projects are included under associated projects (hence included in notes 18,19, 23, 29)

16. Project An Ta Kieu. An individual RCN-grant (PhD-student An Ta Kieu), administrated by CMA

17. Div. income.
- 2004: 15 registration fees (of NOK 4000 each) for the CMA Industry Day, and NOK 10000 from Norsk Hydro for the Multiscale workshop
- 2005 (Confirmed): NOK 59000 from CIPR Bergen and SINTEF for the multiscale workshop.

18. Salary costs for PhD students. This item is covering salaries and direct costs thereof for all our PhD-students in 2004, and those confirmed for 2005. The figures reflect the man year figures in table 3.

19. Salary costs for postdoc positions. As 18.

20. Salary costs for researcher positions. As 18. By «Researcher» we mean senior scientists (including the centre manager), and adjunct positions.

21. Salary costs for guests. As 18. By «Guests» we have only counted official long term guests (who stay full time with us for more than 3 months). They contribute to the CMA research simlilarly 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.

22. Salary costs for administrative and technical personell. As 18. Recall that a major part of the indirect costs (note 23) 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. For 2005 we have also included a 50% position from the summer to strengthen the IT support.

23. Indirect costs, per individual. This item covers offices and infrastructure provided for each individual. We have used prescribed rates at NOK 77.000 pr man-year except for PhD-students and Postdocs where we have used 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.

24. Additional areas. The amount appears in the original contract, and is specified to cover all areas beyond the offices counted in 23, 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 2004 account as well as for the adjusted 2005 budget.

25. Conferences. Workshops and conferences are main activities of the CMA. Appendix 5 contains a full list of the 2004 events. In 2005 we will arrange even more events.

26. Guests and travelling. This item reflects another main activity. Appendix 6 and 8 presents results of this extensive bilateral activity. The specific UiO-contributions (NOK 62K) are internationalization means provided for EU / FP6 proposal preparations (travels to Estonia and Brussel in connection with the succesful CENS-CMA proposal)

27. 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.

28. Teaching services. CMA members are not exemted 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.

29. Various operational costs. This item is meant for the daily needs and actions that are not covered by any other specific item. Rebuilding costs for our premises are included here. Also 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.

30. 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 2004 amount of NOK 520.000 (2005: 531000). The activity goes on as expected, and we see no reasons to adjust this contribution to the figures.

31. Annual Result. We conclude the accounting year of 2004 with a small surplus. With more experience we have during 2004 geared the activity as high as we find reasonable, and these resolutions take full effect in 2005, in which are signalizing that we will catch up with the transferred surplus from 2003.

32. 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.

33. Accumulated result. These figures reflect the balance sheet in table 2, or vice versa.

APPENDIX 4 – List of Associated projects

INDIVIDUAL					
Name	**Pos.**	**Source**	**Project #**	**Project leader/node**	**Period**
Hans Kristian Kamfjord 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
Eirik Endeve	PhD	NFR	145519/432	Egil Leer	... - 30.06.2004
Njål Foldnes	PhD	NFR	142971/432	Geir Dahl	... - 15.04.2004
Sure Mataramvura	PhD	Univ.of Zimbabwe		Bernt Øksendal	... - 30.06.2004
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
Klara Hveberg	PhD	NFR	138388/432	Tom Lindstrøm	... - 31.10.2004
Trond Brenna	PhD	NFR	131867/410	Tom Lyche	... - 31.01.2004
Truls Flatberg	PhD	NFR	134514/410	Geir Dahl	... - 31.03.2004
Elise Bergli	PhD	NFR+Fysikk		Morten Hjort-Jensen	... - 30.07.2005
Gaute Hagen	PhD	NFR		Morten Hjort-Jensen	... - 31.08.2004
Paul C. Kettler	PhD	egenfinansiert		Fred Espen Benth	01.08.2003 - 31.07.2006
An Ta Thi Kieu	PhD	NFR		Bernt Øksendal	01.05.2004 - 30.04.2007
Victoria Popsueva	PhD	UiB		Morten Hjort-Jensen	01.05.2004 - 30.04.2007
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
Frank Proske	postdoc	EU / DFG		Frank Proske	... - 31.05.2004
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 - 30.06.2006
Runhild Aae Klausen	postdoc	CIPR / Bergen		Runhild Aae Klausen	15.10.2004 - 14.10.2005
Mikael Signahl	postdoc	EU / Marie Curie		Bernt Øksendal	01.02.2005 - 31.01.2007
Tore Halsne Flåtten	postdoc	NFR /Rogalandsforskning		Kenneth Karlsen	15.02.2005 - 14.02.2007
Ass. Professor Francesca Biagini	Guest	Univ of Rome			01.08.2004 - 15.02.2005
Postdoc fellow Oleg Yablonski	Guest	Univ Belarus			01.04.2004 - 30.06.2004
Professsor Zoran Popovic	Guest	Univ Washington			01.04.2004 - 30.06.2004
Professor Sebastian Noelle	Guest	University of Aachen			01.02.2005 - 31.07.2005
Ass. Professor Giuseppe Coclite	Guest	Univ of Rome		Kenneth Karlsen	01.01.2005 - 30.09.2005
PhD student Martin Groth	Guest	Univ of Vaxsjø		Fred Espen Benth	01.07.2004 - 31.12.2004

APPENDIX 4 – continued

COLLABORATIVE				
Title	**Source**	**Project #**	**Proj. Leader / node**	**Period**
ESMN (En postdoc)	EU / RTN	HPRN-CT-2002-00313	Mats Carlsson	... - 31.10.2006
TOSTISP (En postdoc)	EU / RTN	HPRN-CT-2001-00310	Viggo Hansteen	01.03.2003 - 28.02.2006
SHP (To postdocs)	NFR / SUP	146467/420	Mats Carlsson	... - 31.12.2005
Norwegian Participation in the Planck				
LFI instrument and cosmology with NOT	NFR	153380/431	Per Lilje	01.01.2003 - 31.12.2004
Planck-prosjekt forlenget (1 postdoc Dahle)	NFR	165491/V30	Per Lilje	01.01.2005 - 31.12.2006
GAIA II (UiO-del, se også 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
OMATS	EU / MC-EST	HPMT-CT-2000-00104	Geir E. / Ragni P.	2001 - 2004
MACSINET	EU / RTN	IST-1999-14077	Helge Holden	... - 13.04.2004
Robust Numerical Methods for Partial				
Differential Equations	NFR / BeMatA	135420/431	Ragnar Winther	20.02.2002 - 19.02.2004
SUPREMA	NFR / SUP	154077/420	Geir E. / Ragni P.	2003 - 2006
Mathematical 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	137461/431	Kenneth K. / Helge H.	2001 - 2004
Winter Schools in Computational Mathematics	NFR / BeMatA		Kenneth K. / Helge H.	2005 - 2006
FORNY	NFR		H Galdal	2004
Analysis and numerics for NonlinearWaves				
(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		Ragnar Winther	01.05.2005 - 30.04.2009
AMaMeF	ESF		Bernt Øksendal	2005 - 2009

THROUGH SINTEF				
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 computational resource	NFR / SIP		Tor Dokken	

APPENDIX 5 – List of CMA events 2004

5a. Workshops arranged at CMA

Workshop: Computational advances in the nuclear many-body problem
- March 11-13, 2004
- Organized by Morten Hjorth-Jensen and Eivind Osnes
- 40 participants: 16 international, 2 national, and 22 CMA-members
- 23 talks: 14 by international guests, 2 by national guests, and 7 by CMA-members.

Workshop: Computational Finance and Physics
- March 22-23, 2004
- Organized by Fred Espen Benth, Morten Hjorth-Jensen, and Kenneth Hvistendahl Karlsen
- 37 participants: 7 international, 10 national, and 20 CMA-members
- 12 talks: 6 by international guests, 5 by national guests, and 1 by CMA-members.

Workshop: Nonlinear PDEs: Theory, Numerics, and Applications
- April 26-27, 2004
- Organized by Giuseppe Maria Coclite, Helge Holden, and Kenneth Hvistendahl Karlsen
- 31 participants: 5 international, 8 national, and 18 CMA-members
- 12 talks: 5 by international guests, 3 by national guests, and 4 by CMA-members

Workshop: Camassa-Holm and other nonlinear dispersive equations
- June 7- 8, 2004
- Organized by Giuseppe Maria Coclite and Kenneth Hvistendahl Karlsen
- 16 participants: 4 international, 2 national, and 10 CMA-members
- 10 talks: 5 by international guests, 2 by national guests, and 3 by CMA-members.

Miniworkshop: Mathematical Aspects of the Schroedinger Equation
- June 14, 2004
- Organized by Giuseppe Maria Coclite, Morten Hjorth-Jensen, and Kenneth Hvistendahl Karlsen
- 15 participants: all CMA-members
- 5 talks: all by CMA-members

Internal seminar/workshop: Focusing the postdocs and PhDs of CMA
- September 22-23, 2004
- Organized by Michael Floater, Inga Baadshaug Eide, Snorre Christiansen, and Helge Galdal
- 55 participants: all CMA-members
- 16 talks: all by CMA-members

Workshop: Mathematical Finance and Copulas - 11th Workshop in Mathematics & Economics
- October 15, 2004
- Organized by Fred Espen Benth, Giulia Di Nunno, and Bernt Øksendal
- 27 participants: 4 international, 11 national, and 12 CMA-members
- 8 talks: 2 by international guests, 5 by national guests, and 1 by CMA-members

Workshop: Multiscale modeling, and applications in fluid flow and material science
- October 18-20
- Organized in cooperation with SINTEF Applied Mathematics and Centre for Integrated Petroleum Research, University of Bergen. The organizing committee was Jørg Aarnes (Sintef), Per Christian Moan (CMA), and Runhild Aae Klausen (CMA and Cipr)
- 52 participants: 10 international, 38 national, and 4 CMA-members
- 21 talks: 8 by international guests, 13 by national guests

Industry Day: Modeling and analysis of risk in electricity markets - recent research results
- November 8
- Organized in cooperation with Birkeland Innovasjon AS, the Technology Transfer Office at The Univesity of Oslo. The organizing committee was Fred Espen Benth and Helge Galda from CMA, and Kathrine Myhre and Anne Therese Rygge from Birkeland
- 25 participants: 5 international, 13 national, and 7 CMA-members
- 5 talks: all by Fred Espen Benth of CMA

Industrial Workshop: GPU as a computational resource
- November 10-11
- Organized in cooperation with SINTEF, Tor Dokken (SINTEF and CMA) organizer
- 34 participants: 1 international, 25 national, and 8 CMA-members
- 13 talks: 5 by international guests (all by the keynote speaker Robert Strzodka of CAESAR, Bonn, Germany), 4 by national guests, and 4 by CMA-members

Workshop: Subdivision curves and surfaces
- December 2-3
- Organized by Tom Lyche and Michael Floater
- 24 participants: 5 international, 4 national, and 15 CMA-members
- 9 talks: 5 by international guests and 4 by CMA-members

5b. Seminar and Lecture Series at CMA

The CMA seminar Series 2004
- The seminar ran both spring and fall semester 2004
- 21 seminars, 3 by international guests, 11 by national guests, and 7by CMA-members,

CMA Guest Lectures, 2004
- Spring and fall 2004
- 22 official guest lectures, of which 19 by international guests, and the remaining 3 by Norwegian guests.

Lectue Series on Large Deviation Theory
- Fall semester,
- Approx 30 lectures given, all by CMA's own Professor II; Professor Tusheng Zhang from the University of Manchester, UK

Computational Quantum Mechanics
- Fall semester,
- Coordinated by postdoc fellow Per Christian Moan and PhD-student Simen Kvaal, both CMA.
- 11 seminars given, 1 by an international guest, 2 by national guests, and 8 by CMA-members

Informal seminar on Geometry and PDEs
- Spring and Fall semester,
- coordinated by Jan Brede Thomassen, Michael Floater, and Tom Lyche, all CMA.
- 12 seminars given, 4 by international guests and 8 by CMA-members

Seminar series, Symplectic Geometry
- Spring semester,
- 9 seminars given, alternating between Snorre Christiansen Geir Ellingsrud

CMA Lecture Series «Weak Convergence Methods and Recent Mathematical Theory for the Compressible Navier-Stokes Equations»
- Spring semester,
- 16 lectures given, all by CMA's own Professor Kenneth Hvistendahl Karlsen.

Crash Course on Nonstandard Stochastic Analysis and Applications to Finance
- Spring semester,
- 14 lectures given, all by CMA's own Professor Tom Lindstrøm

Lectue Series on Dynamic Asset Pricing Theory
- Spring semester,
- 36 lectures given, all by CMA's own Professor II; Professor Knut Aase from NHH, Bergen.

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

Workshop on Hypermodels in Finance
- Tsitsikamma, South Africa March 1-5, 2004
- CMA is official coorganizer, and Bernt Øksendal and Giulia Di Nunno are on the organizing committee.

Fourth Winter School in Computational Mathematics: «Adaptive methods for partial differential equations»
- Geilo, March 7-12, 2004.
- Helge Holden and Kenneth Karlsen are members of the organizing committee.

First CENS-CMA Joint Seminar
- Centre for Nonlinear Studies, Tallinn University of Technology, Tallinn, Estonia, March 9-11,
- Organized by Ewald Quak

EU-MACSINET Workshop on Industry Challenges in Geometric Modelling and CAD 2004
- Darmstadt University of Technology, March 17-18 2004.
- CMA co-sponsor, and Ewald Quak is on the organizing committee.

Shape Modeling International 2004
- Genova, Italy, June 7-9,
- Ewald Quak on the Program Committee.

Minisymposium «The CAD-FEM Link»,
- as part of «The 13-th European Conference on Mathematics for Industry», Eindhoven, The Netherlands, June 21-25,
- organized by Ewald Quak.

Mathematical Methods for Curves and Surfaces
- Tromsø, July 1-6, 2004.
- CMA is official co-organizator, and Knut Mørken is on organizing committee.

New techniques in Applied Stochastics
- Institute of Mathematics, Helsinki University of Technology, Finland, August 16-18, 2004.
- CMA is official coorganizer, and Bernt Øksendal and Giulia Di Nunno are on the organizing committee.

Microscopic Nuclear Structure Theory,
- University of Washington, Sep 27 - Dec 3, 2004.
- Morten Hjorth-Jensen and David Dean are on the organizing committee.

Algebraic Geometry and Geometric Modeling
- University of Nice, France, Sep 27-29, 2004.
- Ragni Piene is co-organizer of this workshop.

SAMSA 2004 Conference
- Polokwane, South Africa Nov 29 - Dec 2, 2004
- CMA is official coorganizer, and Bernt Øksendal and Giulia Di Nunno are on the organizing committee.

APPENDIX 6 – International guests of CMA 2004

Long term guests (> 3 months)
In addition to the 6 longterm guests presented in the report (Section «The People», subsection «Guests»), the CMA has received the following international guests in 2004:

Short term guests (<3 months)
Visitors are chronologically (by date of arrival) listed as follows:

1. Dec 1-4 (CMA Workshop): **Adi Levin**, University of Tel Aviv, Israel
2. Dec 1-5 (CMA Workshop): Professor **Hartmut Prautzsch**, University of Karlsruhe, Germany
3. Dec 1-3 (CMA Workshop): **Malcolm Sabin**, University of Cambridge, U.K.
4. Nov 10-11 (CMA Workshop): **Robert Strzodka**, CAESAR, Bonn, Germany
5. Nov 8 (CMA Industry Day): **Mattias Palm**, Navita Systems, Sweden
6. Nov 8 (CMA Industry Day): **Arne Österlind**, Shepherd Kapitalförvaltning AB, Sweden
7. Nov 8 (CMA Industry Day): **Rurik Oprita**, Nuon, Holland
8. Nov 8 (CMA Industry Day): PhD-student **Rikard Green**, Dept. of Economics, Lund University, Sweden
9. Nov 8 (CMA Industry Day): **Patrik Fastén**, ECGRC Vattenfall AB, Sweden
10. Nov 8 (CMA Industry Day): **Fredrik Fyring**, ECGRC Vattenfall AB, Sweden
11. Oct 18-20 (CMA Workshop): Professor **Louis J. Durlofsky**, Stanford University, USA
12. Oct 18-20 (CMA Workshop): Professor **Yalchin Efendiev**, Texas A&M Univ., USA
13. Oct 18-20 (CMA Workshop): Professor **Bjørn Engquist**, Univ. of Texas at Austin, USA
14. Oct 18-20 (CMA Workshop): Professor **Patrick Jenny**, ETH Zurich, Switzerland
15. Oct 18-20 (CMA Workshop): Professor **Wing Kam Liu**, Northwestern University, USA
16. Oct 18-20 (CMA Workshop): Professor **Mats Larson**, Chalmers Univ. of Technology, Sweden
17. Oct 18-20 (CMA Workshop): **Ivan Lunati**, ETH Zurich, Switzerland
18. Oct 18-20 (CMA Workshop): Professor **Axel Målquist**, Chalmers Univ. of Technology, Sweden
19. Oct 18-20 (CMA Workshop): Professor **Lisette Quettier**, Total S.A., France
20. Oct 15 (CMA Workshop): Professor **Peter Tankov**, Ecole Polytechnique, Palaiseau, France
21. Oct 15 (CMA Workshop): Postdoc fellow **Ariel Almendral**, Univesity of Delft, Netherlands
22. Oct 4-15: Professor **Peeter Oja**, University of Tartu, Estonia
23. Oct 1: Professor **Gilbert Strang**, MIT, USA
24. Sep 23 and Dec 1-4 (CMA Workshop): Professor **Ullrich Reif**, Technische Universität Darmstadt, Germany
25. Sep 23: Professor **Jörg Peters**, University of Florida, USA.
26. Sep 13-17: Professor **Yaozhong Hu**, University of Kansas, USA
27. Sep 10-18: **Hermano Frid**, Instituto de Matemática Pura e Aplicada - IMPA, Brazil
28. Aug 28 - Oct 1: Professor **Salah Mohammed**, Southern Illinois University, Carbondale, Illinois, USA
29. Aug 23-24: Professor **Siu-Ah Ng**, University of Natal, South Africa
30. Aug 19-26: Professor Dr. **Jürgen Prestin**, Institute of Mathematics, University of Lübeck, Germany
31. Aug 13-17: Professor **Heinz Gonska**, University Duisburg-Essen, Germany
32. Aug 4-6: Directeur de Recherche au CNRS **Pierre Degond** INSA; Toulouse, France
33. Aug 1-17: **Kristian Jenssen**, North Carolina State University, USA
34. Jul 7-22: Professor **Zvi Ziegler**, Technion Haifa, Israel.
35. Jul 7-10: Professor **Elaine Cohen**, University of Utah, USA
36. Jun 23-30: Postdoc fellow **Kai Hormann**, Istituto di Scienza e Tecnologie dell'Informazione, CNR, Italy
37. Jun 23-30: Professor **Nira Dyn**, University of Tel Aviv, Israel
38. Jun 7-8 (CMA Workshop): Professor **Luc Molinet**, University of Paris 13, France
39. Jun 7-8 (CMA Workshop): PhD-student **Jonatan Lenells**, Lund University, Sweden
40. Jun 7-8 (CMA Workshop): Professor **Adrian Constantin**, Lund University, Sweden
41. Jun 7-8 (CMA Workshop): PhD-student **Erik Wahlén**, Lund University, Sweden
42. Jun 7-8 (CMA Workshop): Professor **Bo Su**, Iowa State University, USA
43. May 24-28: Research Director **Annalisa Buffa**, IMATI-CNR Pavia, Italy
44. May 11-25: Professor **Robert Stein**, Michigan State University, USA
45. Apr 24-28 (CMA Workshop): **François Bouchut**, CNRS & ENS, Paris, France
46. Apr 26-27 (CMA Workshop): **Corrado Mascia**, University of Rome, Italy

47. Apr 24-29 (CMA Workshop): **Siddhartha Mishra**, University of Bangalore, India
48. Apr 24-28 (CMA Workshop): **Achim Schroll**, University of Lund, Sweden
49. Apr 22-28 and Oct 29 - Nov 2: Professor **Raimund Bürger**, Universität Stuttgart, Germany
50. Apr 20 - May 2: Postdoc **Arne Løkka**, Kings College, London, England
51. Apr 13-27 and Aug 30 - Sep 11: PhD student **Damian Fabbian**, Mount Stromlo and Siding Spring Observatories, Australia
52. Apr 6-15: Dr. **Jarle Brinchmann**, Centro de Astrofisica da Universidade do Porto, Portugal
53. Mar 31: PhD-student **Carl Lindberg**, Chalmers Universitet, Sweden
54. Mar 22-23 (CMA Workshop): **Jordi Boronat**, Universitat Politecnica de Catalunya, Spain
55. Mar 22-23 (CMA Workshop): **Kevin Schmidt**, Arizona State University, USA
56. Mar 22-23 (CMA Workshop): **Agnes Sulem**, Inria, France
57. Mar 22-23 (CMA Workshop): **Anders Szepessy**, Royal Institute of Technology, Sweden
58. Mar 15: Professor **Tom Russell**, University of Colorado, Denver, USA
59. Mar 11-13 (CMA Workshop): **Etienne Caurier** Ires, Strasbourg, France
60. Mar 11-13 (CMA Workshop): **Frederick Nowacki** Ires, Strasbourg, France
61. Mar 11-13 (CMA Workshop): **Andres Zuker** Ires, Strasbourg, France
62. Mar 11-13 (CMA Workshop): **Tom Kuo** SUNY at Stony Brook, New York, USA
63. Mar 11-13 (CMA Workshop): **Jason Holt** SUNY at Stony Brook, New York, USA
64. Mar 11-13 (CMA Workshop): **Paul J. Ellis** UMN, Minneapolis, Minnesota, USA
65. Mar 11-13 (CMA Workshop): **Alex Brown** MSU, East Lansing, Michigan, USA
66. Mar 11-13 (CMA Workshop): **James Vary** Iowa State University, Iowa, USA
67. Mar 11-13 (CMA Workshop): **Roberto Liotta** KTH, Stockholm, Sweden
68. Mar 11-13 (CMA Workshop): **Karlheinz Langanke** University of Århus, Århus, Denmark
69. Mar 11-13 (CMA Workshop): **Mikhail Zhukov** Chalmers, Gøteborg, Sweden
70. Mar 11-13 (CMA Workshop): **Boris Danilin** Moscow State University, Moscow, Russia
71. Mar 11-13 (CMA Workshop): **Sergei Ershov** Moscow State University, Moscow, Russia
72. Mar 11-13 (CMA Workshop): **Luigi Coraggio** Universita' di Napoli, Napoli, Italy
73. Mar 11-13 (CMA Workshop): **Hubert Grawe** GSI, Darmstadt, Germany
74. Mar 9-17: PhD-student **George Hitching**, University of Durham, England
75. Feb 23 – 29 and Dec 1-3 (CMA Workshop): Professor **Jean-Louis Merrien**, INSA, Rennes, France
76. Jan 31 - Feb 5: Professor **Douglas N. Arnold**, Institute of Mathematics and its Applications, Minnesota, USA
77. Jan 25 - Feb 7: PhD student **Jorrit Leenarts**, Sterrekundig Instituut, Utrecht, Netherlands
78. Jan 25 – 31 and Mar 28 - April 2: Professor **Robert J. Rutten**, Sterrekundig Instituut, Utrecht, Netherlands
79. Jan 14-21: Professor **Luis Gouveia**, University of Lisbon, Portugal.
80. Jan 12 - 20: Dr. **Tusheng Zhang,** University of Manchester, England.
81. Jan 10 - 31: Professor **Francesca Biagini**, University of Bologna, Italy
82. Jan 5-10, Jun 24-30, Jul 7-13, and Aug 15-22: Professor **Richard F. Riesenfeld**, School of Computing, University of Utah, USA.

APPENDIX 7 PUBLICATIONS 2004

7a. Scientific articles in refereed journals:

1. **Bendahmane, Mostafa; Karlsen, Kenneth Hvistendahl.** *Renormalized entropy solutions for quasi-linear anisotropic degenerate parabolic equations*. SIAM Journal on Mathematical Analysis 2004;36(247):405-422
2. **Benth, Fred Espen; Karlsen, Kenneth Hvistendahl; Reikvam, Kristin.** *A semilinear Black and Scholes partial differential equation for valuing American options: approximate solutions and convergence*. Interfaces and Free Boundaries 2004;6:379-404
3. **Benth, Fred Espen;** Løkka, Arne. *Anticipative calculus for Lévy processes and stochastic differential equations*. Stochastics and Stochastics Reports 2004;76(3):191-211.
4. **Benth, Fred Espen**; Reikvam, Kristin. *A connection between singular stochastic control and optimal stopping*. Applied mathematics and optimization 2004;49:27-41
5. **Benth, Fred Espen; Saltyte-Benth, Jurate**. *The normal inverse Gaussian distribution and spot price modelling in energy markets*. International Journal of Theoretical and Applied Finance 2004;7(2):177-192
6. **Børve, Steinar**; Omang, Marianne G.; Trulsen, Jan. *Simulating the Orszag-Tang vortex using RSPH*, ICTAM04 Abstracts Book and CD-ROM Proceedings
7. **Børve, Steinar**; Omang, Marianne G.; Trulsen, Jan. *Two-dimensional MHD smoothed particle hydrodynamics stability analysis*. Astrophysical Journal Supplement Series 2004; 153:447-462
8. **Carlsson, Mats; Rouppe, Van Der Voort Luc; Hansteen, Viggo**. *Observations at 0".1 Resolution of the Dynamic Evolution of Magnetic Elements,* Proceedings of Multi Wavelength Investigations of Solar Activity, IAU Symp. 223; St.Petersburg, Russia, June 14-19, 2004. 4 pages.
9. **Carlsson, Mats**; Stein, R.F.; Nordlund, Å.; Scharmer, G.B.. *High resolution limb images synthesized from 3D MHD simulations* Proceedings of Multi Wavelength Investigations of Solar Activity, IAU Symp. 223; St.Petersburg, Russia, June 14-19, 2004. 2 pages.
10. **Carlsson, Mats**; Stein, R.F.; Nordlund, Å.; Scharmer, G.B.. *Observational manifestations of solar magneto-convection - center-to-limb variation*. Astrophysical Journal Letters 2004;610:137-140
11. Judge, P.G.; Saar, S.H.; **Carlsson, Mats**; Ayres, T.R. *A Comparison of the Outer Atmosphere of the «Flat Activity» Star tau Ceti (G8 V) with the Sun (G2 V) and alpha Centauri A (G2 V)*. Astrophysical Journal 2004;609:392-406
12. Loukitcheva, M.; Solanki, S.K.; **Carlsson, Mats**; Stein, R.F.. *Millimeter observations and chromospheric dynamics*. Astronomy and Astrophysics 2004;419:747-756
13. **Christiansen, Snorre H**. *A characterization of second order differential operators on finite element spaces*. Mathematical Models and Methods in Applied Sciences 2004;14(12): 1881-1892
14. **Christiansen, Snorre H**. *Discrete Fredholm properties and convergence estimates for the electric field integral equation*. Mathematics of Computation 2004;73(245):143-167
15. **Coclite, Giuseppe Maria**; Georgiev, V. *Solitary Waves for Maxwell-Schr"odinger Equations*. Electronic Journal of Differential Equations 2004(94):1-31
16. **Dahl, Geir**. *Tridiagonal doubly stochastic matrices*. Linear Algebra and its Applications 2004;390:197-208
17. **Dahl, Geir; Flatberg, Truls**. *Some constrained partitioning problems and majorization*. European journal of operational research 2004;158(2):434-443
18. **Dahl, Geir; Foldnes, Njål**; Gouveia, Luis. *A note on hop-constrained walk polytopes*. Operations Research Letters 2004;32
19. **Dahl, Geir**; et al.: *On the directed hop-constrained shortest path problem*. Operations Research Letters 2004;32:15-22
20. **Dahl, Geir**; et al.. *The 2-path network problem*. Networks 2004
21. Ouyed, Rachid; Elgarøy, Øystein; **Dahle, Håkon**; Keranen, Petteri: *Meissner Effect and Vortex Dynamics in Quark Stars - A Model for Soft Gamma-Ray Repeaters*. Astronomy and Astrophysics 2004;420:1025-1032
22. Smith, Robert E.; **Dahle, Håkon**; Maddox, Steve J; Lilje, Per Barth. *Spectro-Photometric and Weak Lensing Survey of a Supercluster and Typical Field Region - I. Spectroscopic Redshift Measurements*. Astrophysical Journal 2004; 617: 811-828.
23. Belic, Alexandar; **Dean, David J.; Hjorth-Jensen, Morten**. *Pairing correlations and transitions in nuclear systems*. Nuclear Physics A 2004;731:381-391
24. **Dean, David J.; Engeland, Torgeir; Hjorth-Jensen, Morten; Kartamyshev, Maxim; Osnes, Eivind.** *Effective interactions and the nuclear shell-model*. Progress in Particle and Nuclear Physics 2004;53:419-500
25. **Dean, David J.; Hjorth-Jensen, Morten.** Coupled cluster approach to nuclear physics. Physical Review C, Nuclear Physics 2004;69:054320-1-054320-14
26. Kowalski, Karol; **Dean, David J.; Hjorth-Jensen, Morten**; Papenbrock, Thomas; Piecuch, Piotr. *Coupled Cluster calculations of ground and excited states of nuclei*. Physical Review Letters 2004;92(13):132501-1-132501-4

27. **Di Nunno, Giulia; Proske, Frank; Øksendal, Bernt.** *White noise analysis for Levy processes.* Journal of Functional Analysis 2004;206:109-148
28. **Endeve, E**, Holzer, Thomas E., **Leer, E**: *Helmet Streamers Gone Unstable: Two-Fluid Magneto-Hydrodynamic Models of the Solar Corona,* Astrophysical Journal 2004;603:307
29. Gausemel, Håvar; Fogelberg, Birger; **Engeland, Torgeir; Hjorth-Jensen, Morten**; et al. *Decay of 127In and 129In.* Physical Review C, Nuclear Physics 2004;69(5):054307
30. **Eriksen, Hans Kristian Kamfjord**; Banday, Anthony J.; Górski, Krzysztof M.; **Lilje, Per Vidar Barth.** *On Foreground Removal from the Wilkinson Microwave Anisotropy Probe Data by an Internal Linear Combination Method: Limitations and Implications.* Astrophysical Journal 2004;612:633-646
31. **Eriksen, Hans Kristian Kamfjord**; Hansen, Frode K.; Banday, Anthony J.; Górski, Krzysztof M.; **Lilje, Per Vidar Barth.** *a. Asymmetries in the Cosmic Microwave Background Anisotropy Field.* Astrophysical Journal 2004;605:14-20
b. Erratum: «Asymmetries in the Cosmic Microwave Background Anisotropy Field» (ApJ, 605, 14 [2004]). Astrophysical Journal 2004;609:1198-1199
32. **Eriksen, Hans Kristian Kamfjord; Lilje, Per Vidar Barth;** Banday, Anthony J.; Górski, Krzysztof M.. *Estimating N-point Correlation Functions from Pixelized Sky Maps.* Astrophysical Journal Supplement Series 2004;151:1-11
33. **Eriksen, Hans Kristian Kamfjord**; Novikov, Dimitri; **Lilje, Per Vidar Barth**; Banday, Anthony J.; Górski, Krzysztof M.. *Testing for Non-Gaussianity in the Wilkinson Microwave Anisotropy Probe Data: Minkowski Functionals and the Length of the Skeleton.* Astrophysical Journal 2004;612:64-80
34. **Eriksen, Hans Kristian Kamfjord**; O'Dwyer, I. J.; Jewell, J. B.; Wandelt, B. D.; Larson, D. L.; Górski, Krzysztof M.; Levin, S.; Banday, Anthony J.; **Lilje, Per Barth.** *Power Spectrum Estimation from High-Resolution Maps by Gibbs Sampling.* Astrophysical Journal Supplement Series 2004;155:227-241
35. O'Dwyer, I. J.; **Eriksen, Hans Kristian Kamfjord**; Wandelt, B. D.; Jewell, J. B.; Larson, D. L.; Górski, Krzysztof M.; Banday, Anthony J.; Levin, S.; **Lilje, Per Barth.** *Bayesian Power Spectrum Analysis of the First-Year WMAP Data.* Astrophysical Journal 2004;617:L99-L102
36. Peter, Hardi; **Gudiksen, Boris**; Nordlund, Å.. *Coronal Heating through Braiding of Magnetic Field lines.* Astrophysical Journal 2004;617:L85-L88
37. **Hagen, Gaute; Hjorth-Jensen, Morten**; Vaagen, Jan Sigurd. **The contour deformation method in momentum space, applied to subatomic physics.** Journal of Physics A - Mathematical and General 2004;37:8991-9021
38. **Hansteen, Viggo**. *Initial simulations spanning the upper convection zone to the corona,* Proceedings of Multi Wavelength Investigations of Solar Activity, IAU Symp. 223; St.Petersburg, Russia, June 14-19, 2004. 2 pages.
39. **Holden, Helge**; Gesztesy, Fritz; Cascaval, Radu; Latushkin, Yuri.: *Spectral analysis of Darboux transformations for the focusing NLS hierarchy.* Journal D Analyse Mathematique, 2004;93:139-197
40. **Karlsen, Kenneth Hvistendahl**; Klingenberg, C.; **Risebro, Nils Henrik**. *A relaxation scheme for conservation laws with a discontinuous coefficient.* Mathematics of Computation 2004;73(247):1235-1259
41. **Karlsen, Kenneth Hvistendahl; Risebro, Nils Henrik**; Towers, John D.. *Front tracking for scalar balance equations.* Journal of Hyperbolic Differential Equations 2004;1(1):115-148
42. **Karlsen, Kenneth Hvistendahl**; Towers, John D.. *Convergence of the Lax-Friedrichs scheme and stability for conservation laws with a discontinuous space-time dependent flux.* Chinese Annals of Mathematics Series B 2004;25(3):287-318
43. Amadori, Anna Lisa; **Karlsen, Kenneth Hvistendahl; La Chioma, Claudia.** *Nonlinear degenerate integro-partial differential evolution equations related to geometric Lévy processes and applications to backward stochastic differential equations.* Stochastics and Stochastics Reports 2004;76(247):147-177
44. Berres, Stefan; Burger, Raimund; **Karlsen, Kenneth Hvistendahl**. *Central schemes and systems of conservation laws with discontinuous coefficients modeling gravity separation of polydisperse suspensions.* Journal of Computational and Applied Mathematics 2004;164-165:53-80
45. Burger, Raimund; Damasceno, J. J. R.; **Karlsen, Kenneth Hvistendahl**. *A mathematical model for batch and continuous thickening of flocculent suspensions in vessels with varying cross section.* International Journal of Mineral Processing 2004;73:183-208
46. Burger, Raimund; **Karlsen, Kenneth Hvistendahl**. *On strongly degenerate parabolic problems with discontinuous coefficients* Monografias del Seminario Matematico Garcia de Galdeano 31, Prensas Universitarias de Zaragoza, Universidad de Zaragoza, Spain; 2004, Invited paper for VIIIemes Journees de Mathematiques Appliquees et Statistique Zaragoza-Pau
47. Burger, Raimund; **Karlsen, Kenneth Hvistendahl; Risebro, Nils Henrik**; Towers, John D. *Monotone difference approximations for the simulation of clarifier-thickener units.* Computing and Visualization in Science 2004;6:83-91
48. Burger, Raimund; **Karlsen, Kenneth Hvistendahl; Risebro, Nils Henrik**; Towers, John D.. *Numerical methods for the simulation of continuous sedimentation in ideal clarifier-thickener units.* International Journal of Mineral Processing 2004;73:209-228

49. Burger, Raimund; **Karlsen, Kenneth Hvistendahl; Risebro, Nils Henrik**; Towers, John D.. *Well-posedness in BV_t and convergence of a difference scheme for continuous sedimentation in ideal clarifier-thickener units.* Numerische Mathematik 2004;97(1):25-65
50. **Killie, Mari Anne; Janse, Åse Marit**; Lie-Svendsen, Øystein; Leer, Egil. *Improved transport equations for fully ionized gas.* Astrophysical Journal 2004;604:842
51. **Klausen, Runhild Aae**; et al.. *Multi Point Flux Approximation and Finite Element Method; Practical Aspects of Discontinous Media.* ECMOR Proceedings 2004;IX
52. **Klausen, Runhild Aae**; et al.. *Recent Advances for MPFA Method.* ECMOR Proceedings 2004;IX
53. **Klausen, Runhild Aae**; et al.. *Relationships among some locally conservative discretization methods which handle discontinuous coefficients.* Computational Geosciences 2004
54. **Kozlov, Roman**; et al.. *Continuous symmetries of Lagrangians and exact solutions of discrete equations.* Journal of Mathematical Physics 2004;45(1):336-359
55. **Kozlov, Roman**; Kværnø, Anne; Owren, Brynjulf. *The behaviour of the local error in splitting methods applied to stiff problems.* Journal of Computational Physics 2004;195(2):576-593
56. **Lanconelli, Alberto; Proske, Frank Norbert**. *On explicit strong solutions of Ito-SDE's and the Donsker delta function of a diffusion.* Infinite Dimensional Analysis, Quantum Probability and Related Topics, 2004;7(3)
57. **Lindstrøm, Tom Louis**. *Hyperfininite Lévy processes.* Stochastics and Stochastics Reports 2004;76(6):517-548
58. **Lindstrøm, Tom Louis**. *Model Theory of Stochastic Processes - Book Review.* Bulletin of the London Mathematical Society 2004;36(2):281-282
59. **Lyche, Tom** ; et al.. *Optimally Stable Multivariate Bases.* Advances in Computational Mathematics 2004;20:149-159
60. **Meyer-Brandis, Thilo; Proske, Frank Norbert**. *Explicit solution of a non-linear filtering problem for Levy processes with application to finance.* Applied mathematics and optimization 2004(50):119-134
61. **Moan, Per Christian**. *On the KAM and Nekhoroshev theorems for symplectic integrators and implications for error growth.* Nonlinearity 2004;17:67-83
62. **Moan, Per Christian**; Quispel, G.R.W.; Sofroniou, M.; Spaletta, G.; et al.. *Symplectic elementary differential Runge-Kutta methods.* Numerische Mathematik 2004
63. **Moan, Per Christian**; Quispel, G.R.W.; Spaletta, G.. *Some invariance theorems for one-step integration methods and their consequences for B-series methods.* Foundations of Computational Mathematics 2004
64. **Müller, Daniel**; Peter, H.; **Hansteen, Viggo**. *Dynamics of solar coronal loops. II. Catastrophic cooling and high-speed downflows.* Astronomy and Astrophysics 2004;424:289-300
65. **Piene, Ragni**; Kleiman, Steven. *Node polynomials for families: methods and applications.* Mathematische Nachrichten 2004;271:69-90
66. **Proske, Frank Norbert**. *The stochastic transport equation driven by Levy white noise.* Communications in Mathematical Sciences 2004;2(4):627-641
67. **Proske, Frank Norbert**. *Explicit solution of a non-linear filtering problem for Levy processes with application to finance,* Applied mathematics and optimization; 2004
68. **Proske, Frank Norbert**. *Explicit strong solution of Ito-SDE's and the Donsker delta function of a diffusion* Infin. Dimen. Anal. Quant. Prob. Related Topics; 2004
69. Berger, T.E.; **Rouppe, Van Der Voort Luc**; Löfdahl, M.G.; **Carlsson, Mats**; Fossum, Astrid; **Hansteen, Viggo**; Marthinussen, Elin; Title, A.; Scharmer, G.B.. *Solar magnetic elements at 0.1 arcsec resolution. General appearance and magnetic structure.* Astronomy and Astrophysics 2004;428:613-628
70. **Rouppe, Van Der Voort Luc**; Löfdahl, M.G.; Kiselman, D.; Scharmer, G.B.. *Penumbral structure at 0.1 arcsec resolution. I. General appearance and power spectra.* Astronomy and Astrophysics 2004;414:717-726
71. **Saltyte-Benth, Jurate**; Ducinskas, Kestutis. *Linear Discriminant Analysis of Spatial-Temporal Data.* Lithuanian Mathematical Journal 2004(44)
72. **Surazhsky, Vitaly**; et al.. *High quality compatible triangulations.* Engineering with Computers 2004;20(2):147-156
73. **Surazhsky, Vitaly**; et al. *Type-safe covariance in C++* Proceedings of the 2004 ACM symposium on Applied computing; 1496-1502
74. Chan, Tony F; **Tai, Xue-Cheng**; et al.. *Level Set And Total Variation Regularization For Elliptic Inverse Problems With Discontinuous Coefficients.* Journal of Computational Physics 2004;193(1):40-66
75. Majava, Kirsi; **Tai, Xue-Cheng**. *A Level Set Method for Solving Free Boundary Problems Associated with Obstacles.* International Journal on Numerical Analysis and Modeling 2004;1(2):157-172
76. Marius, Lysaker; Osher, Stanley; **Tai, Xue-Cheng**. *Noise Removal Using Smoothed Normals and Surface Fitting.* IEEE Transactions on Image Processing 2004;13:1345-1457
77. **Tai, Xue-Cheng**; Chan, Tony. *A survey on Multiple Level Set Methods with Applications for Identifying Piecewise Constant Functions.* International Journal on Numerical Analysis and Modeling 2004;1(1):25-48
78. Mardal, K.-A., **Winther, R**. *Uniform preconditioners for the time dependent Stokes problem,* Numerische Mathematik, 2004;98:305-327

79. Ivar Østby, **Ragnar Winther**. *Stability of a human granulopoiesis using continuous maturation,* Journal of Mathematical Biology, 2004;49:501-536
80. Smolyansky, Stanislav; Prozorkevich, Alexandr; Skokov, Vladimir; **Zabrodin, Evgeny**. *Vacuum creation of quarks at the time scale of QGP thermalization and strangeness enhancement in heavy-ion collisions.* Physics Letters B 2004;583(1-2): 103-110
81. Bravina, Larissa; **Zabrodin, Evgeny**; Fuchs, Christian; Faessler, Amand. *Microscopic description of anisotropic flow in relativistic heavy ion collisions* Progress in Particle and Nuclear Physics, April 2004
82. **Øksendal, Bernt; Biagini, Francesca**; Sulem, Agnès; Wallner, Naomi. *An introduction to white noise and Malliavin calculus for fractional Brownian motion.* Proceedings of «Stochastic Analysis with Applications to Mathematical Finance», J.Cash (ed.), Royal Society London A 2004;460:347-372
83. **Øksendal, Bernt**; Hu, Yaozhong; **Zhang, Tusheng**. *General fractional multiparameter white noise theory and stochastic partial differential equations.* Communications in Partial Differential Equations 2004;29:1-23
84. **Øksendal, Bernt**; Løkka, Arne; **Proske, Frank**. *Stochastic partial differential equations driven by Lévy space-time white noise.* Annals of Applied Probability 2004;14:1506-1528
85. **Øksendal, Bernt; Proske, Frank**. *White noise of Poisson random measures.* Potential Analysis 2004;21:375-403
86. **Øksendal, Bernt; Proske, Frank; Mataramvura, Sure**. *The Donsker delta function of a Levy process with applications to chaos expansion of local time.* Annales De L Institut Henri Poincare - Probabilites et Statistiques 2004;40(5):553-567
87. **Øksendal, Bernt**; Sulem, Agnès. *Partial observation control in an anticipating environment.* Russian Mathematical Surveys 2004;59:161-184
88. **Øksendal, Bernt**; Sulem, Agnès; Framstad, Nils Christian. *Sufficient stochastic maximum principle for optimal control of jump diffusions and applications to finance.* Journal of Optimization Theory and Application 2004;121:77-98
89. **Aase, Knut K.**: *A Pricing Model for Quantity Contracts,* Journal of Risk and Insurance 71 (2004), 617-642

7b. Books 2004

1. **Benth, F. E.**: *Option Theory with Stochastic Analysis - An Introduction to Mathematical Finance,* Springer-Verlag 2004. ISBN: 3-540-40502-X
2. **Dokken, Tor**; Jüttler, Bert. *Computational Methods for Algebraic Spline Surfaces.* Heidelberg: Springer Publishing Company 2004. ISBN 3-540-23274-5. 237 pages.
3. Dodgson, Neil; **Floater, Michael S.**; Sabin, Malcolm. *Advances in Multiresolution for Geometric Modelling.* Heidelberg: Springer Publishing Company 2004. ISBN 3-540-21462-3. 436 pages.
4. Owe, Olaf; Krogdahl, Stein; **Lyche, Tom**. *From Object-Orientation to Formal Methods. Essays in Memory of Ole-Johan Dahl.* Berlin, Heidelberg, New York: Springer-Verlag 2004. ISBN 3-540-21366-X. 388 pages.
5. **Piene, Ragni**; Laudal, Olav Arnfinn. (eds) *The Legacy of Niels Henrik Abel.* Berlin Heidelberg New York: Springer-Verlag 2004. ISBN 3-540-43826-2. 784 pages.
6. **Øksendal, Bernt**; Sulem, Agnès. Applied Stochastic Control of Jump Diffusions. Berlin: Springer 2004. ISBN 3-540-14023-9. 208 pages.

7c. Book Chapters

1. Demaret, Laurent; Dyn, Nira; **Floater, Michael S.**; Iske, Armin. *Adaptive Thinning for Terrain Modelling and Image Compression,* in «Advances in Multiresolution for Geometric Modelling». Heidelberg: Springer Publishing Company 2004. ISBN 3-540-21462-3. s. 319-338
2. **Floater, Michael S.**; Hormann, Kai. *Surface Parameterization: a Tutorial and Survey,* in «Advances in Multiresolution for Geometric Modelling». Heidelberg: Springer Publishing Company 2004. ISBN 3-540-21462-3. s. 157-186
3. **Johansen, Pål Hermunn**. *The Geometry of the Tangent Developable.* in «Computational Methods for Algebraic Spline Surfaces». Berlin Heidelberg New York: Springer Publishing Company 2004. ISBN 3-540-23274-5. s. 95-106
4. Owe, Olaf; Krogdahl, Stein; **Lyche, Tom**. *A Biography of Ole-Johan Dahl,* in «From Object-Orientation to Formal Methods. Essays in Memory of Ole-Johan Dahl». Berlin, Heidelberg, New York: Springer-Verlag 2004. ISBN 3-540-21366-X. s. 1-7
5. **Piene, Ragni**. *Singularities of some projective rational surfaces,* in «Computational Methods for Algebraic Spline Surfaces». Berlin Heidelberg New York: Springer Publishing Company 2004. ISBN 3-540-23274-5. s. 171-182
6. B. Falcidieno, M. Spagnuolo, P. Alliez, **E. Quak**, E. Vavalis and C. Houstis: *Towards the Semantics of Digital Shapes: the AIM@SHAPE Approach,* in «Proceedings of the European Workshop on the Integration of Knowledge, Semantic and Digital Media Technologies EWIMT 2004», Royal Statistical Society, London, UK, 2004.
7. J. Prestin and **E. Quak**: *Periodic and Spline Multiresolution Analysis and the Lifting Scheme,* in «Advances in Multiresolution for Geometric Modelling», N.A. Dodgson, M.S. Floater, M.A. Sabin (eds.), Springer Verlag, pp. 369--390
8. **Thomassen, Jan Brede**. *Self-Intersection Problems and Approximate Implicitization,* in «Computational Methods for Algebraic Spline Surfaces». Berlin Heidelberg New York: Springer Publishing Company 2004. ISBN 3-540-23274-5. s. 155-170
9. Wurm, Elmar; **Thomassen, Jan Brede**; Jüttler, Bert; **Dokken, Tor**. *Comparative Benchmarking of Methods for Approximate Implicitization,* in «Geometric Modeling and Computing: Seattle 2003». Brentwood, TN: Nashboro Press 2004. ISBN 0-9728482-3-1.
10. **Aase, Knut K**. *The Life and Career of Karl H. Borch,* in «Encyclopedia of Actuarial Science» 1 (2004), Wiley, 191-195
11. **Aase, Knut K**. *Financial Economics,* in «Encyclopedia of Actuarial Science» 2 (2004), Wiley, 676-685
12. **Aase, Knut K**. *Optimal Risk Sharing,* in «Encyclopedia of Actuarial Science» 3 (2004), Wiley, 1212-1215
13. **Aase, Knut K**. *Pooling in Insurance,* in «Encyclopedia of Actuarial Science» 3 (2004), Wiley, 1308-1311

7d. Contributions, Proceedings, Reports etc.

1. Bogdan, T.J.; **Carlsson, Mats; Hansteen, Viggo**; Heggland, Lars; **Leer, Egil; Mcmurry, Andrew David**; Stein, R.F.. *Mode Conversion in Magneto-Atmospheres,* AGU Fall Meeting, abstract #SH13A-1162, Proceedings from American Geophysical Union, Fall Meeting 2004; December 13-17, 2004.
2. Stein, R.F.; **Carlsson, Mats**; Nordlund, Å.; Scharmer, G.B.. *G-band Images from MHD Convection simulations* Bulletin of the American Astronomical Society, Proceedings from AAS Meeting 204; May 30 - June 3, 2004.
3. **Coclite, Giuseppe Maria**. *Problemi di Controllo per Sistemi di Leggi di Conservazione*. Bollettino dell'U.M.I. sez. A 2004;VII-A(VIII):471-474
4. **Dahle, Håkon**. *M/L of X-ray luminous clusters from weak lensing,* Proceedings of IAU Colloquium no.195, Cambridge University Press 200-204, 2004
5. **Dean, David J.**; Grour, Jeffrey; **Hagen, Gaute; Hjorth-Jensen, Morten**; et al. *Nuclear Structure Calculations with Coupled Cluster Methods from Quantum Chemistry.* Los Alamos National Laboratory, xxx.lanl.gov 2004. 10 s. http://xxx.lanl.gov/archive/nucl-th ; nucl-th/0409062
6. **Di Nunno, Giulia**. *Differenziazione stocastica non-anticipativa e applicazione alle coperture a varianza minima.* Bollettino UMI 2004
7. **Hagen, Gaute; Hjorth-Jensen, Morten**; Vaagen, Jan Sigurd. *Effective Interaction Techniques for the Gamow Shell Model.* Los Alamos National Laboratory, xxx.lanl.gov 2004. 23 s. http://xxx.lanl.gov/archive/nucl-th ; nucl-th/0410114
8. Vistnes, Arnt Inge; **Hjorth-Jensen, Morten**. *Numerical methods as an integrated part of physics education,* Proceedings of 9th Workshop on Multimedia in Physics Teaching and Learning; Graz, Austria, September 9-11, 2004http://physik.uni-graz.at/MPTL9/index.php?style=2&item=5&subitem=3; 2004
9. **Reimers, Martin**; Røtnes, Jan Sigurd; Aurdal, Lars; Djupesland, Per; et al.. *Fluid flow and particle deposition simulations in the human nose,* Proceedings of SIMS 2004, Copenhagen, Denmark, September 23-24, 2004.
10. Berger, T.E.; **Rouppe, Van Der Voort Luc**; Löfdahl, M.G.; **Carlsson, Mats**; Fossum, Astrid; **Hansteen, Viggo**; Marthinussen, Elin; Title, A.; Scharmer, G.B.. *Observations of Solar magnetic elements with 0.1 arcsec resolution,* Bulletin of the American Astronomical Society, Proceedings from AAS Meeting 204; May 30 - June 3, 2004
11. **Surazhsky, Tatiana; Surazhsky, Vitaly**. *Sampling planar curves using curvature-based shape analysis* Proceedings of the Sixth International Conference on Mathematical Methods for Curves and Surfaces, Tromsø, 2004
12. Lie, Johan; Marius, Lysaker; **Tai, Xue-Cheng**. *A Binary Level Set Model and Some Applications to Mumford-Shah Image Segmentation.* UCLA Applied Mathematics CAM-report 2004;04-31
13. **Winther, Ragnar**; Mardal, Kent-Andre. An observation on Korn's inequality for nonconforming finite element methods: Centre of Mathematics for Applications, Universitetet i Oslo 2004. 6 p.
14. **Zabrodin, Evgeny**; Smolyansky, Stanislav; Prozorkevich, Alexandr; Fuchs, Christian. *Vacuum particle creation in a non-stationary Casimir bag,* Vestnik of Moscow State University , 2004
15. **Aase, Knut K.**: *Negative Volatility and the Survival of the Western Financial Markets,* Wilmott Magazine, July 2004, 64-67
16. **Aase, Knut K.**: *Negative volatility and the Survival of Western Financial Markets,* Institutt for foretaksøkonomi. Norges handelshøyskole, Discussion paper 5 (2004), 8 pp.
17. **Aase, Knut K.**: *Jump Dynamics: The Equity Premium and the Risk-Free Rate Puzzles,* Institutt for foretaksøkonomi. Norges handelshøyskole, Discussion paper 12 (2004), 28 pp.
18. **Aase, Knut K.**: *The perpetual American put option for jump-diffusions: Implications for equity premiums,* Institutt for foretaksøkonomi. Norges handelshøyskole, Discussion paper 19 (2004), 36 pp.

7e. CMA Preprint series 2004.

1. **F. E. Benth** and **J. Saltyte-Benth**: *Stochastic modelling of temperature variations with a view towards weather derivatives.*
2. **H. K. Eriksen**, D. I. Novikov, **P. B. Lilje, A**. J. Banday and K. M. Gorski: *Testing for non-Gaussianity in the WMAP data: Minkowski functionals and the length of the skeleton.*
3. **A. Lanconelli, F. Proske**: *A New Approach to Strong Solutions of SDE's with non-Lipschitzian coefficients.*
4. **F. E. Benth** and **T. Meyer-Brandis**: *Indifference pricing and the minimal entropy martingale measure in a stochastic volatility model with jumps.*
5. **H. K. Eriksen**, A. J. Banday, K. M. Gorski and **P. B. Lilje**: *Foreground removal by an Internal Linear Combination method: limitations and implications.*
6. **T. Meyer-Brandis, F. Proske**: *On the Existence and Explicit Representability of Strong Solutions of Lévy Noise Driven SDE's with Irregular Coefficients.*
7. **F. E. Benth** and **K. H. Karlsen**: *A note on Merton's portfolio selection problem for the Schwartz mean-reversion model.*
8. **F. Biagini** and **B. Øksendal**: *Minimal variance hedging for insider trading.*
9. **G. Di Nunno**: *On Orthogonal Polynomials and the Malliavin Derivative for Lévy Stochastic Measures.*
10. **G. Di Nunno** and **B. Øksendal**: *The Donsker Delta Function, a Representation Formula for Functionals of a Lévy Process and Application to Hedging in Incomplete Markets.*
11. **G. M. Coclite** and V. Georgiev: *Solitary waves for Maxwell-Schrödinger equations.*
12. **K. H. Karlsen** and J. D. Towers: *Convergence of the Lax-Friedrichs scheme and stability for conservation laws with a discontinuous space-time dependent flux.*
13. A. L. Amadori, **K. H. Karlsen**, and **C. La Chioma**: *Nonlinear degenerate integro-partial differential evolution equations related to geometric Lévy processes and applications to backward stochastic differential equations.*
14. **A. Yablonski**: *The calculus of variations for processes with independent increments.*
15. **T. Lindstrøm**: *Hyperfinite Lévy Processes.*
16. M. Bendahmane and **K. H. Karlsen**: *Anisotropic nonlinear elliptic systems with measure data and anisotropic harmonic maps into spheres.*
17. M. Bendahmane and **K. H. Karlsen**: *Uniqueness of entropy solutions for doubly nonlinear anisotropic degenerate parabolic equations.*
18. **A. Yablonski**: *Differential equations with generalized coefficients.*
19. **B. Øksendal** and **T. Zhang**: *The Itô-Ventzell Formula and Forward Stochastic Differential Equations Driven by Poisson Random Measures.*
20. I.J. O'Dwyer, **H.K. Eriksen**, B.D. Wandelt, J.B. Jewell, D.L. Larson, K. M. Gorski, A.J. Banday, S. Levin, P.B. Lilje: *Bayesian Power Spectrum Analysis of the First-Year WMAP data.*
21. **H. K. Eriksen**, I. J. O'Dwyer, J. B. Jewell, B. D. Wandelt, D. L. Larson, K. M. Gorski, S. Levin, A. J. Banday, P. B. Lilje: *Power spectrum estimation from high-resolution maps by Gibbs sampling.*
22. **H. K. Eriksen**, A. J. Banday, K. M. Gorski and **P. B. Lilje**: *The N-point correlation functions of the first-year Wilkinson Microwave Anisotropy Probe sky maps.*
23. **F. Biagini, B. Øksendal**: *Forward integrals and an Itô formula for fractional Brownian motion.*
24. **B. Øksendal**: *Optimal stopping with delayed information.*
25. **T. Meyer-Brandis, F. Proske**: *Explicit Representation of Solutions of Forward Stochastic Differential Equations.*
26. **G. M. Coclite**, M. M. Coclite: *Positive Solutions for an Integro-Differential Equation with Singular Nonlinear Term.*
27. **G. M. Coclite, H. Holden, K. H. Karlsen**: *Wellposedness of solutions of a parabolic-elliptic system.*
28. **B. Øksendal**: *A Universal Optimal Consumption Rate for an Insider.*
29. R. Bürger, **K. H. Karlsen**, J. D. Towers: *Closed-form and finite difference solutions to a population balance model of grinding mills.*
30. E. R. Jakobsen and **K. H. Karlsen**: *Continuous dependence estimates for viscosity solutions of integro PDEs.*
31. R. Bürger, **K. H. Karlsen**, J. D. Towers: *A model of continuous sedimentation of flocculated suspensions in clarifier-thickener units.*
32. G.-Q. Chen, **K. H. Karlsen**: *Quasi-linear anisotropic degenerate parabolic equations with time-space dependent diffusion coefficients.*
33. E. R. Jakobsen, **K. H. Karlsen**: *A convergence rate for semi-discrete splitting approximations for degenerate parabolic equations with source terms.*
34. **S. H. Christiansen, R. Winther**: *On constraint preservation in numerical simulations of Yang-Mills equations.*
35. **S. Mataramvura**: *On risk minimizing portfolios and martingale measures in Lévy markets.*
36. **G. M. Coclite, H. Holden, K. H. Karlsen**: *Global weak solutions to a generalized hyperelastic-rod wave equation.*
37. M. Chu, **H.K. Eriksen**, L. Knox, K. M. Gorski, J. B. Jewell, D. L. Larson, I. J. O'Dwyer, B. D. Wandelt: *Cosmological Parameter Constraints as Derived from the Wilkinson Microwave Anisotropy Probe Data via Gibbs Sampling and the Blackwell-Rao Estimator.*
38. **H. Holden**, L. Holden, S. Holden: *Contract Renewal*
39. **G. Di Nunno**: Random Fields: *Skorohod integral and Malliavin derivative.*
40. **T. Meyer-Brandis**: Stochastic Feynman-Kac Equations associated to Lévy-Itô Diffusions.

APPENDIX 8 – Talks outside CMA by CMA-members in 2004

8a. Invited scientific talks

1. **Benth, Fred Espen**. *Pricing in electricity and weather markets,* Technische Universitat Munchen, Germany, January 29, 2004.
2. **Benth, Fred Espen**. *Pricing in electricity and weather markets, Department of Actuarial Mathematics,* University of Copenhangen, Denmark, March 2, 2004
3. **Benth, Fred Espen**. *Modelling of spot and forward contracts in weather and electricity markets,* The 3rd World Congress of the Bachelier Finance Society, Chicago, USA, July 24, 2004.
4. **Benth, Fred Espen**. *A stochastic temperature dynamics with applications to weather derivatives pricing,* Helsinki Technical University, Finland, December 2, 2004.
5. **Benth, Fred Espen**. *Prising i vær- og elektrisitetsmarkeder,* Statistical section, Department of Mathemmatics, University of Oslo, Norway, February 16, 2004
6. **Carlsson, Mats**. *NLTE in Stellar Atmospheres,* Workshop on non-LTE in Stellar Atmospheres, Montpellier, France, January 16-18, 2004
7. **Carlsson, Mats; Rouppe, Van Der Voort Luc; Hansteen, Viggo**. *Observations at 0".1 Resolution of the Dynamic Evolution of Magnetic Elements,* Multi Wavelength Investigations of Solar Activity, IAU Symp. 223; St.Petersburg, Russia, June 14-19, 2004.
8. **Mats Carlsson**: *Time Dependent Chromosphere: Models and Observations,* Solar Chromosphere and Wind, Tromsø, Norway, June 23-25, 2004
9. **Mats Carlsson**: *Non-LTE,* School on «Analysis techniques for turbulent plasmas», Copanello, Italy, September 28 - October 2, 2004
10. **Mats Carlsson**: *Numerical Solar MHD,* School on «Solar Magnetometry and Solar Magnetism», Tatranska Lomnica, Slovakia, November 3-10, 2004.
11. **Christiansen, Snorre H**. *Div-Curl lemma for edge elements,* Workshop on Computational Electromagnetism, Oberwolfach, Germany, February 22-28, 2004
12. **Christiansen, Snorre H**. *On the use of Calderon formulas to precondition acoustic boundary integral equations on open surfaces,* First Chilean Workshop on Numerical Analysis of PDE's (WONAPDE), Conception, Chile, January 13-16, 2004
13. **Christiansen, Snorre H**. *Div-curl lemma for edge elements,* IMA «Hot Topics» Workshop: Compatible Spatial Discretizations for Partial Differential Equations, Minneapolis, USA, May 11-15, 2004.
14. **Christiansen, Snorre H**. *On divergence control in numerical simulations of Yang-Mills equations,* 3rd Danish Symposium on Applied Analysis; Copenhagen, Denmark, August 25-28, 2004
15. **Christiansen, Snorre H**. *Preconditioning the Electric Field Integral Equation (Two talks),* Seminaire d'electromagnetisme et calcul parallele, Centre Europ'een de Recherche et de Formation Avanc'ee en Calcul Scientifique, Toulouse, France; September 28, 2004
16. **Christiansen, Snorre H**. *On divergence control in numerical simulations of Yang-Mills equations,* Istituto di Matematica Applicata e Tecnologie Informatiche del Consiglio Nazionale delle Ricerche e Dipartimento di Matematica, Pavia, Italy, October 5, 2004
17. **Christiansen, Snorre H**. *Sur le controle de la divergence dans la simulation numerique des equations de Yang-Mills,* Seminaire d'analyse numerique, Ecole Polytechnique, Paris, France; October 12, 2004.
18. **Christiansen, Snorre H**. *Sobre la simulacion numerica de las ecuaciones de Yang-Mills,* XXXI Semana de la Matematica, Pontificia Universidad Católica de Valparaíso, Chile, October 20-22, 2004
19. **Christiansen, Snorre H**. *Numerical simulation of a non-linearly constrained evolution PDE: the Yang-Mills equations,* Universidad de Santiago, Chile November 4, 2004
20. **Coclite, Giuseppe Maria**: *On the boundary control of first order hyperbolic equations,* Workshop «Fourth World Congress of Nonlinear Analysts WCNA-2004», Orlando, USA, July 1, 2004.
21. **Dahle, Håkon**. *Still trouble for the LambdaCDM model on small scales?* Internal Colloqium, Department of Physics & Astronomy, University of Calgary, Canada, May 20, 2004
22. **Dean, David J.; Hjorth-Jensen, Morten**; et al. Coupled Cluster Theory for Nuclei International Workshop on Condensed Matter Theories CMT28 ; University of Washington, USA, September 27 - October 2, 2004
23. Piecuch, Piotr; **Dean, David J.**; Grour, Jeffrey; **Hjorth-Jensen, Morten**; et al. *Coupled Cluster Calculations of Ground and Excited States of Nuclei,* The Fourth International Conference on Exotic Nuclei and Atomic Masses; Callaway Gardens, Georgia, USA, September 12-16, 2004
24. **Di Nunno, Giulia**. *On Minimal Variance Hedging in a General Risk-Neutral Market,* University of Bonn, Germay. January 15, 2004
25. **Di Nunno, Giulia**. *On Minimal Variance Hedging Strategies,* Symposium on Mathematical Finance, African Institute of Mathematical Sciences, Cape Town, South Africa, February 27, 2004

26. **Di Nunno, Giulia**. *On pre-considered boundaries for equivalent martingale measures in a multi-perid market.* Tsitsikamma conference on HyperFinance, South Africa, March 1-5, 2004.
27. **Di Nunno, Giulia**. *On minimal variance hedging and a non-anticipating stochastic derivative,* Center for Mathematical Sciences, Technical University of Munich, Germany, April 26
28. Di **Nunno, Giulia**. *On equivalent martingale measures with pre-considered boundaries for their density.* The Third Scientific Conference on Insurance and Finance, Dresden, Germany, April 28, 2004
29. **Di Nunno, Giulia**. *Optimal portfolio problems in a market driven by Levy processes,* Department of Mathematics, University of Pavia, Italy. June 7, 2004
30. **Di Nunno, Giulia**. *Optimal portfolio of an insider in a market driven by Lévy processes,* Workshop on New Techniques in Applied Stochastics, Helsinki, Finland, August 14-18, 2004.
31. **Di Nunno, Giulia**. *Stochastic Integral Representations and Minimal Variance Hedging in Finance,* 6th Pan African Conference Of Mathematicians, Tunis, Tunisia, August 31-September 6, 2004
32. **Di Nunno, Giulia**. *On equivalent martingale measures and events of small probability,* Workshop on Advanced Mathematical Methods for Finance, Munich, Germany, October 27-30, 2004.
33. **Di Nunno, Giulia**. *Minimal Variance Hedging and Stochastic Differentiation,* Manchester University, U.K., November 15, 2004.
34. **Di Nunno, Giulia**. *Minimal Variance Hedging in Levy Markets,* University of Botswana, Gaborone, Botswana, November 23-27.
35. **Di Nunno, Giulia**. *Optimal portfolio problems for an insider in a market driven by Lévy processes,* SAMSA conference 2004, Polokwane, South Africa, November 28- December 5, 2004.
36. **Dokken, Tor**. *Weak approximate implicitization II Workshop on Algebraic Geometry and Geometric Modeling,* University of Nice Sophia Antipolis, France, September 27-29, 2004
37. **Floater, Michael S**. *Arc length estimation and the convergence of spline curve interpolation,* Mathematics Seminar, Leciester University, UK, October 21, 2004
38. **Floater, Michael S**. *On the approximation order of parametric spline interpolation,* MAIA 2004, Hohenheim, Stuttgart, Germany October 12-17, 2004
39. **Floater, Michael S**. *On the approximation order of parametric spline interpolation,* Numerical Analysis Seminar, University of Cambridge, UK, November 18, 2004
40. **Hjorth-Jensen, Morten**. A computational Environment for Nuclear Structure, Isolde Lecture series, CERN, Switzerland (6 lectures) November 11-25, 2005
41. **Hjorth-Jensen, Morten**. *Challenges for Nuclear Structure; from Stable to Weakly Bound Nuclei Theory seminar University of Tuebingen,* Germany, December 7, 2004
42. **Hjorth-Jensen, Morten**. *Challenges for Nuclear Structure Studies,* Isolde workshop 2004, CERN, Switzerland, December 13-15, 2004
43. **Hjorth-Jensen, Morten**. *Coupled Cluster approaches to nuclei, ground state and excited states* 8th International Spring Seminar on Nuclear Physics, Paestum, Italy, May 23- 27, 2004
44. **Hjorth-Jensen, Morten**. *Effective Interactions for the Nuclear many-body problem,* Workshop on Nuclear structure Studies for Light Nuclei; UMIST, Manchester, UK, July 4-8, 2004
45. **Hjorth-Jensen, Morten**. *Nuclear Many-Body Approaches and Experiment;* Insitute of Nuclear Theory workshop series; University of Washington, Seattle, USA, October 4-8, 2004
46. **Hjorth-Jensen, Morten**. *Nuclear structure and the coupled-cluster method,* International Nuclear Physics Conference, INPC2004, Gothenburg, Sweden, June 27- July 2, 2004
47. **Hjorth-Jensen, Morten**. *Nuclear Structure for Radioactive Ion Beam Physic,* Isolde Physics Group Seminar Series, CERN, Switzerland September 21, 2004
48. **Hjorth-Jensen, Morten**. *Selected Nuclear Structure Topics* [Vitenskapelig foredrag]. Workshop on Nuclear structure Studies for Light Nuclei; UMIST, Manchester, UK, July 4-8, 2004
49. **Hjorth-Jensen, Morten**. *Shell-Model Approaches and Effective Interactions for Weakly Bound Systems,* Insitute Seminar Max-Planck Institut fuer Kern Chemie, Mainz, Germany; December 6, 2004
50. **Hjorth-Jensen, Morten**. *Økt innsikt og læring ved hjelp av IKT i Fysikk - Det Umuliges kunst?* IKT i utdanning - kvalitetetsreformen i praksis; University of Oslo, Norway, April 28, 2004
51. **Holden, Helge**. *On the Camassa-Holm and the Hunter-Saxtion equations,* Fourth European Congress of Mathematics, Stockholm, Sweden, June 28, 2004.
52. **Karlsen, Kenneth Hvistendahl**. *Quasilinear anisotropic degenerate parabolic equations: continuous dependence estimates and renormalized entropy solutions* Institute of Applied Analysis and Numerical Simulation, University of Stuttgart, Germany, February 15, 2004.
53. **Karlsen, Kenneth Hvistendahl**. *Recent progress on a theory of entropy solutions for quasilinear degenerate parabolic equations,* Helsinki University of Technolog, Finland; August 24-27, 2004
54. **Karlsen, Kenneth Hvistendahl**. *Strongly degenerate parabolic equations,* Mathematisches Forschungsinstitut Oberwolfach, Germany, Meeting on Wave motion, January 25-31, 2004.
55. **Karlsen, Kenneth Hvistendahl**. *Uniqueness/ continuous dependence results for integro-PDEs and Applications,* University of Freiburg, Germany, January 22, 2004.
56. **Klausen, Runhild Aae**. *Discretization of the Pressure Equation for Reservoirsimulation; Multi Point Flux Approximation and Finite Elements,* Computational Mathematics Seminar, Pittsburgh University, USA, November 17, 2004
57. **La Chioma, Claudia**: *Integral-Partial Differential Equations in a Market Driven by Geometric Levy Processes: Theoretical Aspects and Numerical Approximation,* Royal Institute of Technology - KTH, Stockholm, Sweden. May, 3, 2004,
58. **La Chioma, Claudia**: *Integro–partial differential equations in a market driven by geometric Levy processes: theoretical aspects and numerical approximation,* Oberwolfach, Germany, May 19, 2004
59. **Lyche, Tom**. *Spline quasi-interpolant projectors on a three direction mesh.* Int. conference on Multivariate Approximation and Interpolation; University of Hohenheim, Stuttgart, Germany, October 13-17, 2004
60. **Lyche, Tom**. *Univariate and bivariate Hermite subdivision with shape constraints* Int. conference on Multivariate Approximation and Interpolation; University of Hohenheim, Stuttgart, Germany, October 13-17, 2004
61. **Makasu, Cloud**. *Stochastic control of the running max with jump-diffusions,* King's college, London, UK. April 19, 2004.
62. **Meyer-Brandis, Thilo; Proske, Frank Norbert**. *Podium discussion: characterization theorems for the Meyer-Watanabe test function and distribution space* Workshop on Stochastic analysis and applications; University of Madeira, Portugal, August 21-28, 2004
63. **Moan, Per Christian**. *Generalizations and applications of Maguns expansions Heriot-Watt University,* UK, November 2-9, 2004
64. **Moan, Per Christian**. *Modified vector fields; asymptotic and convergent expansions* Magic 04; Røros, Norway, March 30 - April 2, 2004
65. **Müller, Daniel**. *Thermal instability as the origin of high-speed coronal rain,* 2nd Coronal Loop Workshop; Palermo, Italy, September 1-3, 2004
66. **Mørken, Knut Martin**. *On polynomial interpolation of parametric curves and surfaces,* Workshop on Geometric Properties from Incomplete Data, Schloss Dagstuhl, Germany, March 21-26, 2004
67. **Ovrum, Eirik**. *Quantum Computers and Eigenvalues: Simulating a 1D Heisenberg Spin Chain.* Workshop on Theoretical solid state physics, University of Stockholm, Sweden, February 15, 2004
68. **Piene, Ragni**. *Cuspidal plane curves* University of Trieste, Italy; October 13-15, 2004
69. **Piene, Ragni**. *Enriques diagrams and equisingular strata of families of curves,* KTH, Stockholm, Sweden, May 19, 2004
70. **Piene, Ragni**. *Enriques diagrams and the equisingular stratification of famlies of curves,* Conference on Algebraic Geometry, Paris, France; June 15-19, 2004
71. **Piene, Ragni**. *Enumerating and characterizing real and complex singularities of curves and surfaces Conference on Algebraic Geometry and Geometric Modeling,* University of Berkeley, California, USA; April 3-4, 2004
72. **Piene, Ragni**. *The equisingular stratification of families of curves on surfaces,* Cambridge-Oxford-Warwick Algebraic Geometry Seminar, Oxford University, UK, April 22, 2004.
73. **Piene, Ragni**. *The equisingular stratification of families of curves on surfaces,* Arcs, calcul differentiel et applications a l'etude des singularites; Luminy, France. May 10-14, 2004
74. **Proske, Frank Norbert**. *Explicit solution of a non-linear filtering problem for Levy processes with application to finance,* University of Ulm, Germany. December 2-9, 2004
75. **Proske, Frank Norbert**. *Explicit strong solution of Ito-SDE's and the Donsker delta function of a diffusion University of Ulm,* Germany. January 20, 2004
76. **Quak, Ewald**. *Industrial mathematics at SINTEF,* Tallin University of Technology, Estonia, March 10-12, 2004
77. **Quak, Ewald**. *B-spline wavelets,* Universität Kaiserslautern, Germany, March 16, 2004
78. **Quak, Ewald**. *The AIM@SHAPE project,* Workshop on Mathematical Foundations of Scientific Visualization, Computer Graphics, and Massive Data Exploration, Banff International Research Station, Banff, Canada, May 24, 2004
79. **Quak, Ewald**. *The AIM@SHAPE project,* Eurographics 2004, Grenoble, France, September 3, 2004.
80. **Rouppe, Van Der Voort Luc**. *Small-scale magnetic elements on the Sun,* ESMN School on Solar Magnetometry and solar magnetism; Tatranska Lomnica, Slovakia, November 3-10, 2004
81. **Surazhsky, Tatiana**; et al.. *Arbitrary precise orientation specification for layout of text,* dagen@ifi; University of Oslo, Norway, October 28, 2004
82. **Surazhsky, Vitaly**; et al. *Type-safe covariance in C++* ACM Symposium on Applied Computing; Nicosia, Cyprus, March 14-17, 2004. Publisert i: Proceedings of the 2004 ACM symposium on Applied computing
83. **Tai, Xue-Cheng**. *Superconvergence for the gradient of finite element approximation by L^2-projection and applications to mesh adaptivity,* May 24-28, 2004. Hangzhou, China (Conference: Recent Advances in adaptive computation)
84. **Tai, Xue-Cheng**. *Uniform finite elemenets for singular perturbed 4th order problem and Stokes problems,* June 21, 2004, Depart. Of Math., Peking University, China
85. **Tai, Xue-Cheng**. *Image processing using PDE tools and Shape identification using level set methods,* June 25,2004, Depart. Of Math., Peking University, China

86. **Tai, Xue-Cheng**. *Some Variants of the Level Set Methods and Applications to Image Segmentation and Some Other Medical Imaging Problems* June 30-July 02, 2004. Singapore (Conference: The 2nd International Conference on Scientific and Engineering Computation)
87. **Tai, Xue-Cheng**. *Image processing using partial differential equations,* August 2, 2004, Morningside Center of Mathematics, Chinese Academy of Sciences, Beijing, China. (Conference: Multiscale Modelings and Simulations")
88. **Tai, Xue-Cheng**. *Level Set Methods for Recovering Permeabilities Functions,* Aug 4-7, 2004, Beijing, China (International Conference On Scientific Computing In Petroleum Industry)
89. **Tai, Xue-Cheng**. *Piecewise constant level set methods and their fast solutions for image segmentation,* October 23 - 28, 2004, Conference: Mathematical Image Analysis and Processing, Banff International Research Station, Canada.
90. **Tai, Xue-Cheng**. *Using Navier-Stokes equations for digital image denoising and restoration,* Program: Wall-bounded and free-surfaceturbulence and its computation, December 9-17, 2004, Institute of Mathematics, National University of Singapore, Indonesia
91. **Tai, Xue-Cheng**. *A remark on MBO scheme and multiphase piecewise constant level set methods,* Dec. 20-24, 2004, Conference: Workshop on image processing and computer vision, Zhejiang University, Hangzhou, China.
92. **Winther, Ragnar**. *From the de Rham sequence to mixed finite elements for elasticity,* Workshop on compatible spatial discretization of partial diff. eq., University of Minnesota, USA, May 11-15, 2004
93. **Winther, Ragnar**. *On the construction of mixed finite elements for elasticity,* 4th International congress on computational methods in applied science and engineering, Jyvaskyla, Finland, July 24-28, 2004
94. **Winther, Ragnar**. *Preconditioning saddle point systems,* Sixth international conference on mathematical methods for curves and surfaces, Tromsø, Norway, July 1-7, 2004
95. **Winther, Ragnar**. *Robust preconditioners for mixed systems,* Tallin University of Technology, Estonia, March 10-12, 2004
96. Bravina, Larissa; **Zabrodin, Evgeny**. *Freeze-out of hadrons at AGS, SPS, and RHIC: differences and similarities,* Quark Matter 2004; Lawrence Berkeley National Laboratory, California, USA, January 11-18,2004
97. **Zabrodin, Evgeny**; Bravina, Larissa; Fuchs, Christian; Faessler, Amand. *Space-time development of directed and elliptic flow at RHIC* Quark Matter 2004; Lawrence Berkeley National Laboratory, California, USA, January 11-18,2004
98. **Øksendal, Bernt**. *Optimal control for an insider in a market driven by Levy processes,* INRIA Workshop on Mathematical Finance, Paris, France, January 22-23, 2004
99. **Øksendal, Bernt**. *Stochastic control with delayed information,* Workahop on Stochastic Systems with Delay and Memory, Wittenberg, Germany, February 2-5, 2004
100. **Øksendal, Bernt**. *The value of information in stochastic control and finance,* Workshop on Mathematical Finance, Cape Town, South Africa, February 27, 2004
101. **Øksendal, Bernt**. *Local time and the Donsker delta function of a Levy process,* Workshop «Hypermodels in Finance», Tsitsikamma, South Africa March 1-5, 2004
102. **Øksendal, Bernt**. *Optimal portfolio for an insider in a market driven by Levy processes,* Yellow Mountain Workshop on Mathematical Finance, Huanshang, China, May 24-31, 2004
103. **Øksendal, Bernt**. *Optimal portfolio for an insider in a market driven by Levy processes,* Fourth World Congress of Nonlinear Analysts(WCNA 2004), Orlando, Florida, USA, June 30 - July 7, 2004
104. **Øksendal, Bernt**. *Optimal portfolio for an insider with general utility,* New Techniques in Applied Stochastics, Espoo, Finland; August 16-18, 2004
105. **Øksendal, Bernt**. *Some optimal portfolio problems for an insider,* 6th Pan African Congress of Mathematicians, Tunis, Tunisia, September 1-6, 2004
106. **Øksendal, Bernt**. *The value of information in stochastic control and finance,* University of Odense, Denmark, September 10, 2004
107. **Øksendal, Bernt**. *Optimal consumption and portfolio for an inider in a market driven by Levy processes,* Workshop on Mathematical Finance, London Business school, UK, September 14, 2004
108. **Øksendal, Bernt**. *Anticipative stochastic calculus and optimal consumption and portfolio for an insider in a market driven by Levy processes,* Imperial College, London, UK, October 27, 2004
109. **Øksendal, Bernt**. *Optimal consumption rate for an insider in a market driven by Levy processes,* SAMSA 2004 Conference, Polokwane, South Africa Nov 29 - Dec 2, 2004
110. **Aase, Knut K**. *Area Yield Futures and Futures Options: Risk Management and Hedging,* FIBE XXI: Fagkonferanse i Bedriftsøkonomiske emner, Bergen, Norway, January 8-9, 2004
111. **Aase, Knut K**. *Incomplete Markets,* Symposium on Mathematical Finance, African Institute of Mathematical Sciences, Cape Town, South Africa, February 27
112. **Aase, Knut K**. *Can Dynamic Asset Pricing Theory Survive?* Tsitsikamma conference on HyperFinance, South Africa, March 1-5.
113. **Aase, Knut K**. *Area Yield Futures and Futures Options: Risk Management and Hedging,* 35th International ASTIN Colloquium, Bergen, Norway, June 6-9, 2004

8b. - Contributed talks, posters etc

1. **Børve, Steinar**; Omang, Marianne G.; Trulsen, Jan. *Simulating the Orszag-Tang vortex using RSPH* 21st International Congress of Theoretical and Applied Mechanics; Warszawa, Poland, August 15-21, 2004.
2. Omang, Marianne Gjestvold; **Børve, Steinar**; Trulsen, Jan. *Applications of SPH in spherically and cylindrically symmetric systems,* 1th International Mach Reflection Symposium cum Shock-Vortex interaction Workshop; Jeju Island, South Corea, November 1-4, 2004
3. Omang, Marianne Gjestvold; **Børve, Steinar**; Trulsen, Jan. *Blast type shock phenomena simulated using regularized smoothed particle hydrodynamics,* ISSW24; Beijing, China July 11-16, 2004
4. **Carlsson, Mats**; Stein, R.F.; Nordlund, Å.; Scharmer, G.B.. *High resolution limb images synthesized from 3D MHD simulations* Multi Wavelength Investigations of Solar Activity, IAU Symp. 223; St. Petersburg, Russia, June 14-19, 2004.
5. Bogdan, T.J.; **Carlsson, Mats; Hansteen, Viggo**; Heggland, Lars; **Leer, Egil; Mcmurry, Andrew David**; Stein, R.F.. *Mode Conversion in Magneto-Atmospheres,* American Geophysical Union, Fall Meeting 2004; San Francisco, USA, December 13-17, 2004.
6. Stein, R.F.; **Carlsson, Mats**; Nordlund, Å.; Scharmer, G.B.. *G-band Images from MHD Convection simulations* American Astronomical Society Meeting 204; May 30 - June 3, 2004.
7. **Coclite, Giuseppe Maria**: *On the Existence of Weak Solutions for the Generalized Camassa-Holm Equation,* Workshop «Hyperbolic Conservation Laws», Oberwolfach, Germany, April 8, 2004.
8. **Coclite, Giuseppe Maria**: *On the Existence of Weak Solutions for the Generalized Camassa-Holm Equation,* Workshop «Around Hyperbolic and Kinetic Equations 2» Second annual meeting of the HYKE network, Paris, France, April 16 2004.
9. **Coclite, Giuseppe Maria**: *Solitary Waves for the Maxwell-Schr"odinger Equations,* NTNU, Norway, May14
10. **Coclite, Giuseppe Maria**: *An Overview of Boundary Control Problems for Systems of Conservation Laws,* KTH, Stockholm, Sweden, June 2
11. **Coclite, Giuseppe Maria**: *On the Wellposedness for a Generalized Hyperelastic-Rod Wave Equation,* Lund University, Sweden, July 22
12. **Dahl, Geir**. *A method for approximating symmetrically reciprocal matrices by transitive matrices,* Nordic Mathematical Programming Society, Linkøping University, Sweden, October 22-23, 2004
13. **Dahle, Håkon**. *M/L of X-ray luminous clusters from weak lensing.* (IAU Colloquium no. 195: «Outskirts of Galaxy Clusters: Intense Life in the Suburbs»).; Torino, Italia, March 11-16, 2004.
14. **Dahle, Håkon**. *Mass function from lensing,* (Conference: Fundamental Physics from Galaxy Clusters), FERMILAB, Batavia, Illinois, USA, December 9-11, 2004
15. **Dyken, Erik Christopher; Reimers, Martin**. *Improving Silhoettes for Coarse Triangles Meshes,* The Sixth International Conference on Mathematical Methods for Curves and Surfaces, Tromsø, Norway, July 1-6, 2004
16. **Eide, Inga Baadshaug; Di Nunno, Giulia**. *Insurance pricing in a finance framework,* SAMSA conference 2004, Polokwane, South Africa, November 28- December 5, 2004.
17. **Eriksen, Hans Kristian Kamfjord**; Novikov, Dimitri; **Lilje, Per Vidar Barth**; Banday, Anthony J.; Górski, Krzysztof M.. *Non-Gaussianity in the WMAP data on intermediate scales,* 2nd Planck Symposium and Consortium Meeting; LAL Orsay, France, January 26-30, 2004
18. **Floater, Michael S**.. *Arc length estimation and the error in parametric polynomial interpolation,* The Sixth International Conference on Mathematical Methods for Curves and Surfaces, Tromsø, Norway, July 1-6, 2004
19. **Hagen, Gaute**. *Expansion and perturbation methods for the Gamov shell model,* October 4-8, 2004, Institute for Nuclear Theory, University of Washington, USA.
20. **Hansteen, Viggo**. *Initial simulations spanning the upper convection zone to the corona* Multi Wavelength Investigations of Solar Activity, IAU Symp. 223; St. Petersburg, Russia, June 14-19, 2004.
21. Vistnes, Arnt Inge; **Hjorth-Jensen, Morten**. *Numerical methods as an integrated part of physics education,* 9th Workshop on Multimedia in Physics Teaching and Learning; Graz, Austria, September 9-11, 2004.
22. **Janse, Åse Marit**; Lie-Svendsen, Øystein; **Leer, Egil**. *Transport equations for a magnetized,* fully ionized gas, EGU 1st General Assembly; Nice, France, April 25-30, 2004
23. **Johansen, Pål Hermunn; Thomassen, Jan Brede**. *Closest point calculations by an algebraic method* Sixth International Conference on Mathematical Methods for Curves and Surfaces, Tromsø, Norway, July 1-6, 2004
24. **Killie, Mari Anne; Janse, Åse Marit**; Lie-Svendsen, Øystein; **Leer, Egil**. *Improved Transport Equations For Fully Ionized Gases,* EGU 1st General Assembly; Nice, France, April 25-30, 2004
25. **Killie, Mari Anne**; et al.. *Self-Consistent Model Of The Outer Solar Wind Including Turbulence Transport American Geophysical Union,* Fall Meeting 2004; San Francisco, USA, December 13-17, 2004.
26. **Klausen, Runhild Aae**; et al. *Recent advances for MPFA methods,* 9th European Conference on the Mathematics of Oil Recovery, Cannes, France August 29 - September 2, 2004.

27. **Klausen, Runhild Aae**; et al. *Multi Point Flux Apporximation and Finite Element Methods* [Vitenskapelig foredrag]. 9th European Conference on the Mathematics of Oil Recovery, Cannes, France August 29 - September 2, 2004.
28. **Lindstrøm, Tom Louis**. *Hyperfinite Lévy processes* Workshop «Hypermodels in Finance», Tsitsikamma, South Africa March 1-5, 2004
29. **Makasu, Cloud**. *A maximum principle for stochastic control systems with delay,* SAMSA 2004 Conference, Polokwane, South Africa Nov 29 - Dec 2, 2004.
30. **Meyer-Brandis, Thilo**. *Non-Linear Filtering for Levy Processes,* Workshop «Hypermodels in Finance», Tsitsikamma, South Africa March 1-5, 2004
31. **Meyer-Brandis, Thilo**. *On strong solutions of Levy-Ito diffusions,* New Techniques in Applied Stochastics, Espoo, Finland; August 14-18, 2004
32. **Müller, Daniel**; De Groof, A.; **Hansteen, Viggo**; Peter, H.. *Thermal non-equilibrium in coronal loops: A road to complex evolution* Multi Wavelength Investigations of Solar Activity, IAU Symp. 223; St. Petersburg, Russia, June 14-19, 2004.
33. **Müller, Daniel**. *Thermal instability as the origin of high-speed coronal rain,* International conference SOHO-15: Coronal Heating; St. Andrews, UK, September 6-9, 2004
34. **Mørken, Knut Martin; Reimers, Martin**. *An algorithm for finding zeros of spline functions,* The Sixth International Conference on Mathematical Methods for Curves and Surfaces, Tromsø, Norway, July 1-6, 2004
35. **Ovrum, Eirik**; Leinaas, Jon Magne; **Hjorth-Jensen, Morten**. *Quantum Computation of Energy Levels in a Spin Chain: A Detailed Simulation for a Small no of Spins.* Gordon Research Conference; Ventura, California, USA, February 22-28, 2004
36. **Reimers, Martin**. *Geodesic Distance and applications in Geometric Modelling,* The Sixth International Conference on Mathematical Methods for Curves and Surfaces, Tromsø, Norway, July 1-6, 2004
37. **Reimers, Martin**; Røtnes, Jan Sigurd; Aurdal, Lars; Djupesland, Per; et al.. *Fluid flow and particle deposition simulations in the human nose,* SIMS 2004, Copenhagen, Denmark, September 23-24, 2004. Publisert i: SIMS 2004 Proceedings; 2004
38. Berger, T.E.; **Rouppe, Van Der Voort Luc**; Löfdahl, M.G.; **Carlsson, Mats**; Fossum, Astrid; **Hansteen, Viggo**; Marthinussen, Elin; Title, A.; Scharmer, G.B.. *Observations of Solar magnetic elements with 0.1 arcsec resolution,* American Astronomical Society Meeting 204; May 30 - June 3, 2004.
39. **Surazhsky, Tatiana; Surazhsky, Vitaly**. *Sampling planar curves using curvature-based shape analysis* The Sixth International Conference on Mathematical Methods for Curves and Surfaces, Tromsø, Norway, July 1-6, 2004
40. **Tai, Xue-Cheng**. *Noise Removal Using Smoothed Normals and Surface Fitting,* SIAM Conference on Imaging Science (IS04), Salt Lake City, Utah, USA, May 3-5, 2004
41. **Tai, Xue-Cheng**. *Nonlinear positive interpolation operators and mesh independent algorithms for variational inequalities.* Institute of Computational Mathematics and Scientific/Engineering Computing, Chinese Academy of Sciences, Beijing, China, June 17, 2004

8c. - Talks for general audiences, Public Outreach

1. **Benth, Fred Espen**. *Det nordiske elektrisitetsmarkedet NordPool - prising og hedging,* December 16, 2004, Norges Bank, Oslo, Norway. Full talk here.
2. **Hjorth-Jensen, Morten**. *Fra Supernovaer og nøytronstjerner til nøytronrike kjerner; en reise fra giga/megameter til femtometer skala.* Norsk Astronomisk selskap, Oslo, Norway, January 14, 2004
3. **Lilje, Per Barth**. *Hva er sorte hull?* Fjellsrud skole (8th grade), Lørenskog, Norway, October 19, 2004
4. **Lilje, Per Barth**. *Universet* Nordberg skole, Oslo, Norway, December 21, 2004
5. **Lilje, Per Barth**. *Bilder fra universet - Vitenskapen møter kunsten,* Kunstindustrimuseet, Oslo, Norway, March 11, 2004
6. **Lilje, Per Barth**. *Skjønnheten i universet,* Stiftelsen Realfagsskolen, Lysaker, Norway, May 8, 2004
7. **Ovrum, Eirik**. *Kvantedatamaskiner,* Bjørnegildet 2004, Oslo Norway, February 20, 2004
8. **Reimers, Martin**. *Emner i 3D modellering,* Intervensjonssenteret,m Rikshospitalet, Oslo, Norway, December 12, 2004
9. **Winther, Ragnar**. *Matematiske muligheter,* Seniormøte, Norsk polyteknisk forening; October 4, 2004

APPENDIX 9 – Media appearances 2004

TV
- none

Radio
- NRK P2, «P2-akademiet», **Viggo Hansteen**: *Fra innerst til ytterst. Solens hete hemmeligheter.* (26.02.2004)
- NRK P1, «Nitimen», **Njål Foldnes** interviewed on his PhD thesis «Polyhedra and Algorithms for some Knapsack Problems and Hop-constrained Paths» (14.04.2004)

Newspapers
- Europower, monthly insert to «Dagens Næringsliv» **Fred Espen Benth**: *Regner med kraftopsjoner.* (November 2004)
- Dagbladet (Feature Article), **Geir Ellingsrud** and **Ragnar Winther**: *Matematiske muligheter* (21.09.2004)

Magazines
- Kraftjournalen, **Fred Espen Benth** and **Helge Galdal**: *Industridag med fokus på modellering av risiko i elektrisitetsmarkedet,* No 6/2004 (December 2004), page 98-99
- Apollon, **Geir Dahl**: *Ny matematisk teori: Stor kommersialiseringsgevinst* (17.12.2004)
- Apollon, **Fred Espen Benth**: Kraftmarkedet: Opsjoner med spenning (04.10.2004)

Internet
- ESI Special Topics, **Michael S Floater**: *Fast Breaking Comments. Fast Breaking Papers* 01.12.2004
- Forskning.no, **Per Barth Lilje**: *Kom sorte hull før stjernene?,* (23.11.2004)
- Forskning.no, *Norske mattebøker på løpende bånd* (14.05.2004)
- Uniforum nett, **Ragnar Winther**: *To år som SFF: Matematikk på eit høgt plan* (10.05.2004)
- Forskning.no, **Njål Foldnes**: *Perfekt pakking* (08.04.2004)
- Riskbook.com: *A book report on **Bernt Øksendal**'s book «Stochastic Differential Equations»*



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