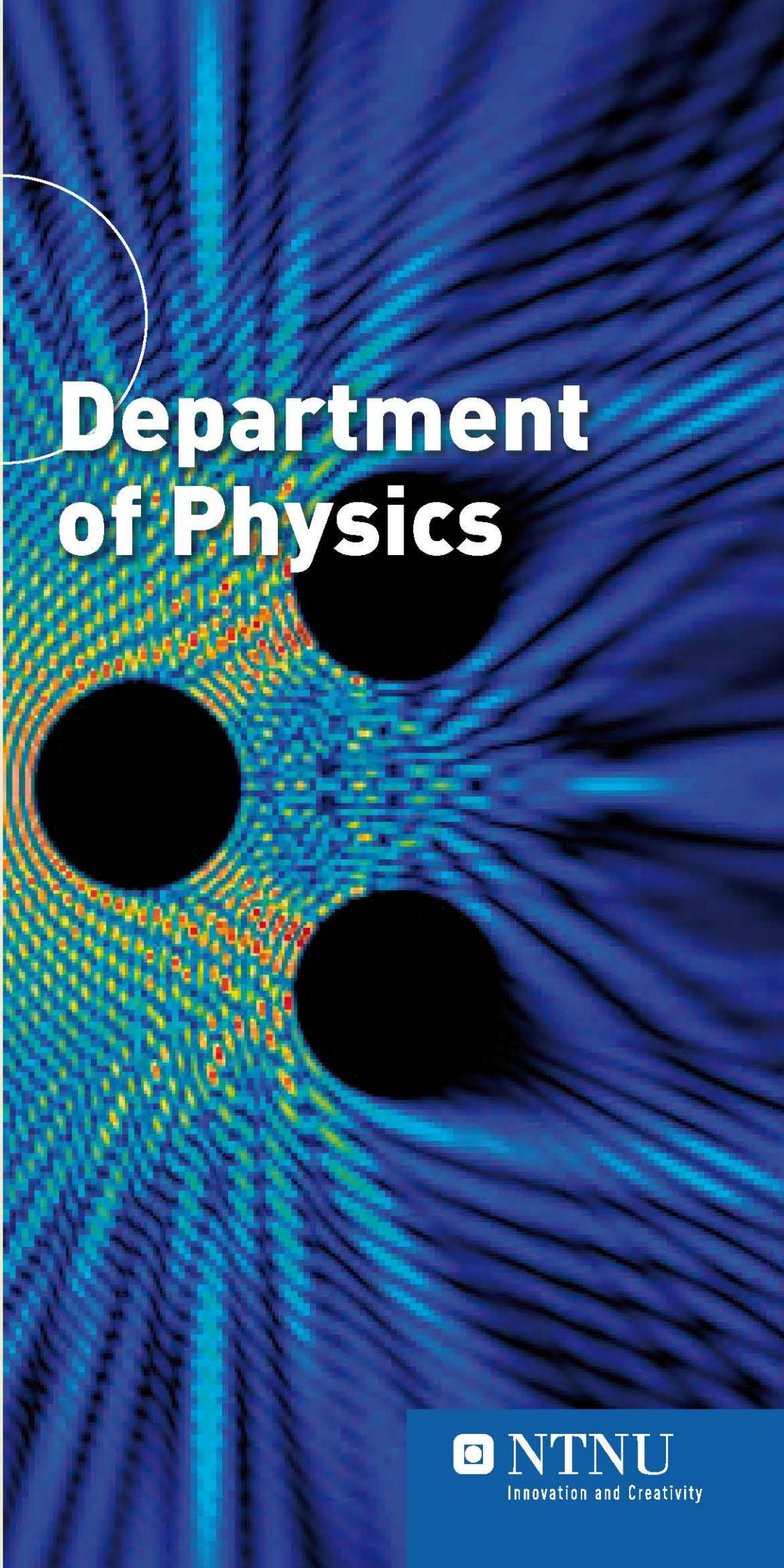
Department of Physics

Annual Report 2008



NTNU
Innovation and Creativity

DEPARTMENT OF PHYSICS, NTNU

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Head of the Department	Professor Berit J. Kjeldstad
Deputy Head of the Department	Professor Kåre Olaussen
Head of Administration	Cand.scient Sylvi Vefsnmo

Departmental Council

Elected members:

Representing the permanent scientific staff	Professor Randi Holmestad
	Professor Catharina Davies
	Professor Alex Hansen
	Professor Mikael Lindgren
Representing the temporary scientific staff	Doctoral student Eirik Glimsdal
Representing the technical/administrative staff	Head Engineer Oddbjørn Grandum
Representing the students of the department	Student Jørgen kristoffersen
	Student Aksel Jan Vestby

Appointed external member:	Research Manager Jostein Mårdalen (chair) SINTEF Petroleum Research
	Professor Lisa Lorentzen, NTNU, Department of Mathematical Sciences

COVER PAGE

Intensity contour plots of the total electromagnetic field after the incident finite sized beam is scattered from three conductive cylinders (illuminated from the left). This result was obtained by rigorous computer simulations based on the Maxwell's equations.

Image: Thomas Berg and Ingve Simonsen

DEPARTMENT OF PHYSICS, NTNU

http://www.ntnu.no/fysikk

CONTENTS

Edited by:
Eli Monsøy, Arne Mikkelsen, Sylvi Vefsnmo og Berit Kjeldstad

The Annual report is also available on the internet address:
http://www.ntnu.no/fysikk/arsrapporter

A GLANCE AT 2008

This report summarizes activities at the department in 2008 within research, teaching and popular dissemination of science, and we hope you will find it interesting.

Several new colleagues have established their research activities at our department in 2008 due to many new appointments the previous year. Plans have been made to establish a new fibre tower laboratory (Sorokina) in K1 close to the NanoLab. The new NanoLab, to be opened in May 2009, has been developed in close collaboration with the department. One of our colleagues (Wahlström) has been the daily manager of the laboratory development. The start of a new X-ray laboratory at the department (Breiby and Mathiesen) can also be seen. Monitoring equipment for atmospheric studies has been established in Antarctica in collaboration with the British Antarctic Survey, the Max-Planck Institute and the Norwegian Polar Institute (Espy). A research group successfully carried out a new experiment aboard the International Space Station (Johnsson). Preparations were made for several new proposals related to new equipment, for instance new electron microscopy equipment, and for renewing parts of the equipment at the Molecular image laboratory.

The first project within EU 7FP was established (Kachelriess). During 2008 several research groups submitted proposals to different calls in EU 7FP, and at the moment it seems that there will be more success projects to come. Participation in EU collaborations has been an important strategic task for the department. However, the competition between different projects has increased, and it seems more difficult enter into negotiations than in the 6th FP. However, the department continues to keep high priority on EU proposals.

The number of new projects funded by the Norwegian Research Council has been the same as previous years. The situation for basic research is still difficult, with an unreasonably low success rate for proposals sent to the free projects area. The trend has been that the applied programmes tend to support more of the basic research, which gives a better situation for the department.

The number of publications in peer review journals has increased over 2007, which itself had been a record year. The percentage of publications in level 2 journals is now approximately 50 % which is the highest rate at NTNU.

16 new PhD students began their studies in 2008, and there have been many good applicants to all positions. PhD student Morten (supervisor Brataas) received the award for best PhD thesis at the Faculty of Natural Science and Technology. Post Doc. Stine Nalum Næss received the Teknas Prize for Younger Researchers 2008. There are an increasing number of PhD students from abroad. The percentage of female PhD students was 24 % in 2008, and the department wants to increase that number.

It is positive that the physics study-programmes continue to be popular among applicants to NTNU. Particularly, the interest for the Bachelor Physics programme is increasing. In addition, the Technology Master programme in Physics and Mathematics continues to be one of the most popular technology programmes. Last year student Iver Bakken Sperstad (supervisor Sudbø) received the award for best Master thesis at the Faculty.

This year also some colleagues retire (Løvaas, Valberg) and the department is thankful for the job they have done during many years. No new permanent staff members were employed, and the total number of academic staff is decreasing at the department, reaching the lowest level since the 70's. According to the long term plan from our Faculty the trend will change next year with an increasing number of permanent academic staff. This will be of importance to achieve the strategies stated by the Department.

Berit Kjeldstad

Head of Department

STAFF

Head of Department:
Professor Berit Kjeldstad

Deputy Head of Department:
Professor Kåre Olaussen

PERMANENT STAFF

SCIENTIFIC STAFF:

Professors
Jens O. Andersen, Anne Borg, Arne Brataas, Catharina Davies, Arnljot Elgsæter, Patrick Espy, Jon Otto Fossum, Alex Hansen, Randi Holmestad, Ola Hunderi, Johan S. Høye, Anders Johnsson, Michael Kachelriess, Berit Kjeldstad, Mikael Lindgren, Tore Lindmo, Thor Bernt Melø, Arne Mikkelsen, Jan Myrheim, Kalbe Razi Naqvi, Kåre Olaussen, Steinar Raaen, Ingve Simonsen, Bo-Sture Skagerstam, Irina Sorokina, Bjørn Torger Stokke, Asle Sudbø, Arne Valberg.

Associate professors
Berit Bungum, Dag W. Breiby, Antonius Helvoort, Morten Kildemo, Tore H. Løvaas, Pawel Sikorski, Knut Arne Strand, Jon A. Støvneng, Erik Wahlstrøm, Turid Worren, Ingjald Øverbø.

Adjunct professors
Kenneth Dahl Knudsen, Einar Rofstad, Phil Scott, Arne Skretting, Roger Sollie, John Walmsley, Tor Wøhni.

TECHNICAL AND ADMINISTRATIVE STAFF:

Head of Administration
Sylvi Vefsnmo

Administrative staff
Margit C. Hagen, Snorre Hansen, Inger Kosberg, Inger J. Lian, Eli Monsøy, Tove G. Stavø.

Technical staff
Irene Aspli, Astrid Bjørkøy, Ole Tore Buset, Knut R. Gjervan, Oddbjørn Grandum, Tor Jakobsen, Dagfinn Johnsen, Erling Kristiansen, Lise Kvalø, Per Magne Lillebekken, Arne Moholdt, Jon Ramlo, Inge Sandaunet, Edrun Andrea Schnell, Bjørn Gunnar Soleim, Bertil O. Staven, Kristin Grendstad Sæterbø.

TEMPORARY STAFF

Post- docs/research scientists
Trine Højberg Andersen, Swarnali Bandopadhyay, Øyvind Borck, Flemming Ehlers, Daniel Huertas-Hernando, Dionne Klein, Steinar Kragset, Sylvie Lélu, Magnus Borstad Lilledahl, Ragnvald Mathiesen, Gjertrud Maurstad, Anh Kiet Nguyen, Sergey Ocapchenko, Katarzyna Maria Psonka-Antonczyk, Stein Olav Skrøvseth, Marit Sletmoen, Mathieu Taillefumier, Makoto Takemasa, Yaroslav Tserkovnyak, Rene Vissers, Per Erik Vullum, Baoxiang Wang, Justin Wells, Minli Xie, DeZheng Yang, Seoung Shan Yap, Xiaofeng Yu, Min Zhou.

Doctoral students
Christian Andresen, Mercy Afadzi, Asadollah Bagheri, Ruben Bjørge, Kjetil Børkje, Actor Chikukwa, Eskil Kulseth Dahl, Roya Dehghan, Arne Erikson, Bjørn-Tore Esjeholm, Tom Richard Evensen, Amund Gjerde Gjendem, Davi Fonseca, Jørn Foros, Knut Gjerden, Eirik Glimsdal, Morten Grøva, Martin S. Grønsleth, Kjetil Magne Dørheim Hals, Henning Frydenlund Hansen, Yngve Hofstad Hansen, Håvard Haugen, Henrik Hemmen, Egil Vålandsmyr Herland, Rashid Khan, Lars Kyllingstad, Lars Erlend Leganger, Paul Anton Letnes, Jacob Rune Linder, Yun Liu, Hanne Mehli, Åsmund Fløystad Monsen, Jan Petter Morten, Florian Mumm, Kjetil Liestøl Nielsen, Ingar Stian Nerbø, Kenate Nemera Nigussa, Tor Nordam, Amna Noreen, Heidi Nordmark, Magnus Østgård Olderøy, Amutha Ramachandran, Ole Christen Reistad, Nina Kristine Reitan, Zbigniew Rozynek, Jan Rødal, Severin Sadjina, Sigrun Saur, Risi Ram Sharma, Magne Saxegaard, Hans Joakim Skadsem, Marius Aase Solberg, Bjarte Gees Bokn Solheim, Iver Bakken Sperstad, Frantz Stabo-Eeg, Rune Strandberg, Ingeborg-Helene Svenum, Ragnhild Sæterli, Sven Tierney, Sedsel Fretheim Thomassen, Henrik Tollefsen, Malin Torsæter, Wakshum M. Tucho, Glenn Tørå, Asle Heide Vaskinn, Lars Erik Walle.

PROFESSOR EMERITI

Johannes Falnes, Per C. Hemmer, Kristian Fossheim, Eivind Hiis Hauge, Hans Kolbenstvedt, Ole J. Løkberg, Jørgen Løvseth, Frode Mo, Kjell Mork, Haakon Olsen, Emil J. Samuelsen, R. Svein Sigmond, Helge R. Skullerud, Ivar Svare, Sigmund Waldenstrøm.

ACCOUNTS 2008

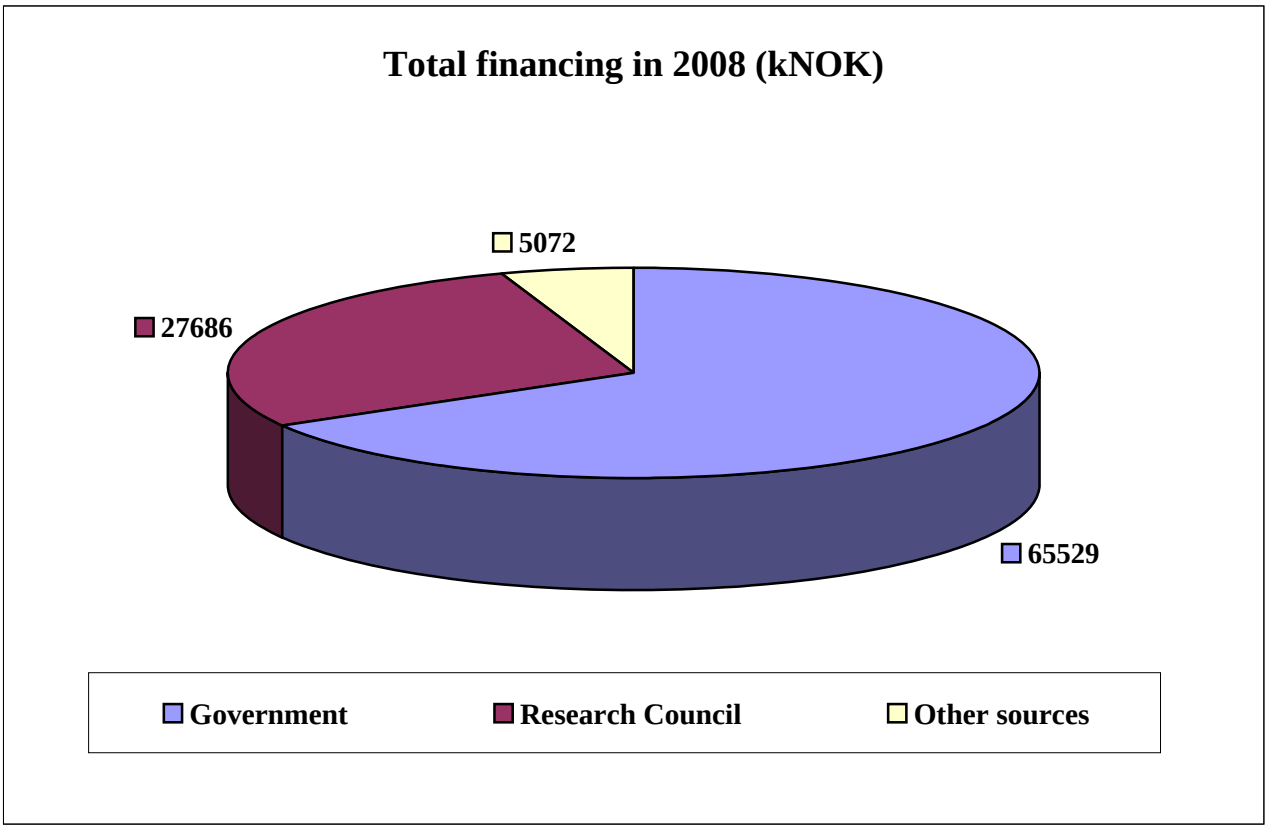
	Amount kNOK
Government University Funding (including NTNU strategy projects)	**65 529**

Projects financed by the Research Council of Norway	**Project manager**	**Amount kNOK**
Structural, Electronic and Optical Properties of Atomic Overlayers on Surfaces	Borg Anne	131
Materials for Hydrogen Technology	Borg Anne	131
En reise i realfagenes verden	Borg Anne	800
Quantum Transport in Nanoscale Systems	Brataas Arne	6
Fundamentals of Nanoscale Systems	Brataas Arne	1 441
Fundamentals of Condensed Matter	Brataas Arne	3 172
ColdWear	Breiby Dag Werner	2
Intravital Microscopy and MRI	Davies Catharina	49
Norwegian Molecular Imaging Consortium	Davies Catharina	1 277
Structure and Dynamics of Soft and Complex Nanomaterials	Fossum Jon Otto	452
Interconnected Physical Phenomena	Fossum Jon Otto	1 359
Transport in dual-porosity clay systems	Fossum Jon Otto	9
Nanostructured Soft and Complex Materials	Hansen Alex	1 164
Metal Printing	Hansen Alex	174
Mapping of Residual Oil between Wells	Hansen Alex	417
Role of Bursts in Fracture Front Propagation	Hansen Alex	851
Two-phase flow	Hansen Alex	27
Fracture-Failure Phenomena	Hansen Alex	41
Membranes for hydrogen separation	Holmestad Randi	354
Studies of the Electronic Structure of Materials at the Nanoscale	Holmestad Randi	1 175
Kimdanningskontroll for Optimaliserte Egenskaper	Holmestad Randi	1 524
Fundamental investigations of Solute Clustering and Nucleation of Precipitation	Holmestad Randi	1 633
Optimisation of Aluminium Alloys in a Recyckling Context	Holmestad Randi	250
Novel nanomaterials and nanostructured materials for hydrogen storage applications	Holmestad Randi	3
Factors Controlling UV radiation in Norway	Kjeldstad	115
Posisjoneringstiltak EUs 7 RP	Kjeldstad/Stokke/Lindgren	82
Clinical applications of multiphoton microscopy	Lilledahl Magnus B.	199
Travel Support SNBL/ESRF	Mo Frode	562
Thin-film III-V Semiconductors	Reenaas Turid Worren	42
Tynnfilmsolceller	Reenaas Turid Worren	389
Nanomaterials for 3rd Generation Solar Cells	Reenaas Turid Worren	1 817
Nanoscale Control of Mineral Deposition within Polysaccharide Gel Networks	Sikorski Pawel	807
Study of Entanglement and Quantum Information in Condensed Matter Sys.	Skrøvseth Stein Olav	747
Infrared frequency combs and supercontinua for spectroscopy	Sorokina Irina	40
Polymer Gel Signal Transducers	Stokke Bjørn Torger	170
Structure Formations and Properties of Polyelectrolyte Complexes	Stokke Bjørn Torger	47
Activation of toll-like reseptors	Stokke Bjørn Torger	404
Advanced Biological Materials	Stokke Bjørn Torger	65
Biopolymer Engineering, KMB	Stokke Bjørn Torger	10
Quantum Transport in Nanoscale Systems	Sudbø Asle	4
IKT-Oxides	Sudbø Asle	1 598
Point Contact Investigations	Wahlstrøm Erik	1 899
Magnetodynamics of Nanostructured Metal Oxides	Wahlstrøm Erik	761
Advanced transmission electron microscopy in catalysis	Walmsley John	355
Småforsk	Several	1 131
	Sum	**27 686**

Contribution from other financial sources

Contributors	Project name	Project manager	Amount kNOK
EU FP6	Dynamax, Dynamic Magnoelectronics	Brataas Arne	698
EU FP7	C2CR - High Energy Interactions	Kachelriess Michael	696
Statoil	Prof II, Roger Solli	Head of Department	93
Statoil	CO2-fangst fra røykgass	Raaen Steinar	24
FOI, Totalforsvarets foskningsinstitutt	Sensorskydd	Lindgren Mikael	338
Kreftforeningen	Transport av terapeutiske makromolekyl i tumorvev	Davies Catharina	105
Nordic Energy Research	Nordic Centre of Excellence in Photovoltaics	Reenaas Turid Worren	28
NUFU	Spatial and Seasonal variation in solar radiation	Kjeldstad Berit	2 223
Statens Strålevern	Prof II, Tor Wøhni	Head of Department	117
IFE	Prof II, Kenneth Knudsen	Head of Department	117
Sør-Trøndelag Fylkeskommune	Kurs for lærere i fysikk	Bungum Berit	20
NordForsk	The role of theory in science education research	Bungum Berit	255
Astro Ltd	International Laser Physics Workshop	Sorokina Irina	287
Deutche Forschungsgemeinschaft	Kosmische Strahlung als Prove für Teilchenphysikjenseits des Standartmodels	Kachelriess Michael	65
Other customers		Head of Department	6
		Sum	**5 072**

Total external accounts in 2008 **32 758**



AWARDS

Photo: Marianne Sjøholtstrand.

Jan Petter Morten received the award for the best PhD thesis at the Faculty of Natural Sciences and Technology. His supervisor has been professor Arne Brataas.

Photo: Marianne Sjøholtstrand.

Iver Bekken Sperstad received the award for the best Master thesis at the Faculty of Natural Sciences and Technology. His supervisor has been professor Asle Sudbø.

Photo: Universitetsavisa / Arne Asphjell.

Stine Nalum Næss was awarded the Tekna Prize for Younger Researchers 2008. She has done research within the field of nanoparticles and her supervisors in the PhD work were professors Arnljot Elgsæter and Arne Mikkelsen.

HIGHLIGHTS FROM THE ACTIVITY

The Onsager medal is awarded to an international top physics researcher
Tuesday 16th September professor Peter S. Riseborough was awarded the Onsager medal. Riseborough works as a professor at the Department of Physics, Temple University, Phildelphia, USA. Riseborough visited our department June – September.

Alzheimer's disease takes you into a deep darkness. But a laser light and a detective molecule will lead you out. (Cover photo: Digital Vision Singles)

Spectroscopic studies of amyloidic proteins
The Alzheimer disease puzzle is actually a whole series of unknown biochemical events. It is known that the disease is accompanied with accumulation of so-called amyloid fibrillar plaques. So what is it that goes wrong, and how can we find new means to study these protein misfolding processes? Together with Linköping University, the Department of Physics (Prof. Lindgren) is developing and studying a new type of fluorescent probe that has certain advantages compared with the commonly used ones. In comparison with regular fluorescent amyloid probes, these so-called “Luminescent conjugated polythiophenes” (LCPs) give changes of emitted light intensity upon protein binding with different spectral signatures depending on the type AND conformation of the protein. A variety of related probes have shown very promising results in the diagnostics of amyloids and similar protein fibrillation processes, for example in mice with Alzheimer disease.

LPHYS'08

The 17th annual International Laser Physics Workshop (LPHYS'08) took place in Trondheim, NTNU, from June 30 to July 4. The chairmen from NTNU were Mikael Lindgren and Irina Sorokina. About 600 participated in the workshop.

The first project within EU 7FP was estabalished in 2008, with **Professor Michael Kacelriess** as project manager. The project name is "C2CR-High Energy Interactions: From Colliders to Cosmic Rays". This project aims to use data from the Large Hadron Collider experiments at CERN to test and develop further the existing QGSJET simulation model. It is planned to include nonlinear interaction effects, to generalize the model to photo-nuclear interactions, and to account for higher twist QCD effects. This is a Marie Curie project on which Sergey Ostapchenko is employed for two years.

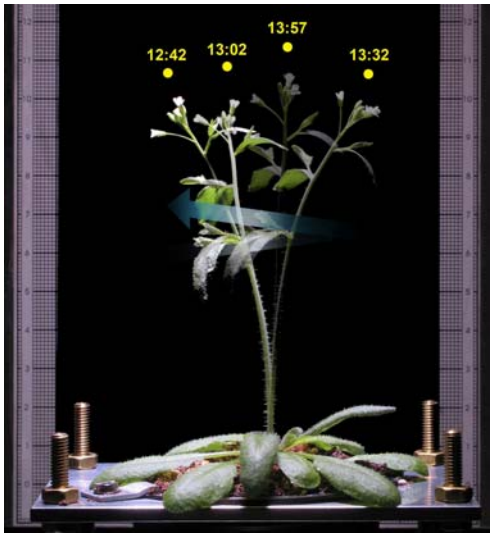
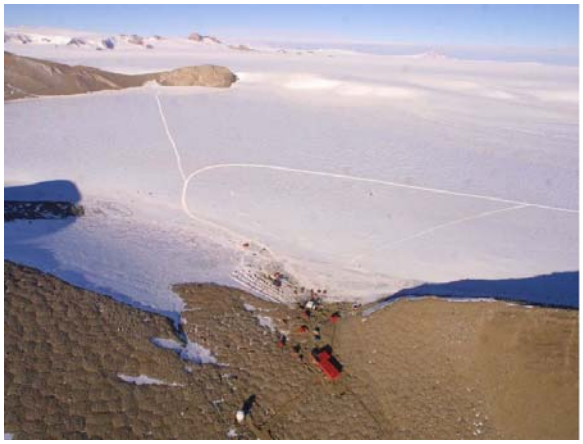


Image source: Bjarte G.B. Solheim

Growth of plants in space

A long term experiment on the Space Station has been carried out by a team from the Department of Physics and the Department of Biology. For about 70 days the growth of plants, especially oscillatory growth, was video-documented, partly in three dimensions. The analysis of the about 30 000 images produced totally new information about plant growth in weightlessness. The instrumentation developed for the experiment allowed the plants to be slowly centrifuged so that plant growth and movements under different acceleration levels could be recorded as well.

The results elucidated growth mechanisms in plants and were used to critically test and complete theories of growth. For example, the experiment tested a proposal by Charles Darwin on the mechanism of *rotational* growth (see image), and proved that gravity plays an amplifying role in such movements.



Troll Station seen from the air looking toward the ice sheet. (Photo courtesy NPI)

Climate Research in Antarctica

As part of an international collaboration between the Department of Physics and the British Antarctic Survey, the Max-Planck Institute for Solar System Research and the Norwegian Polar Institute, a new radiometer operating at 250 and 230 GHz has been developed and deployed at Troll Station, Antarctica (72^{o}S, 2.5^{o}E) to simultaneously measure profiles of ozone and nitric oxide between 30 and 80 km, deep within the Antarctic polar vortex. A third channel will be used to infer the average vertical transport velocities using carbon monoxide. Together they will give the first time-resolved picture of how high-altitude auroral energy enters and affects the stratosphere, and ultimately how it influences the climate of the Earth.

RESEARCH

DIVISION OF APPLIED PHYSICS AND DIDACTIC PHYSICS

Staff
Assoc. professor Berit Bungum
Professor Patrick Espy
Assoc. professor Morten Kildemo
Professor Berit Kjeldstad
Professor Mikael Lindgren
Assoc. professor Tore Løvaas
Professor Ingve Simonsen
Professor Irina Sorokina
Assoc. professor Knut Arne Strand
Assoc. professor Turid Worren

Professor emeritus Johannes Falnes
Professor emeritus Ole Johan Løkberg
Assoc. professor emeritus Jørgen Løvseth
Professor emeritus R. Svein Sigmond
Professor emeritus Helge Skullerud

Non-tenured staff
Seoung Shan Yap (Post-doc)

Overview

The Division of Applied Physics and Didactic Physics consists of several research teams carrying out research within the fields of *applied optics, electron and ion physics, energy, atmospheric and environmental physics, laser physics, as well as physics education ("didactic physics").*

In energy and environmental physics the processes affecting transmission of ultraviolet radiation to the surface, particularly the importance of aerosols and clouds, are being studied (*Kjeldstad, Espy*), as well as renewable energy sources such as wind and ocean waves *(Falnes, Løvseth*). Research on new solar cell materials is also carried out *(Reenaas).*
The applied optics group carries out advanced laser spectroscopy and imaging of molecular systems in biology and materials sciences *(Lindgren).* The optics group also develops optical instrumentation prototypes in polarimetry *(Kildemo, Lindgren)* and theoretical modelling of optical properties of materials and surface reliefs *(Simonsen).* Research in the group also involves video holography and optical coherence tomography *(Kildemo, Løkberg*).
Study of interfaces between fluid phases existing in oil and gas reservoirs is performed by light scattering (*Strand*). Both model systems and samples from actual gas and oil fields are studied under reservoir conditions (studies can be performed at pressure up to 700 bar and temperature up to 180°C.) The studies are performed with the purpose of improving condensate and oil reservoir management and production. In electron and ion physics one studies electrical breakdown in fluids and gases (*Løvaas, Sigmond),* breakdown in vacuum related to the Compact Linear Collider (CLIC) at CERN *(Kildemo),* and transport of ionized gases (*Skullerud).* The laser physics group works with femtosecond lasers based on optical fibers *(Sorokina).*

Research in physics education (*Bungum*) involves curriculum development in physics and technology education, in a contemporary as well as in a historical perspective. A PhD study in the group investigates the effects of in-service courses in space technology, in terms of the nature and extent of teachers' realisation of content knowledge gained from the courses in their teaching.

For 2008 we have chosen to give a more thorough account of research carried out by our groups with interest in applied optics and atmosphere physics.

Spectroscopic studies of amyloidic proteins
(M. Lindgren)
Proteins are made of small "building blocks" - amino acids. Our cells produce 20 different amino acids, which can be arranged in different ways to determine the kind of protein that we get. Moreover, before the protein can start its work it must fold into its functional form. Sometimes this process goes wrong. Incorrectly folded proteins are an important part of the problem for many serious diseases: Alzheimer's, Parkinson's, type II diabetes, Creutzfeldt-Jakob, cancer, cystic fibrosis, and many more.

The Alzheimer's puzzle is actually a whole series of unknown biochemical events. But something links them - this protein that does so much damage on the road to becoming a fibril. What is it that goes wrong, and how can we find new means to study these protein misfolding processes?

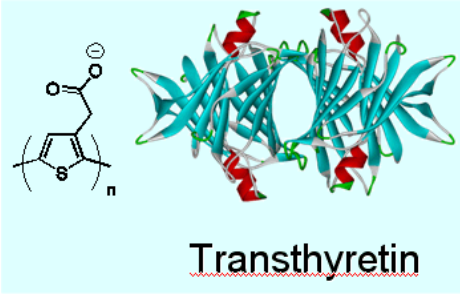


Fig. 1. Fluorescent probe "PTAA" developed and exploited togther with Linköping University. Transthyretin is a protein involved in the protein disease: Familial amyloidotic poly-neuropathy).

Luminescent probes are sensitive to detect hidden species as the probes report back well-defined light upon interrogating with light of another wave-length. There exist many fluorescent probes that bind specifically to protein amyloidic structures, notably, thioflavins (ThT, ThS) and Congo red. These probes dramatically increases their quantum efficiency upon protein binding, however, the emitted spectral distribution is insensitive to the detailed nature of the protein.

Together with Peter Nilsson and Per Hammarström of Linköping University are developing and studying a new type of fluorescent probe that has certain advantages compared with the commonly used ones, so called "Luminescent conjugated polythiophenes" (LCPs). These give in addition to changes of emitted light intensity upon protein binding, different spectral signatures depending on the typa AND conformation of the protein. The image below is a fluorescence microscopy image of protein amyloids stained with such fnew fluorescent probes.

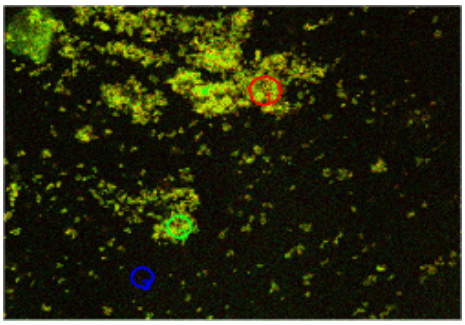


Fig. 2. Laser scanning microscope image of protein amyloids stained with novel LCP fluorescent probes.

Atmosphere and environmental physics

(P. Espy, B. Kjeldstad)

Noctilucent or "night-shining" clouds (NLCs) are tenuous ice clouds forming ~81 km over the Polar Regions during the summer months. The atmospheric conditions that foster their growth are a result of the dynamic wave forcing and composition of this region. NLC are at the limits of their existence, and changes in their density or occurrence rate have been cited as an early indicator of climate change.

The Aeronomy of Ice in the Mesosphere (AIM) satellite is a NASA mission on which NTNU is a co-investigator. It is the first satellite mission dedicated to the study of these clouds at the edge of space in order to understand what creates them, their variability and their possible connection to climate change. At NTNU we are exploring how solar activity changes the atmospheric composition and dynamics in the vicinity of the NLC, and how this affects their formation. To do this, we combine the satellite measurements with the ground-based, remote-sensing observations of ozone and nitric oxide that we are making at Troll Station, Antarctica, in conjunction with the Norwegian Polar Institute and the British Antarctic Survey. This gives us a three-dimensional picture of the atmospheric composition and the wave motions that impact the formation of NLC. By observing over a range of solar and auroral activity, we hope to see if these solar effects can enhance or mask the effects of global climate change on NLC.

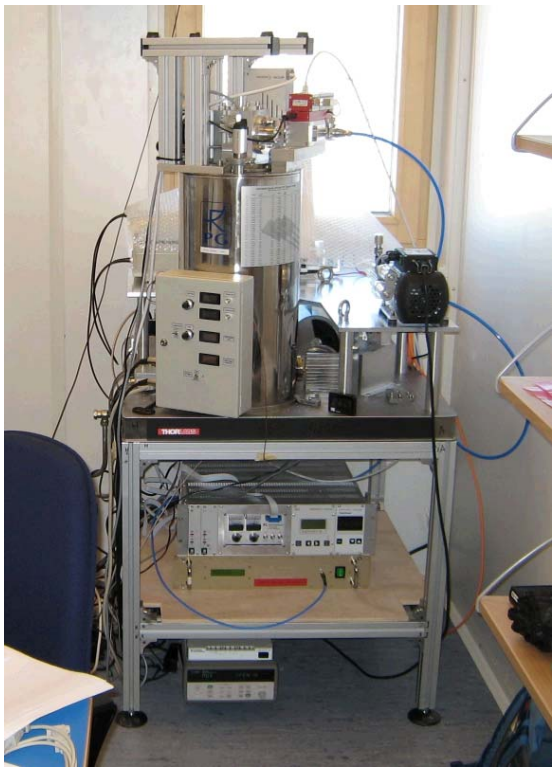


Fig. 3. Intrumentation developed for the "Troll" station, se text for description. (Image: courtesy by the British Antarctic Survey).

Imaging Mueller matrix ellipsometry

(M. Kildemo, M. Lindgren, I. Simonsen)

The Mueller-Stokes formalism is a mathematical representation of polarized light and polarizing properties of optical matter. The light intensity is described via the Stokes vector and the polarization changing properties are described by a 4 by 4 Mueller matrix. The Stokes vector describes the state of polarization based on time averaged intensity measurements, which allow the source of light to be partially incoherent.

Mueller matrix ellipsometry (MME) is a technique which can measure the complete Mueller matrix of a sample and is being developed and used in our laboratory to study the polarization response (retardance, dichroism, depolarization) of colloids, partially ordered (self assembled nanostructures, rough surfaces) and ordered surfaces (e.g. optical gratings). The group aims at being able to develop

research grade proto-types of the state-of the art of optical techniques, particularly related to spectroscopic and laser based methods in polarimetry. The latter involves opto-mechanical design, optical design, instrumentation/acquisition hardware and software in addition to the algorithms for analysis and related software. We here describe recent results with relevance for studies of solar cell materials and the related materials science.

The liquid crystal based systems have been found to be best suited for MME imaging, visible to NIR. A first prototype, implemented at the NTNU, of a Fe-LC based NIR-MME appears promising as the fastest and most robust system known to date.

Some recent examples on an application is shown in Figure 4 below. Here a force is applied to a transparent bulk glass material. A set of Mueller matrix images where each "sub-image" corresponds to an element of the Mueller matrix, is collected. From the raw data (middle 16 x 16 images) one can calculate the retardance and its direction distribution within the materials. One can observe how the the direction of the slow axis arranges vertically under pressure spot in the lower image.

This technique is currently developed for studies of wafers and 3G solar cell materials in collaboration with SINTEF and other researchers at NTNU.

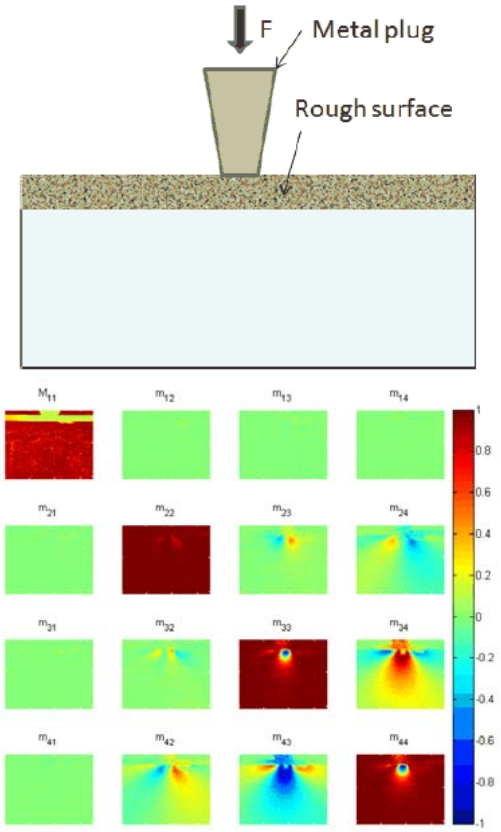


Fig. 4. Top: Mueller matrix polarimetry for studies of strain in a bulk glass material. Bottom: 16 x 16 Mueller matrix images. (Images: by courtesy of project student Mr. Lars Martin Sandvik Aas).

DIVISION OF BIOPHYSICS AND MEDICAL TECHNOLOGY

Staff
Professor Catharina de Lange Davies
Professor Anders Johnsson
Professor Tore Lindmo
Professor Thor Bernt Melø
Professor Kalbe Razi Naqvi
Assoc. professor Pawel T. Sikorski
Professor Bjørn Torger Stokke
Professor Arne Valberg
Professor II Einar Rofstad
Professor II Arne Skretting
Professor II Tor Wøhni

Non-tenured staff
Dionne Klein (Post-doc)
Sylvie Lelu (Post-doc)
Magnus Lilledahl (Post-doc)
Gjertrud Maurstad (Post-doc)
Katarzyna Psonka-Antonczyk (Post-doc)
Marit Sletmoen (Post-doc)
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Overview

The research is presented under the following headings: *Medical physics and technology*, *Biopolymers and bionanotechnology*, *Photobiophysics*, and *Biosystems.* A brief overview is given below, and one project is presented in more detail.

Survey of research activities

Medical physics and technology

Dose to the contralateral breast during radiation therapy of breast cancer
(S. Saur, J. Frengen, T. Lindmo)
Due to the carcinogenic effect of ionizing radiation, it is important to keep the radiation dose to sensitive structures outside the target volume as low as possible. In a project at the Dept. of Oncology and Radiotherapy, St.Olav's University Hospital, we studied the dose imparted to the contralateral breast (CLB) during radiation therapy of breast cancer based on a standard treatment technique utilizing tangential fields.
The CLB dose was characterized by using a female thorax phantom and GAFChromic EBT film (Fig. 1). Dose calculations by the pencil beam (PB) and collapsed cone (CC) algorithms were included for comparison. Film dosimetry reveals a highly inhomogeneous dose distribution within the CLB, and skin doses due to the medial fields that are several times higher than the interior dose (Fig. 2). These phenomena are not correctly reproduced by the calculation algorithms. In addition to quantifying the dose in the contralateral breast, the aim of this study was also to suggest an improved procedure that would minimize dose to the contralateral breast.

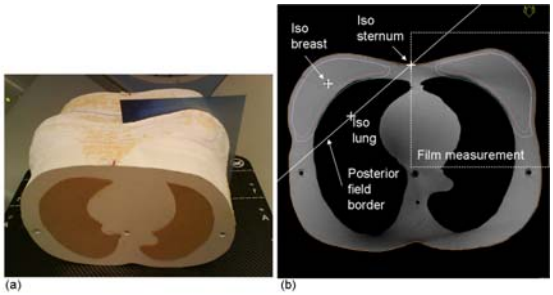

Fig. 1. a) Image of the phantom used. b) Transversal CT image with indication of the isocenter (Iso breast) and the posterior field border for radiotherapy of the left breast. Target volumes CTV (pink) and PTV (blue) on both sides are delineated. The PTV to the left is the treated breast, while the PVT to the right defines the contralateral breast (CLB).

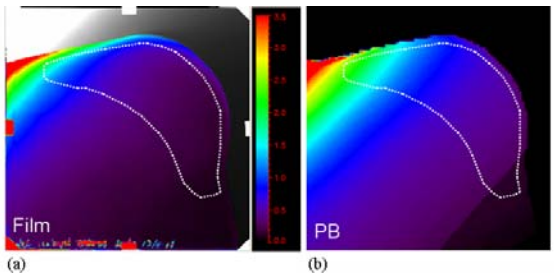

Fig. 2. Measured and calculated dose distribution in the contralateral side for a mean PTV dose of 50 Gy to the breast on the left side. (a) Film measurement. (b) Pencil beam (PB) calculation.

Biological effects of electromagnetic fields
(A, Johnsson, G. Oftedal)
The studies have continued on exposure to weak electromagnetic fields in the radiofrequency and the low frequency regions. Results from a study of low frequency magnetic fields in a city environment were published. Experimental results on radio frequency exposure (mobile phone frequencies) of mobile phone users reporting headaches were summed up and published in 2008 (in collaboration with Department of Neurology, St.Olav's University Hospital, Trondheim).

Transport of therapeutic macromolecules in tumour tissue and cells

(C. de Lange Davies, T. Lindmo, A. Erikson, N. Reitan, Y. Hansen, M. Afadzi, S. Lelu)

Successful therapy requires that the therapeutic agent reaches its target. The high interstitial fluid pressure and the extracellular matrix consisting of a structural network of collagen embedded in a gel of glycosaminoglycans are potent barriers to delivery of therapeutic macromolecules. Diffusion of various macromolecules in the extracellular matrix has been studied by fluorescence correlation microscopy (FCS) and fluorescence recovery after photobleaching (FRAP). Cellular uptake and intracellular trafficking represents further barriers.

In 2008 the main focus has been on gene therapy based on DNA-chitosan complexes. Chitosan is a positively charged polysaccharide which interacts with the negatively charged DNA, forming nanoparticles. The interactions with DNA and ability to transfect cells depend on intrinsic chitosan properties such as chain length, charge density, and molecular structure, as well as the relative ratio between DNA and chitosan. Chitosan oligomers of different chain lengths as well as substituted with a tri-saccharide (trisaccharide substituted chitosan oligomer = TCO) and self branched (SB-TCO) chitosans to improve the solubility and stability, were compared.

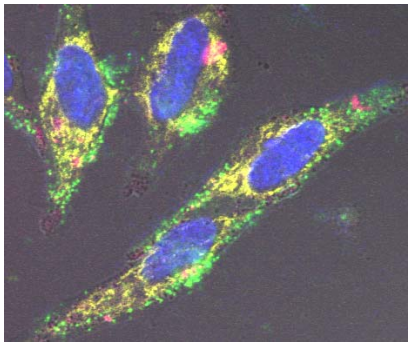

Fig. 3. Cells incubated with DNA (green)-chitosan (red), and stained for nucleus (blue) and lysosomes (yellow).

The various nanoparticles were characterized using atomic force microscopy, dynamic light scattering and fluorescence correlation spectroscopy.

The nanoparticles based on TCO and SB-TCO demonstrated higher transfection efficiency compared to linear chitosans, probably due to endosomal/lysosomal escape thereby avoiding degradation, and more efficient release of DNA from the chitosan in the nanoparticles. Colocalization studied of DNA-chitosan using confocal laser scanning microscopy and FCS revealed a lower uptake of TCO- and SB-TCO-DNAcomplexes in lysosomes, and DNA showed less colocalization with TCO or SB-TCO compared to linear chitosan.

Clinical applications of multiphoton microscopy

(C de Lange Davies, M. Lilledahl)

Multiphoton microscopy can be used to image the three-dimensional structure of connective tissue proteins without exogenous staining. This information is valuable in characterizing many types of pathologies. We are investigating the use in a number of applications like atherosclerosis, valvular fibrosis, and aneurysms to aid in the diagnosis and understanding of these diseases. The connective tissue is what imparts mechanical strength to tissue and the mechanical properties are important in many clinical applications. We have established an experimental setup to image tissue during application of stress. Collagen fibers were straightened and elongated. Information obtained from the image analysis is important inputs to mechanical models, and we are working closely with biomechanics groups in Norway and abroad to investigate how multiphoton microscopy can be used to improve mechanical models and better understand the mechanical properties of tissue.

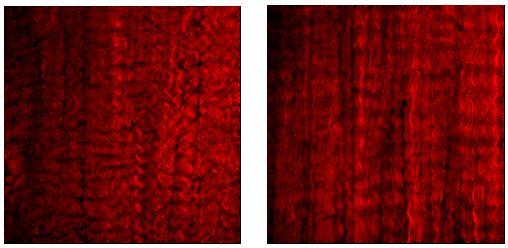

Fig. 4. Collagen fibers imaged by the second harmonic signal before (left) and after (right) stress was applied.

Biopolymers and bionanotechnology

Biopolymers mesoscale structural organization and interactions

(B. T. Stokke, D. Klein, G. Maurstad, K.Psonka-Antonczyk, M. Sletmoen, M. Takemasa, S. Tierney)

Our research focuses on mesoscale structure formation of biological macromolecules. This research field includes the internal and collective organisation of biological polymers that is crucial for life, as well as a basis for various technological exploitations. Within mesoscale structure formation and interactions of biological macromolecules, we are currently pursuing research topics as e.g., polyelectrolyte complexation, biopolymer multi-layers and gels, (1,3)-β-D-glucans and their inter-actions with polynucleotides, physics of enzymatic mode of action, responsive gels as biospecific signal transducers and nanoscale studies of toll-like receptors. In addition to classical ensemble

averaging techniques, application of single-molecule techniques is a distinctive facet of our approach to tackle core issues within these topics.

Electrostatic interactions are important driving forces for numerous biological processes, e.g. organisation of DNA to packed chromosones, or interactions between enzymes and charged ligands. Our research is two-fold and includes investigating the use of chitosan (and modified chitosans) for compaction of DNA for gene delivery, and in general investigating the influence of macromolecular properties and preparation conditions on the structure of condensed semiflexible biopolymers. In 2008, we have established quantitative methods for the analysis of surface structure of biopolymer multilayers, the polyelectrolyte complexation between alginate and chitosans of various molecular parameters and preparation conditions have been performed.

The research on (1,3)-β-D-glucans aims at an understanding of stability, structure and biological activity of (1,3)-β-D-glucans exposed to different pre-treatments. Details of complexes formed between (1,3)-β-D-glucans and polynucleotides have been elucidated. This is the first example of a specific polysaccharide-polynucleotide interaction. Single-molecule studies of the interaction between hydrophobically modified hydroxyethyl cellulose and amylose have been performed in order to elucidate molecular interactions contributing to the rheological properties of these materials. We are also in the process of establishing single-molecule techniques for the study of search strategy of DNA binding proteins in reaching their specific target.

The incorporation of responsive polymeric material as a Fabry-Perot cavity to support high resolution determination of swelling response has been pursued in the context a glucose sensing material. The design principles of a glucose sensing material, with focus on sensitivity and selectivity, as well as possible interference with other blood components have been elucidated. The resulting material reveals a reversible swelling on glucose.

Bionanotechnology

(P. Sikorski, F. Mumm, M. Olderøy, M. Xie)

Our research is focused on characterization and application of nanostructured materials from nature (Project 1), as well as on using fabrication strategies inspired by nature to make new nanostructured materials (Project 2).

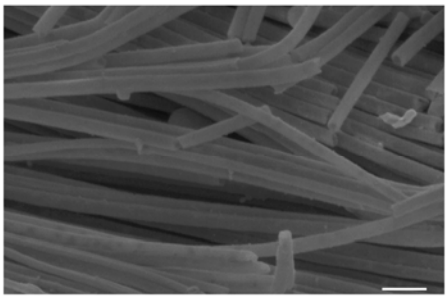

Fig. 5. Al_2O_3 nanotubes made by atomic layer deposition. Scalebar corresponds to 500 nm.

Project 1: In the past year we have continued working on applications of chitin-protein structures from the marine worm *Aphroditha Aculeata* as templates for the fabrication of long nanowires and nanotubes, with diameters of around 150 nm and lengths reaching towards the millimetre length scale. Nanowires can be deposited electro-chemically (Cu, Ni), whereas tubes are fabricated using atomic layer deposition (Al_2O_3).

Project 2: In 2008, we have obtained first results on mineralization of polysaccharide gels using an approach inspired by biomineralization in nature. We are able to produce gel beads with good distribution of nm-size mineral crystals.

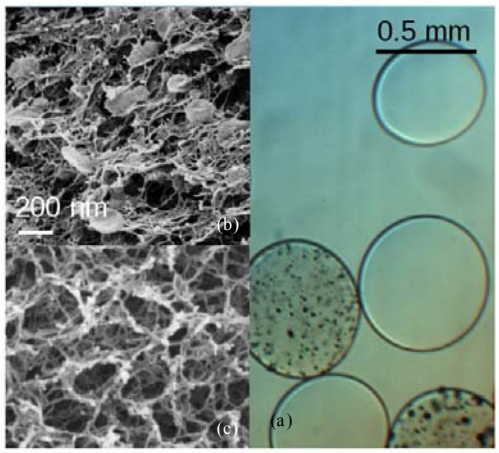

Fig. 6. Polysaccharide gel beads (a) and high magnification FEG-SEM images of mineralized and and non-mineralized gel network (b, c).

We have also observed that polysaccharide polymers can interact with mineral crystals and at some conditions can influence their growth and stability. Methods for characterisation of mechanical properties of fabricated beads are currently under development.

Photobiophysics

Photoinduced reactions in cancer cells
(A. Johnsson, T.B. Melø, O.Gederaas)
Photoinduced reactions are studied in AY-27 cells – a rat bladder cancer cell line. Light induced reactions leading to cell destruction are of interest, and sensitizers added to the cells increase the light effects.

Photosynthetic systems and pigments
(R. Naqvi, T.B. Melø)
One of our main activities last year was the investigation of photoprotection in whole apple fruit and in leaves. Some other problems included the following: hexanol-induced order-disorder transition in lamellar aggregates of bacterio-chlorophyll *c*, light absorption and scattering by cell suspensions of some cyanobacteria and microalgae, excited properties of hydrophilic carotenoids and generation of their radical cations.

Biosystems

Plant growth in weightlessness
(A. Johnson, B. Solheim)
In an experiment on the International Space Station in 2007 we performed a study in weightlessness of plant growth and growth movements in a long term (about 70 days) experiment. Of particular interest were rotational growth movements and the possible importance of the gravity in creating such movements. The interpretations and the quantitative evaluation of more than 30 000 pictures dominated the work in this project in 2008.
Several image processing techniques were developed to extract as much information as possible from the images. Frequency analysis of stem and leaf movements also completed the analysis. It was shown that gravity plays a role in amplifying minute oscillatory tendencies in the plants. Some manuscripts have been accepted, and at the end of the year B. Solheim delivered his doctoral thesis for the PhD degree to the faculty.

Example of research carried out in 2008

Different neural substrates for luminance and brightness

(A. Valberg and T. Seim)
The relationship between the relative spectral luminous efficiency function V(λ) and the functional properties of cells in the retina and later in the visual pathway is a fascinating topic. The V(λ) function is not only essential in bridging radiometric measurements of light with e.g. photometric measurements of luminance – a task that it serves with excellence – it is also a good example of the difficulties involved in establishing a link between psychophysics and visual neuroscience. Some years ago we demonstrated that the properties of V(λ) could be traced back to the sensitivity of the large magnocellular cells of the retina, receiving inputs from a sum of long (L)- and middle (M) wavelength sensitive cone receptors ('L+M' cells). Magnocellular cells are extremely sensitive when it comes to the detection of borders and contours, in situations where saccadic eye movements refresh their responses. But, given the transient character of these cells' response (being active only for a short period after a stimulus change), they are not likely to be the physiological substrate for sustained sensory magnitudes such as brightness and lightness. The more numerous parvocellular cells are much better candidates for neural mechanisms responsible for the perception of surface properties such as colour and lightness. These latter cells respond in a sustained fashion, firing as long as the stimulus is on. They are also cone opponent, meaning that one cone receptor type (say the L-receptor), when excited, activates a given cell, whereas another cone type inhibits the same cell (the M-receptor). This particular parvocellular cell would be an 'L-M' opponent cell dividing the spectrum into an excitatory long wavelength region and an inhibitory short wavelength region. Its counterpart, the equally frequent 'M-L' cells, are excited by short wavelength lights and inhibited by long wavelength lights. The neutral wavelength or zero crossing of these cells is near 570 nm where they are unable to differentiate between yellow and white. Neural modelling shows that the summed outputs of opposite 'L-M'and 'M-L' types would give excellent brightness signals for achromatic stimuli. In a recent paper we have demonstrated quantitatively that such combinations of opponent parvocellular ON-cells, responding to incremental light stimuli, can account well for the psychophysical scaling of brightness. Similarly, a sum of parvocellular OFF-cell outputs, responding to light decrements, accounts equally well for blackness scaling (the opposite of lightness scaling) in a given experimental situation.

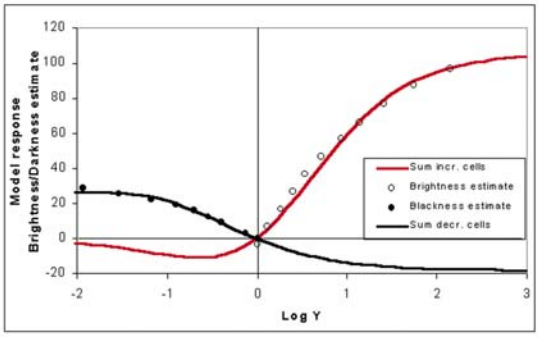

Fig. 7. A comparison of the combined neural responses of Increment and Decrement cells (also called ON- and OFF-cells) with the psychophysical estimates of brightness and blackness, respectively. Symbols represent scaled psychophysical data and curves the averaged neurophysiological response data as a function of the relative luminance of light stimuli.

These results support the notion that the relative spectral luminosity function V(λ), as derived by MDB or flicker photometry, is representative for the threshold spectral sensitivity of transiently responding magnocellular cells. Therefore, and contrary to common belief, this function does not tell us much about relative brightness or lightness of steady chromatic lights. In fact, two stationary stimuli (e.g. blue and yellow) that have the same photometric luminance and therefore elicit the same response in magnocellular cells, are quite different with respect to brightness (blue being the brighter). Parvocellular cells are highly sensitive to chromatic differences of stationary stimuli, and summing the signals from opposite types (see above) largely removes the chromatic components. In concert, the parvocellular cells are able to construct the opposite brightness and blackness dimensions of light sources and reflecting surfaces.

DIVISION OF COMPLEX MATERIAL

Staff
Professor Arnljot Elgsæter
Professor Jon Otto Fossum
Professor Alex Hansen
Professor Arne Mikkelsen
Professor Steinar Raaen
Professor Bo Sture Skagerstam
Adjunct professor Kenneth D. Knudsen

Professor emeritus Frode Mo

Non-tenured staff
Peter Riseborough (Onsagerprof. June-Nov)
Baoxiang Wang (Post-doc)
Xiaofeng Yu (Post-doc)
Min Zhou (Post-doc)

Overview

The research is focused on the *physics of soft and complex materials* including *biological physics.* The phenomena studied include: The structure and dynamics of nanostructured surface alloys, clay-containing systems and biopolymers; atomic and domain structure in ferroelectric thin films; spontaneous and guided selfassembly of nano-particles of various kinds; diffusion properties in nanoporous media; folding and conformational dynamics of proteins and other biopolymers; anomalous diffusion processes; mechanical properties of rough surfaces; brittle fracture; mechanical properties of granular media; multiphase flow in porous media.

The research comprises the use of experimental methods, computer simulations and theoretical methods. The *home laboratories* of the division contain facilities for: X-ray photoelectron spectroscopy (XPS); ultraviolet photoelectron spectroscopy (UPS); low energy electron diffraction (LEED); photoemission electron microscopy (PEEM); temperature programmed desorption (TPD) spectroscopy; a range of UHV sample preparation techniques; wide- and small-angle X-ray scattering; static and dynamic light scattering; light microscopy; atomic force microscopy; preparation of soft aqueous samples for transmission electron microscopy; measurements of static and dynamic viscoelastic properties of soft materials (rheology); micro- and nanocalorimetry; thermo-gravimetry; studies of dynamic electro-optic properties of soft materials; circular dichroism; isolation and purification of nanoparticles including biopolymers. Some members of the section are also regular users of the synchrotron facilities in Grenoble, France; Sao Paulo, Brazil; and Pohang, South Korea.

The *computer simulation methods* include Brownian dynamics, Monte Carlo, discrete element methods, solution of boundary value problems.

The *theoretical studies* are mainly on condensed matter physics theory and statistical physics.

Survey of research activities

Experimental and theoretical studies of the dynamics and structure of nanoparticles and polymers
(*A. Elgsæter and A. Mikkelsen*)
Our activity is within the physics of polymer and nanoparticle systems with a primary goal to gain a deeper understanding of the interplay between functions and structural dynamics. The research consists of three closely integrated parts: I) Formal theoretical basis for the nanoscale dynamics using realistic molecular models. II) Numerical algorithms to carry out numerical Brownian dynamics simulations. III) Experimental studies of molecular dynamics using methods such as static and dynamic light scattering, nanocalorimetry, electron microscopy, circular dichroism and electrically induced transient birefringence. Research in 2008 has been focused on electron microscopy and electron diffraction of carbon nanocones and nanodisks. In August 2008 Tom Richard Evensen defended his PhD thesis on work in activity I) and II) above.

Experimental investigations of soft and complex matter: From nano to macro.
(*J.O. Fossum*)
The research group has during several years focused on basic understanding of problems within soft and complex materials, in particular physical phenomena in soft matter using synthetic nano-layered silicates (clays), and more recently paper, as physical complex model systems. Main physical phenomena studied in these systems include flow and diffusion processes, intercalation processes, spontaneous selforganization into liquid crystalline phases in systems of nanoplatelets, and guided self-organization into electro-rheological and magneto-rheological systems with smart material properties. During the past couple of years the activity has moved into including similar phenomena in other types of nanoparticle systems, such as gold, silver, surface modified clays and ZnO. The most important experimental methods used at NTNU include standard microscopy, as well as AFM and STM; rheology in external applied fields (magnetic or electric); visible light scattering; and wide- and small-angle X-ray scattering. Synchrotron X-ray scattering is performed at ESRF in France, LNLS in

Brazil, PAL in South Korea, Max-lab Lund universitet in Sweden and other sources. Small-angle-neutron-scattering (SANS) at IFE, Kjeller. Magnetic mesonance-spectroscopy and -imaging is performed in collaboration with Universidade Federal de Pernambuco, Recife, Brazil, where J.O. Fossum spent 7 months on sabbatical in 2008. Other important international collaboration is with University Paris7, University Rennes 1 in France, University of Amsterdam, Universidade de Brasilia and other institutions in Brazil.

Fracture and transport in disordered systems, growth processes, two-phase flow in porous media

(*A. Hansen*)

The physics of fracture processes and physical processes near fracture surfaces remain a major focal point in our research. A coherent understanding of the geometrical scaling properties of fracture surfaces seems now finally to be within reach. Up to now two irreconcilable models of the fracture processes giving rise to the scaling properties, the fluctuating line model and the stress-weighted percolation model, have been in competition. However, reanalysis of experimental data coupled with a better understanding of the models themselves, have led to the idea that both models are correct, but work on different length scales. We have in 2008 collaborated with groups at the University of Oslo and the University of Strasbourg addressing these problems, and in particular adapting the stress-weighted percolation model to the geometries that are relevant for comparison with the experimental data. A second important subject is two-phase flow under steady-state conditions. We are at present pursuing the idea that the macroscopic properties of this state may be described using a formalism that is reminiscent of thermodynamics.

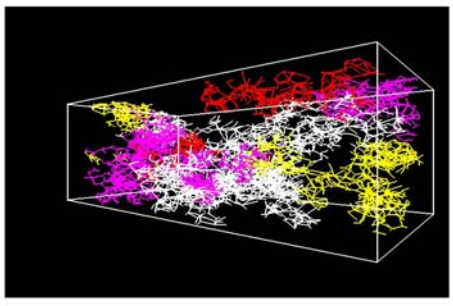

Fig. 1. Clusters of non-wetting fluid moving under steady-state conditions in a numerically reconstructed berea sandstone filled with wetting fluid.

Another important research effort along these lines is to implement film flow in the two-phase flow model we are basing our work on. Lastly we mention our work on developing tools for analyzing fracture networks. There has over the last ten years been a huge effort in describing networks, such as internet. Such networks consist of nodes and links. Fracture networks, however, are essentially intersecting planes. Our work, which has been in collaboration with the Geophysics Department at the University of Rennes 1, has consisted in adapting recent results on node-and-link networks to fracture networks.

X-ray scattering and diffraction studies of ferroelectric thin films.

(F. Mo)

The structure studies of ferroic compounds have been focussed on ferroelectric thin films. Ferroelectric $PbTiO_3$-films of thickness 6-50 unit cells (uc) or ~ 2.4- 20.7 nm deposited on $SrTiO_3$ have been investigated, also under weak electric fields, by the use of a specially designed sample cell. Targets for the studies are atomic/molecular structure, domain structure and dynamics, and their dependencies on film thickness and electric field. A surprising result is that application of a very weak field (< 1 % of the estimated coercive field) along the polar axis induces significant changes in the domain structure of a 50 uc thick film as revealed in the diffuse scattering distribution. These changes were not reversed when the field was switched off. Continued studies will be carried out to explore further the nature of the observed changes as a function of magnitude and direction of field for a range of film thicknesses.

Nanostructured surfaces: carbon cones, rare earth doped surfaces, shape memory alloys

(*S. Raaen*)

A range of experimental surface analytical tools (XPS, UPS, LEED, PEEM, TPD) are used to investigate electronic and structural properties.

It was found that hydrogen adsorbs on carbon nanocones in a temperature region which is suitable for hydrogen storage applications. The nature of adsorption for doped and undoped carbon material has been characterized.

We have demonstrated that the surface properties may vary dramatically for different rare earth doped transition metal surfaces, and have explored the temperature stability of such systems. Gas adsorption has also been explored.

Shape memory alloys (SMA) have many applications within several fields of materials technology, and are also used in biocompatible applications. Oxidation studies of NiTi SMA indicate that oxide growth and stability may be enhanced in the presence of small amounts of K at the surface,

which in turn is of consequence for biocompatibility.

Cavity quantum electrodynamics and anomalous diffusion in granular/traffic flows
(*Bo-Sture Skagerstam*)
We have focused our attention on the large-time statistical properties of granular flows (work done in collaboration with J.O. Fossum and A. Hansen and project/master students). In this study use has been made of the so-called Hurst exponent to classify the large-time properties of granular/traffic flows and properties of stochastic differential equations. Some features of the large-time behavior can be interpreted as anomalous diffusion. We have shown that such an anomalous diffusion can be described in terms of a conventional memory function in contrast to the sometimes used method of fractional derivatives.

In the field of cavity quantum electrodynamics we have studied various collective effects of atoms interacting with a micro-cavity radiation field. We have also studied the Purcell effect for atoms close to superconducting bodies. We have suggested that the low-frequency dielectric properties of superconducting bodies, which to a large extent is poorly understood, can be investigated by means of spontaneous emission of atoms. The research project on the human eye as a quantum-mechanical detector of photons has continued. Various features of a predictive model for the response of the human eye on low intensity (quantum) light have been investigated.

Example of research carried out in 2008

A transmission electron microscope and electron diffraction study of carbon nanodisks and nanocones *(Stine N. Naess, Torgunn Garberg, Harald F. Cuesta, Geir Helgesen, Kenneth D. Knudsen, Gunnar Kopstad and Arnljot Elgsaeter)*

Diamonds, graphite, spherical fullerenes (Bucky balls) and nanotubes constitute the four fundamental allotrops of carbon. About ten years ago it was found that output from the Kvaerner Carbon Black & Hydrogen Process actually contains only a minor amount of carbon back (amorphous carbon). The major part of the output consists of carbon nanodisks and nanocones. The apex angles of these cones exhibits only five different values.

We have studied these carbon nanodisks and nanocones using various transmission electron microscopic (TEM) techniques. Fig. 2 shows a representtative collection of carbon nanodisks and Fig. 3 shows representative examples of carbon nanocones. When nanocarbon disks were frozen in dimethyl sulfoxide (DMSO) and fractured at -150 ^{O}C we frequently find that the nanodisks split along the middle as shown in Fig. 4.

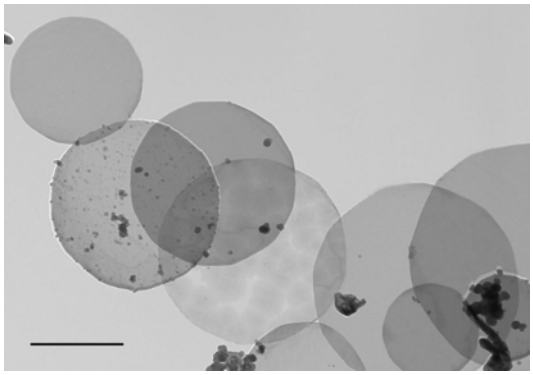

Fig. 2. TEM image of carbon nanodisks. Bar =1000 nm.

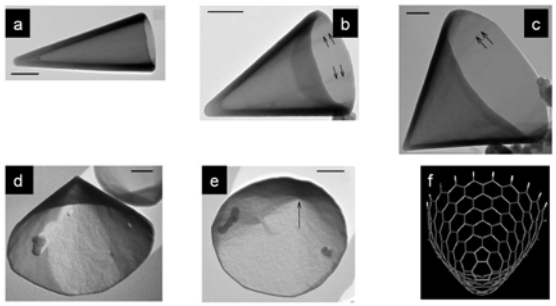

Fig. 3. TEM images of carbon nanocones lying on their side inside a mica-carbon composite support film. a, b, c, d and e show nanocones with nominal apex angle α = 19.2°, 38.9°, 60.0°, 83.6° and 112.9°, respectively. f shows an energy minimized atomistic model of a cone (ca. 300 atoms) - here with 38.9° apex angle, having 4 pentagons at the tip. d and e were shadowed at 30° with a 1-2 nm thick Pt-film in order to enhance the contrast. For the specimens shown in a, b and c there is no Pt-film present. On top of all specimens was added a 10-20 nm thick carbon support film deposited at a direction 90° relative to the mica surface. The smaller dark spherical objects in the micrographs are other forms of carbon found throughout the sample. Bar=200 nm.

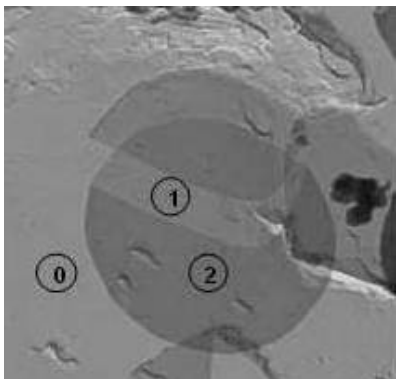

Fig. 4. Freeze-fracture TEM of carbon nanodisks frozen in DMSO.

Electron diffraction (ED) studies of individual carbon nanodisks reveal that part of the carbon in such a disk is crystalline. See Fig. 5. Upon a closer examination of Fig. 2 it can also be seen the edge of many of the nanodisks have a total of 12 facets.

Electron diffraction of the different parts of freeze-fractured nanodisks shows that often the crystalline part of the disk is included mainly in one of the halves shown in appearing after fracturing. This leads to the conclusion that the carbon nanodisk consists of a crystalline central layer with an amorphous outer layer on each side.

Electron diffraction of the wall of a carbon nanocone (Fig. 7) revealed that the wall structure of this is similar to what we found for the nanodisk. The rim of many cones shows a faceting similar to what is seen for the carbon disks. For the cones the facets angles are the same as for the disks, but for the cones the number of facets depends on the side of the apex angle. These finding are all in agreement with published theoretical prediction of the carbon atomic structure and symmetry of the nanocones. Because of these striking structural similarities it in some sense seems valid to classify the carbon nanodiscs simply as a special case of carbon nanocones, i.e. a nanocone with apex angle 180°.

Part of this work is published in: **Carbon**, **46**, 1535 –1543 (2008).

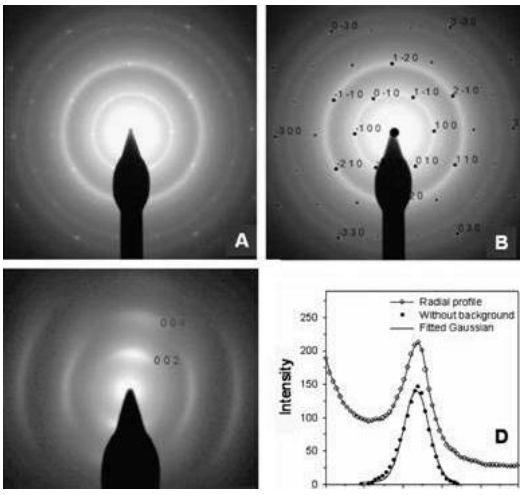

Fig. 5. Electron diffraction recordings from a carbon nanodisk embedded in the mica-carbon support film. (A) Diffraction pattern for incident beam normal to the disk surface, i.e. along the (002)-direction of the graphite reciprocal lattice. (B) Same as in (A) with indexing of the strongest reflections. (C) Scattering from a carbon disk hanging from the TEM grid so that the incident beam is nearly parallel to the disk surface. (D) Radial profile through the (002)-reflection in (C) with a Gaussian fitted to the profile of this reflection.

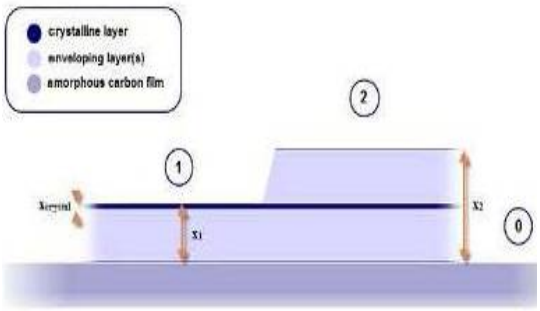

Fig. 6. Schematic structure of carbon nanodiscs. The labels are the same as shown in Fig. 4.

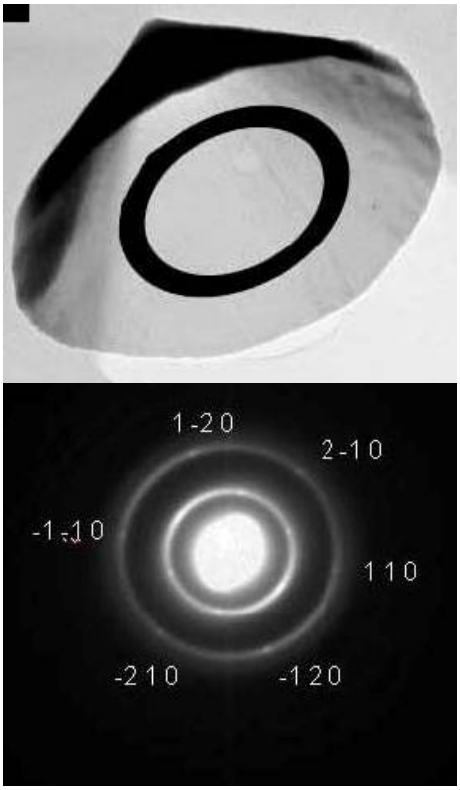

Fig. 7. Electron diffraction (ED) image (below) of a 83.6° cone lying on its side on the support film (top). The marked region corresponds to the area hit by the electron beam. The ED-image shows hexagonal symmetry. Some of the hkl-reflections corresponding to the hexagonal in-plane symmetry of graphite are indicated.

DIVISION OF CONDENSED MATTER PHYSICS

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DeZheng Yang (Post-doc)

Overview

The research activities include topics both in experimental and theoretical condensed matter physics. The members of the division work with a variety of experimental techniques, ranging from scanning tunneling microscopy, electron microscopy, X-ray diffraction and optical spectroscopy to synchrotron radiation, for studying physical properties of materials and material structures. A large fraction of the research is focused on nanoscale structure studies and the connection to macroscopic physical properties. The group is therefore heavily involved in the establishment of the new Nanolab at NTNU A brief survey of the research is given. One research project is described in more detail.

Survey of research activities

X-ray scattering
(D.W. Breiby, R.H. Mathiesen, E. J. Samuelsen)
The X-ray group is active in several ongoing projects over a wide range of materials, from organic electronics to various functional and structural inorganic oxides and metallic nano- and microstructured materials. In 2008 the group also established several new activities within national and European research projects, such as FME Solar Cells, ColdWear, SUP Improvement, Nasjonal Forskerskole "Nanoteknologi for Mikrosystem" and FP7 MIntWeld. The X-ray laboratory has been undergoing substantial upgrades involving new focusing optics and a 1 megapixel area X-ray detector for diffraction and scattering experiments that will be commissioned in 2009. Also new hardware to allow for a more flexible change between setups and easier alignment has been ordered. A significant part of the experimental activities of the X-ray group is carried out at synchrotron radiation facilities – a total of 5 beamtime sessions were carried out in 2008. Current research activities include:

- Micro- and mesoscale transport during unconstrained dendritic growth
- Convective-diffusive interaction during non-equilibrium transport in metal solidification processes.
- Structure-properties relations in soft-condensed matter, mainly conjugated polymers and liquid crystals for organic electronics.
- Modeling of grazing-incidence small- and wide angle X-ray scattering (GISAXS / GIWAXS).
- Recrystallisation kinetics in ultra-fine grained metals.
- Domain and structure response to weak electric and thermal fields in ferroelectric thin films.

Transmission electron microscopy (TEM)
(R. Holmestad, A.T.J. van Helvoort, J.Walmsley, P.E. Vullum, R. Vissers,F. Ehlers)
The transmission electron microscopy (TEM) research group is active in several projects including nanoscale structural studies and the connection to macroscopic physical properties, within the field of materials physics. The group has 6 PhD students and 3 post-docs, and work in close collaboration with SINTEF through the TEM Gemini centre.

In May 2008, the TEM group organized an international workshop on electron diffraction with 25 participants and lectures by several international capacities in the field. In the fall, the group organized a 18 hours introduction course to transmission electron microscopy for more than 30 PhD students/post-docs from 6 different departments at NTNU. 11 of the students continued with a PhD level TEM course. In 2008 the TEM Gemini centre were involved in 32 journal publications. The main objective of the group now is to secure funding for new state-of-the-art TEMs to Norway. We have joined forces with the TEM environment at UiO to apply for a nationally coordinated investment plan.

The group has for many years worked with SINTEF and Hydro on alloy development and nucleation of precipitates in aluminum alloys, including structure determination of metastable hardening phases by combining experiments (high resolution TEM, scanning TEM, quantitative diffraction and atom probe) and modeling (density functional theory). In addition, there is a broad range of research activity on other materials, with a common emphasis on nano/micro understanding of properties and advanced microscopy techniques. Examples are:

- Multicrystalline silicon solar cell materials-defects and impurity influence on efficiency
- Palladium membranes for hydrogen gas separation – microstructure evolution
- Electronic structure of thermoelectric materials
- Functional perovskite materials - ferroelectric thin films and nanorods
- Nanoparticles and support in catalyst materials – electron tomography and other advanced techniques
- High temperature corrosion in steels
- Nanowires of III-V semiconductors
- Intermediate band solar cell materials
- Aluminum surface properties related to corrosion
- High quality TEM sample preparation - tripod polishing

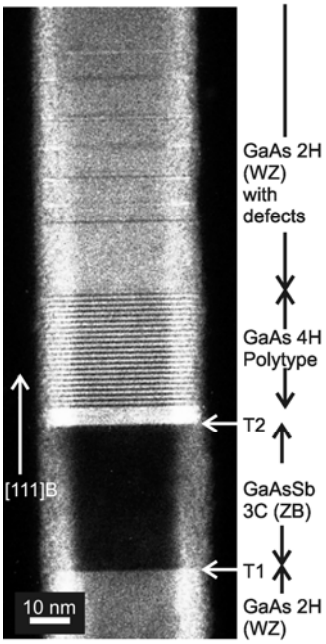

Fig. 1. Dark field image of GaAs nanowire with GaAsSb insert. In Collaboration with H. Weman, IET, NTNU. From Dheeraj DL et al., "Growth and characterization of GaAs nanowires with defect-free zinc blende GaAsSb inserts", Nano Letters, 8, 4459-4463, 2008.

Scanning tunnelling microscopy

(E. Wahlström, DeZheng Yang, Justin Wells, A. Borg, T. Højberg Andersen)

The scanning tunnelling microscopy group has two major lines of research activities primarily based on the scanning tunnelling microscopy instruments in the department, namely nanomagnetics and surface science. There are two ultra high vacuum STM's operated by the group, one of which has been upgraded with sources and electron energy analyser for UPS/XPS analysis during the last year. In addition to this two scanning probe microscopes are being constructed and during 2008 the first images of the NTNU STM design were acquired.

Surface science

The surface science activities are primarily directed to experimental investigations of adsorption behaviour at bimetallic surfaces by scanning tunnelling microscopy (STM) and high-resolution photoelectron spectroscopy (HRPES). The HRPES studies are performed at MAX-lab, the synchrotron radiation laboratory at Lund University, Sweden. The experimental work is complemented with density functional theory calculations performed at Division of Theoretical Physics. We have continued our research on studies of adsorbates on anatase surfaces through collaboration with Uppsala University:

- Adsorption at NiAl single crystal surfaces
- Adsorption at PdAg single crystal surfaces and surface properties of PdAg membranes
- Adsorbates at anatase surfaces

Experimental Nanomagnetics

The research on nanomagnetics is dedicated to understanding the physics of magnetic structures at the nanoscale. In particular STM-based transport measurements are utilised to understand how charge and spin currents within materials interplay with the magnetisation of materials. A main line of research is performed in conjunction with the Department of Electronics and Telecommunications (Prof. T. Tybell) to study functional metal oxides. In addition to this we have active collaborations with groups in Sweden (Uppsala, Göteborg), Denmark (Aarhus) and China (Shanghai). The specific activities are during the last year has been performed mainly along these lines:

- Nanostructuring and magnetic properties of $La_{1-x}Sr_xMnO_3$
- Model systems for current induced magnetisation reversal investigated through laterally resolved point contact studies.
- Transport properties of (Ga,Mn)As nanowires.

Example of research carried out in 2008

Studies of multicrystalline as-cast solar cell silicon grown from metallurgical feedstock

(H. Nordmark, J. Walmsley and Randi Holmestad)

Solar cell production presently experiences a yearly growth of more than 40 %, rapidly approaching 3 GWp of solar cell installations a year. Multicrystalline (mc) silicon solar cells constitute about 50 % of the total solar cell production. Currently, the supply of solar grade silicon is the bottleneck for further growth. Due to the high investment costs and complexity of the standard Siemens process, other routes for production of solar grade silicon are being developed. These must be able to produce silicon at lower cost and with less energy consumption. The disadvantage is that the resulting feedstock often contains higher level of impurities and structural defects which act as recombination centers. Recombination activity depends on grain boundary character and contamination. While grain boundaries in clean samples show very low recombination activity, almost independent of misorientation and temperature, the recombination activity increases with contamination level.

In the present work, grain boundaries in multicrystalline silicon material grown from metallurgical feedstock, were investigated in detail using Electron Beam Induced Current (EBIC), Electron Back-Scattered Diffraction (EBSD) and Transmission Electron Microscopy (TEM) techniques. EBIC was used to identify electrically active defects in the material, such as grain boundaries and dislocations. EBSD was used to determine grain orientations and grain boundary misorientation in the same samples. To correlate the EBIC map with the microstructure, the samples had to be carefully thinned, and the grain boundaries examined in TEM. The type and nature of the precipitates observed in the grain boundaries was carefully examined by use of scanning TEM in combination with x-ray Energy Dispersive Spectroscopy. The combination of these three techniques provides a powerful tool in relating recombination activity with grain misorientation and contamination in the grain boundaries.

The EBSD analysis showed that small angle grain boundaries, with misorientation angles lower than 2°, gave high EBIC contrast, i.e., high recombination activity. EBIC combined with TEM showed that at low temperatures, silicon oxide was found to be recombination centers, both at grain boundaries and on decorated dislocations in the bulk. The grain boundaries containing multi-metallic silicides were found to have random misorientations and showed strong contrast in the EBIC images while clean twins showed less or no contrast. The metallic precipitates observed in the sample contain mainly nickel silicide with an iron rich core. Figs. 2 and 3 show examples of the studies.

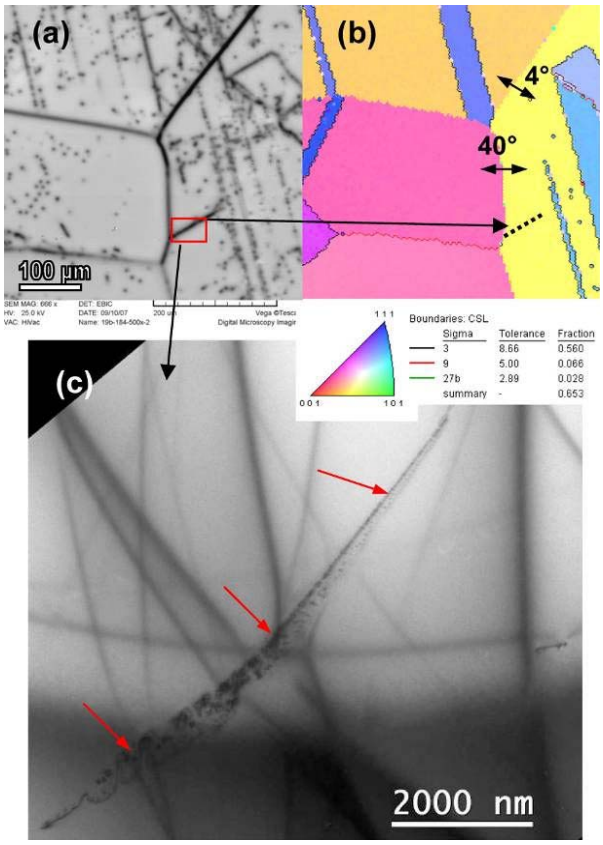

Fig. 2. EBIC, EBSD and TEM images of corresponding areas. (a) EBIC map at T = 100 K of the recombination activity of the extended defects. High contrast (dark) areas have high recombination activity, (b) EBSD map from the same area indicating grain orientation and grain boundary misorientation. (c) TEM of the area from the rectangle in (a) showing a large climbing dislocation leaving oxide precipitates in its path

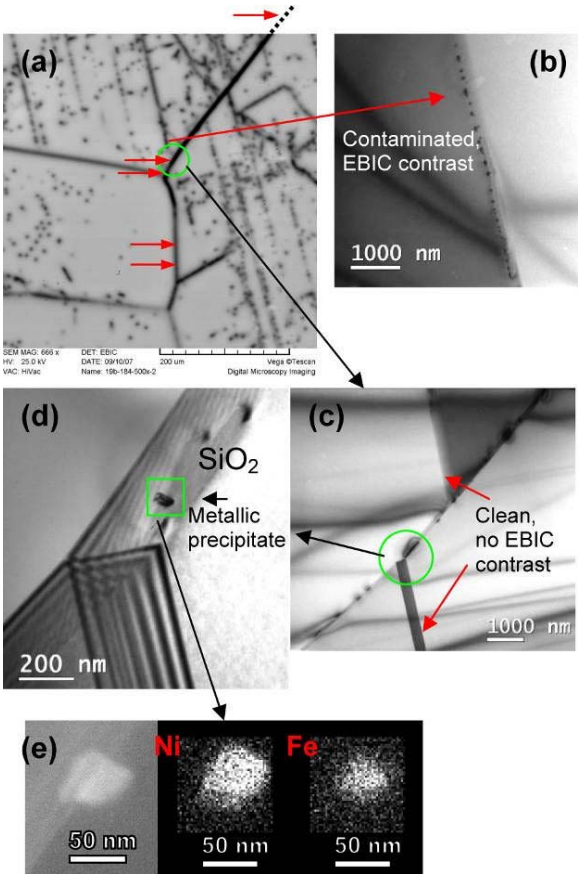

Fig.3. (a) EBIC map. The red arrows indicate positions of observed metal silicides, (b) Twin boundary heavily contaminated with oxides that showed moderate contrast in the EBIC map, (c) Enlarged image of the area inside the green circle in (a). Clean twins show norecombination activity in the EBIC map, (d) Enlarged TEM image of the grain boundary triple point, marked by a green circle in (c). A small metallic precipitate can be observed at the edge of a silicon oxide platelet, (e) EDS maps of the metallic precipitate show that in addition to silicon, the precipitate contains mainly nickel, with an iron rich core

This work has been financed by the SUP programme 'Micro- and nanostructural based materials developments', the KMB project 'Si Cost Reduction' and the 6th Framework programme 'FoXy'. It was published in: H. Nordmark, M. Di Sabatino, M. Acciarri, S. Binetti , J. Libal, E. J. Øvrelid, J. C. Walmsley and R. Holmestad in *Proceedings of the 33rd IEEE Photovoltaic Specialists Conference, San Diego, USA* (2008).

DIVISION OF THEORETICAL PHYSICS

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Stein Olav Skrøvseth (Post-doc)
Mathieu Taillefumier (Post-doc)
Yaroslav Tserkovnyak (Research scientist)

Overview

The research is mainly carried out within the broad fields of condensed matter physics, statistical physics, quantum physic, astroparticle-physics. These contain several subfields with a large variety of topics for research. A brief overview is given.

Survey of research activities

Understanding nano-structures requires a combination of expertise in different fields by integrating semiconductors and normal metals with magnetic and superconducting materials. Our group explores spin and charge flow in such nanostructures. We aim to develop improved theoretical methods for describing transport phenomena, and other physical effects, and use these methods to increase our understanding of experiments. We study the properties of novel systems, pure or hybrid, containing ferromagnets, normal metals, semiconductors, and superconductors. Among our current projects are 1) current induced magnetization excitations, 2) two- dimensional “Dirac fermions" in graphene, 3) spin flow into superconductors, 4) transport in magnetic semiconductors, 5) fluctuations and dissipation in ferromagnets, 6) spin-dynamics in spinor Bose-Einstein condensates. We published 13 papers in 2008, among which one in Nature, three in Physical Review Letters, and six in The Physical Review B. (*A. Brataas, D. Huertas-Hernando, M. Taillefumier, S. Bandopadyay,H. J. Skadsem, H. Haugen, K. Hals, and S. Sadjina*).

During 2008 we published 13 papers in Physical Review B, 1 paper in Physical Review A, and 2 papers in Physical Review Letters on topics ranging from 1) unusual vortex states and phase transitions in multi-component Bose-Einstein condensates, 2) effective theory of fluctuating novel order parameters in high-Tc cuprates, 3) heat-transport by Dirac fermions and supercurrent switch in pi-junctions in graphene, 4) quantum transport on novel odd-frequency superconductors, 5) interplay between multiple broken symmetries in non-centrosymmetric superconductors, 6) hidden structures of superconductors, magnets, and non-centrosymmetric metals. (*A. Sudbø, J. Linder, E. K. Dahl, S. Kragset, M. Grønsleth, I. B. Sperstad, T. Bergh Nilssen*).

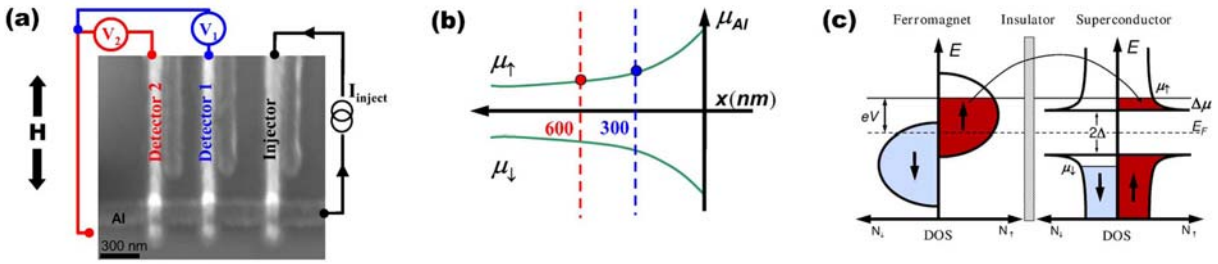

Fig. 1 (a) SEM image of a multi-terminal ferromagnet-superconductor device together with the nonlocal measurement configuration. The electrical circuit schematic illustrates the measurement arrangement used for directly measuring the spin-diffusion length. (b) The spin-diffusion length is the exponential decay length of the spin accumulation away from the injection point. (c) Schematic density of states, illustrating spin accumulation due to tunneling between a ferromagnet and a superconductor.

In the field of ultrahigh energies cosmic ray (UHECR) physics, the recently released data of the Pierre Auger Observatory were studied. The number density of UHECR sources was derived and found to be consistent with the hypothesis that active galactic nuclei are the main UHECR sources. Cluster magnetic fields were investigated and it was shown that magnetic lensing effects lead both to large anisotropies and to an energy modulation of the observed energy spectrum of UHECRs. As an example for multi-messenger astronomy, the neutrino, photon and UHECR fluxes expected from the nearest active galactic nuclei, Centaurus A, were calculated. (*A. Cuoco, S. Hannestad, T. Haugboelle, M. Kachelriess, S. Ostapchenko, D. Semikoz, P. Serpico, and R. Tomas*). We suggested superheavy neutralinos as a possible dark matter candidate, investigating in particular the unitarity problem of heavy particles with weak gauge interactions (*V. Berezinsky, M. Kachelriess, M.Aa. Solberg*).

The Fermi golden rule is a cornerstone of quantum mechanics, although not included among its basic axioms. It gives a prescription for calculating constant transition ratios by e.g. perturbation theory, and predicts that a fraction of unstable particles will decay according to an exponential law. But it is known that exact calculations may lead to results which differ from the Fermi golden rule both for very long and very short times. The latter is often referred to as the quantum zeno effect. It would under certain conditions imply that a sample of unstable particles will have a time-varying decay rate, depending on their age since creation. This is at variance with the principle of absolute identity of elementary particles (implying that there is no way to distinguish young and old particles of the same type from each other) and seems to lead to a paradox. A model of this situation has been analysed within the second quantization formalism, which enforces the identity principle. It reveals the possibility of quantum mechanical rule for combining lifetimes. (*M. Drangfelt, K. Olaussen, I. Øverbø).*

Entanglement in mixed quantum states is studied from a geometric point of view (*J. Myrheim, J. M. Leinaas, P. Ø. Sollied*).

The thermal behavior of the Casimir force between plates made of semiconductors or poor conductors have been investigated. Like the situation for metallic plates this case has also been debated with claims that the third law of thermodynamic is broken unless the small density of free charges is disregarded in apparent agreement with experiments. We show otherwise; so the apparent influence of free charges is due to other reasons like the large Debye shielding length for low charge density. *(S. A. Ellingsen, I. Brevik, J. S. Høye, and K. Milton).*

Molecules with a soft repulsive interaction may have a liquid-solid-liquid phase transition. The free energy for such a situation has been investigated, and an exactly solvable one-dimensional model that shows this behavior has been considered. This model has also been extended to include the usual gas-liquid phase transition and may thus have properties common to those of water. Simulations are also performed on a three-dimensional model with similar properties. (*J. S. Høye, E. Lomba, and N. G. Almarza*).

Unification of HRT (hierarchical reference theory) and SCOZA (self-consistent Ornstein-Zernike approximation) has been further studied by analyzing critical properties. Under the assumptions made, the critical indices for the curve of coexistence and the critical isotherm are found to be $\beta=1/3$ and $\delta=5$ respectively for fluids, lattice gases, and the Ising model in three dimensions. (*J. S. Høye*).

The chromium oxide surface has numerous applications within catalysis and corrosion resistance. The (0001) surface of Cr_2O_3 may terminate with a Cr or an O layer. In the latter case, the surface oxygen atoms may be bonded to Cr with double bonds (Cr=O) or with single bonds (Cr-O-Cr). Adsorption sites and corresponding energies have been determined for atomic H, Cl and S, and the molecules H_2, HCl and Cl_2. Dissociation of some of these molecules has been investigated with so-called “nudged elastic band" calculations, and energy barriers lie in the range 4 – 6 eV. H and S adsorb to oxygen without much reconstruction, whereas Cl adsorbs to a chromium atom which is pulled “outside" the oxygen surface layer. (*Ø. Borck, K. Nigussa, K. L. Nielsen, J. A. Støvneng*)

When the target is to investigate the dynamics of large, reactive systems, quantum mechanical methods like DFT are computationally too expensive. An alternative, then, is to construct an empirical force field which allows breaking and forming chemical bonds; a so-called reactive force field. Accurate DFT calculations are initially performed on small molecular systems and perfect crystals, and the DFT results are used as input for parametrization of the force field. The resulting force field may then be used in molecular dynamics investigations of systems that are too large for DFT calculations. Systems of interest are III-V and group IV semiconductors, with applications to solar cell materials, and perovskites such as $PbTiO_3$ and $SrTiO_3$. (*O. Frisk, M. Søby, G. Oftedal, K. T. Olsen, P. O. Åstrand, A. v. Duin, J. A. Støvneng*).

Quantum chromodynamics is generally accepted as the theory that describes the strong interactions among the quarks and gluons. Due to a remarkable property of nonabelian gauge theories called confinement, free quarks are never observed. All quarks are confined inside the hadrons. Hadrons are

the bound states of a quark and an antiquark (e.g. pions and kaons), and three quarks (e.g. protons and neutrons). If hadronic matter is heated, it is expected to undergo a phase transition to a new state of matter called the quark-gluon plasma. In this state of matter, the quarks and gluons are no longer confined but are free to move around large distances. The quark-gluon plasma is similar to an ordinary electromagnetic plasma, but is more complicated due to the nonabelian aspects of QCD. The quark-gluon plasma existed in the early universe and so understanding its properties is essential in cosmology. In order to study the properties of the plasma, large experimental efforts at CERN and Brookhaven are made to create it in heavy-ion collisions. Strongly interacting matter also behaves in a highly nontrivial manner if one increases the density. If the density becomes sufficiently high, there is a phase transition to quark matter, which might be in colour superconducting state if the temperature is low enough and the baryon density is high enough. This part of the phase diagram (see Fig. 1) is relevant in astrophysics as compact stars are the only known candidate for containing quark matter in its interior.

We are currently carrying out research to determine the thermodynamic properties of the quark-gluon plasma and various phases of dense matter. In particular, we have been studying the possibility for Bose-Einstein condensation of pions in dense matter. This is a part of the large efforts being made to obtain a quantitative understanding of the properties of strongly interacting matter at finite temperature and density. The group published two papers in 2008. (*J.O. Andersen*).

PUBLICATIONS

Journals in Level 1 and 2

1. **Albertsen, Jorun Zahl; Grong, Øystein; Walmsley, John C; Mathiesen, Ragnvald; Beek, W.J.** A Model for High-Temperature Pitting Corrosion in Nickel-Based Alloys Involving Internal Precipitation of Carbides, Oxides and Graphite. *Metallurgical and Materials Transactions. A* 2008; 39, p. 1258-1276

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5. **Antoni, Per; Malkoch, Michael; Vamvounis, George; Nyström, Daniel; Nyström, Andreas; Lindgren, Mikael; Hult, Anders.** Europium confined cyclen dendrimers with photophysically active triazoles. *Journal of Materials Chemistry* 2008; 18, p. 2545-2554

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12. **Brataas, Arne; Tserkovnyak, Y; Bauer, GEW.** Scattering theory of Gilbert damping. *Physical Review Letters* 2008; 101, p. 037207-

13. **Breiby, Dag Werner; Bunk, Oliver; Andreasen, Jens wenzel; Lemke, Henrik t.; Nielsen, Martin Meedom.** Simulating X-ray diffraction of textured films. *Journal of applied crystallography* 2008; 41, p. 262-271

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17. **Børkje, Kjetil; Sudbø, Asle.** Effective theory of fluctuating orbital currents in high-Tc cuprate superconductors. *Physical Review B. Condensed Matter and Materials Physics* 2008; 77, p. 092404-

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25. **Dasa, Lakshmi Narayana; Patriarche, G.; Zhou, Hailong; Hoang, Thang Ba; Anthonysamy, Fervin Moses; Grønsberg, Sondre; Van Helvoort, Antonius; Fimland, Bjørn-Ove; Weman, Helge.** Growth and characterization of GaAs nanowires with defect-free zinc blende GaAsSb inserts. *Nano letters (Print)* 2008; 8(12), p. 4459-4463

26. **Eberg, Espen; Monsen, Åsmund Fløystad; Tybell, Thomas; Van Helvoort, Antonius; Holmestad, Randi.** Comparison of TEM specimen preparation of perovskite thin films by tripod polishing and conventional ion milling. *Journal of Electron Microscopy* 2008; 57(6), p. 175-179

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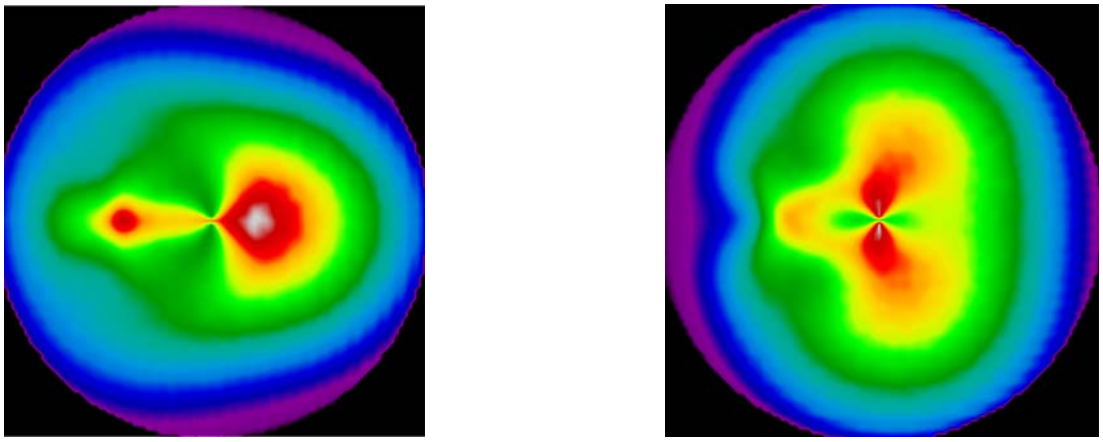

Rigorous computer simulations results for the angular distribution of the mean differential reflection coefficient for the scattering of a p−polarized plane wave into p− and s−polarized scattered waves (left and right figure) for an angle of incidence of 25 degrees (from the left) and wavelength 1 micron. The randomly rough perfectly conducting surface was characterized by a Gaussian height distribution of standard deviation 1 micron and a Gaussian correlation function of correlation length 2 microns.

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PhD student Frantz Stabo-Eeg is developing a broad-band Mueller Matrix Ellipsometer based on Fresnel rhomb prism compensators. (Foto: G. Kallestad, Info)

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Cooperation is an important part when studying physics.
(Photo: B. Bungum)

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A picture taken from one of our reading rooms.
(Foto: B. Bungum)

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47. **Kalashnikov, Valdimir L; Sorokin, Evgeni; Mandon, Julien; Picque, Nathalie; Guelachvili, Guy; Sorokina, Irina T.** Femtosecond Lasers for Intracavity Molecular Spectroscopy. Europhoton conference; Paris, 31.8-5.9.08

48. **Kildemo, Morten; Nerbø, Ingar Stian.** Spectroscopic ellipsometry of nanostructured GaSb surfaces consisting of densely packed 60-200 nm long cones. 5th International Conference on "Nanosciences & Nanotechnologies" – NN08; Thessaloniki, 14-16.7.08

49. **Kildemo, Morten; Stabo-Eeg, Frantz.** Fast polarimetric imaging using liquid crystal retarders. Norsk elektro optikk møte; Hurtigruta Tromsø-Trondheim, 26-28.3.08

50. **Klein, Dionne C.G.** High-resolution microscopy studies of immunostimulatory DNA. 3rd NanoLab User Meeting; Trondheim, 6.3.08

51. **Klein, Dionne C.G.; Øvrebø, Kirsti Marie; Latz, Eicke; Espevik, Terje; Stokke, Bjørn Torger.** Toll-like receptor 9 and its ligand CpG-DNA studied with AFM. Veeco Scandinavian Conference, Developments in Atomic Force Microscopy for advanced imaging techniques; Trondheim, 30-31.10.08

52. **Kragset, Steinar; Dahl, Eskild K.; Babaev, Egor; Sudbø, Asle.** Preemptive phase-transitions in multicomponent BECs. March Meeting of the American Physical Society; New Orleans, 10-14.3.08

53. **Kyllingstad, Lars.** Screened perturbation theory at four loops. Strong and Electroweak Matter 2008; Amsterdam, 26-29.8.08

54. **Lilledahl, Magnus Borstad; Davies, Catharina de Lange.** Multifoton mikroskopi og mekaniske egenskaper i vev. Årsmøte for NOFFOF; Oslo, 6.11.08

55. **Linder, Jacob; Sudbø, Asle.** Identifying the Odd-Frequency Superconducting State by a Field-Induced Josephson Effect. March Meeting of the American Physical Society; New Orleans, 10-14.3.08

56. **Løvseth, Jørgen.** Offshore turbulens - Erfaringer fra vindmålinger på Frøya. Vindkraft FoU Seminar - fremtiden offshore; Trondheim, 24-25.1.08

57. **Mandon, Julien; Guelachvili, Guy; Sorokina, Irina T; Sorokin, Evgeni; Kalashnikov, Valdimir L; Picque, Nathalie.** Enhancement of molecular dispersion spectral signatures in mode-locked lasers. Europhoton Conference; Paris, 31.8-5.9.08

58. **Marioara, Calin D; Andersen, Sigmund J; Stene, Tore; Hasting, Håkon Stokka; Walmsley, John C; Van Helvoort, Antonius; Holmestad, Randi.** Microstructure: The influence of Cu on Hardness and Microstructure in Al-Mg-Si alloys. ICAA 11; Aachen, 22-26.9.08

59. **Maurstad, Gjertrud; Stokke, Bjørn Torger.** Surface structure and polymer assembly modes of biopolymer multilayers involving polysaccharides. 24th International Carbohydrate Symposium; Oslo, 27.7-1.8.08

60. **Meheust, Yves; Fossum, Jon Otto; Knudsen, Kenneth Dahl; Maloy, Knut Jorgen; Helgesen, Geir.** Mesoscopic changes of a model clay soil due to the microscopic swelling of its crystallites. European Geosciences Union; Vienna, 13-18.4.08

61. **Meheust, Yves; Fossum, Jon Otto; Knudsen, Kenneth Dahl; Pamar, K.P.S; Måløy, Knut Jørgen; Helgesen, Geir.** Utilizing WAXS to characterize the orientation distribution of clay assemblies – application to electro-rheological suspensions and weakly-hydrated samples. 5th Nordic Workshop on Scattering from Soft Matter in Trondheim; 6-7.2.08

62. **Mehli, Hanne; Bungum, Berit.** Authentic learning situations for teachers - perceptions and gains from in-service courses in space technology. The 9th Nordic Research Symposium on Science Education; Rekjavik, 11-15.6.08

63. **Mumm, Florian; Sikorski, Pawel.** Fabrication of high aspect ratio Nanotubes and Nanowires using a Biopolymer Template. Nanotechnology Northern Europe 2008; Copenhagen, 23-25.9.08

64. **Nerbø, Ingar Stian; Kildemo, Morten; Leroy, Sebastien; Simonsen, Ingve; Søndergård, Elin; Holt, Liviu; Walmsley, John C.** Characterization of GaSb nanocones by spectroscopic ellipsometry. Norwegian Electro-Optics Meeting; Hurtigruta Tromsø-Trondheim, 26-28.3.08

65. **Nogueira, Flavio; Kragset, Steinar; Sudbø, Asle.** Quantum critical scaling behavior of deconfined spinons. March Meeting of the American Physical Society; New Orleans, 10-14.3.08

66. **Olaussen, Kåre.** Nord-sør, øst-vest, opp-ned. Kan det finnes flere retninger i universet? UiS Seminar i Naturvitenskap; Stavanger, 16.10.08

67. **Olaussen, Kåre.** Our Universe as an Interface? ICE-IEEC Weekly Seminar; Barcelona, 12.6.08

68. **Olaussen, Kåre.** Symmetry and Mass Degeneration in Multi-Higgs-Doublet Models. Nordita program on TeV scale physics and dark matter; Stockholm, 4.7.08

69. **Olaussen, Kåre.** The Quantum Zeno Effect, Identical particles, and the Drangfelt Effect. Symphosium on Statistical Physics in honor of Eivind Hiis Hauge's 70th Birthday; Trondheim, 15.2.08

70. **Olderøy, Magnus Østgård; Strand, Berit Løkensgard; Andreassen, Jens-Petter; Sikorski, Pawel.** Biomineralization: Nanoscale Control of Mineral Deposition Within Polysaccharide Gel Networks. Nanotech Northern Europe 2008; Copenhagen, 23-25.9.08

71. **Picque, Nathalie; Guelachvili, Guy; Sorokin, Evgeni; Sorokina, Irina T.** Frequency combs for high-resolution spectroscopy in the infrared. 17 th International Laser Phyics Workshop; Trondheim, 30.6-4.7.08

72. **Reenaas, Turid Worren.** 3rd Generation Solar Cells at NTNU. Mini conference on PV; Trondheim, 9-10.1.08

73. **Rozynek, Zbigniew; Wang, Bao-Xiang; Zhou, Min; Fossum, Jon Otto.** Dynamic Chain-formation of Na-Fluorohectorite Clay Particles: Wide Angle X-ray Scattering and Electrorheometry results. 11th conference on Electrorheological Fluids and Magnetorheological Suspensions; Dresden, 25-29-8-08

74. **Rørvik, Per Martin; Almli, Åsmund; You, Chang Chuan; Van Helvoort, Antonius; Holmestad, Randi; Tybell, Thomas; Grande, Tor; Einarsrud, Mari-Ann.** Template-free hydrothermal synthesis of PbTiO3 nanorod arrays. Electroceramics XI; Manchester, 31.8-3.9.08

75. **Rørvik, Per Martin; Amli, Åsmund; Van Helvoort, Antonius; Holmestad, Randi; Tybell, Thomas; Grande, Tor; Einarsrud, Mari-Ann.** Template-free hydrothermal synthesis of PbTiO3 nanorod arrays. 3rd Nanolab User Meeting; Trondheim, 6.3.08

76. **Saxegaard, Magne; Hanson, Maj; Brucas, Rimantas; Wahlström, Erik; Yang, De Zheng.** STM based measurements of field and current induced magnetization reversal in spin valve structures. Joint european magnetic symposia; Dublin, 14-19.9.08

77. **Scherbakov, Yu V; Sigmond, Reidar Svein.** Novel high-resolved spectrocopic studies of DC positive streamer corona. I Experimetal results. Sventeenth Internasjonal Conference on Gas Discharges; Cardiff, 7-12.9.08

78. **Seim, Thorstein; Valberg, Arne; Lee, Barry B.** Modelling neural mechanisms of colour vision. Kongsberg Vision Meeting; Kongsberg, 13.10.08

79. **Shcherbakov, Yu V; Nekhamkin, L.I; Sigmond, Reidar Svein.** Novel high-resolved spectroscopic studies of DC positive streamer corona. II. Theoretical background and analysis. Seventeenth Internasjonal Conference on Gas Discharges and Their Applications; Cardiff, 7-12.9.08

80. **Skrøvseth, Stein Olav.** Quantum Computation in Perturbed Cluster States. Foredrag ved University of Queensland; Brisbane, 8.4.08

81. **Sletmoen, Marit; Maurstad, Gjertrud; Tierney, Sven; Klein, Dionne; Mumm, Florian; Sikorski, Pawel; Stokke, Bjørn Torger.** Mesoscale structure formation of biopolymers and bionanotechnology. Biofysikermøtet 2008; Kongsvold, 27-29.2.08

82. **Sletmoen, Marit; Skjåk-Bræk, Gudmund; Næss, Stine Nalum; Stokke, Bjørn Torger.** Investigations of the structure and stability of poly(C)-scleroglucan complexes and the mode of action of alginate epimerases using single molecule and ensemble studies. XXIV International Carbohydrate Symposium; Oslo, 27.7-1.8.08

83. **Sletmoen, Marit; Takemasa, Makoto; Stokke, Bjørn Torger.** Probing Molecular Interactions Involving Polysaccharides - a Single Molecule Approach. 1st Nanotechnology@ International Symposium; Trondheim, 11-12.9.08

84. **Sorokin, Evgeni; Kalashnikov, V.L; Mandon, Julien; Guelachvili, Guy; Picque, Nathalie; Sorokina, Irina T.** Cr:YAG Chirped Pulse Oscillator. Solid-State Photonics 2008; Nara, 27-30.1.08

85. **Sorokin, Evgeni; Sorokina, Irina T; Mandon, Julien; Guelachvili, Guy; Picque, Nathalie.** Multiplex Molecular Fingerprinting with a Mid-Infrared Cr2+ :ZnSe Femtosecond Laser. Workshop on Entanglement and Quantum Decoherence; Nara, 27-310.1.08

86. **Sorokina, Evgeni; Sorokina, Irina T.** Broadband lasers revolutionize high-resolution spectroscopy in infrared. Photonics Prague 2008; Prague, 27-29.8.08

87. **Sorokina, Irina T; Sorokin, Evgeni; Guelachvili, Guy; Picque, Nathalie.** Femtosecond lasers for sensing in the infrared: taking advantage of the bandwidth. Photonics WEST LANE 2008; San Jose, 19-24.1.08

88. **Stokke, Bjørn Torger; Sletmoen, Marit; Draget, Kurt Ingar.** Application of oligoguluronates derived from alginate to influence ionotropic induced alginate gelation, kinetics and polymer organization. Polymer Networks 2008, 19th Polymer Networks Group Conference; Larnaca, 22-26.6.08

89. **Sun, Hao; Lee, Barry B; Wong, Dixon; Valberg, Arne.** Contribution of signals from magnocellular and parvocellular pathways to spatial vision. Kongsberg Vison Meeting; Kongsberg, 13.10.08

90. **Tenorio, Romulo P.; Alme, Lars Ramstad; Engelsberg, Mario; Fossum, Jon Otto; Hallwass, Fernando.** Nano-Scale Hydration of a Model Clay: NMR Studies. Materials Research Society 2008 MRS Fall Meeting; boston, 13.12.08

91. **Tierney, Sven; Hjelme, DR; Stokke, Bjørn Torger.** Glucose responsive hydrogels measured by a novel optical technique. Polymer Networks 2008, 19th Polymer Networks Group Conference; Larnaca, 22-26.6.08

92. **Tucho, Wakshum Mekonnen; Venvik, Hilde Johnsen; Walmsley, John C; Bredesen, Rune; Holmestad, Randi.** Permeation and microstructure studies of Pd-Ag membranes for H2 separation. 3rd Nanolab User Meeting; Trondheim, 6.3.08

93. **Valberg, Arne; Seim, Thorstein.** Neural correlates of lightness, brightness and colour. Kongsberg Vision Meeting; Kongsberg, 13.10.08

94. **Van Helvoort, Antonius; Holmestad, Randi; Sæterli, Ragnhild; Jacobsen, Arnhild.** Hand-on TEM for short time student projects? SCANDEM conference; Copenhagen, 2-4.6.08

95. **Van Helvoort, Antonius; Holmestad, Randi; Walmsley, John C.** Transmission Electron Microscopy: now and in the very near future, an invitation to enter a new field of physics. 3rd Nanolab User Meeting; Trondheim, 6.3.08

96. **Vissers, Rene; Marioara, Calin D; Andersen, Sigmund J; Holmestad, Randi.** Process, Mechanical and Heat Treatment Modelling: Crystal Structure determination of the B' phase in Al-Mg-Si Alloys by combining Quantitative Electron diffraction and ab initio Calculations. ICAA 11; Aachen, 22-26.9.08

97. **Walle, Lars Erik; Plogmaker, Stefan; Borg, Anne; Sandell, Anders.** Growth of Au on Single Crystalline Anatase TiO2(101) and (001): Probing Under-Coordinated Sites with Core Level Photoelectron Spectroscopy. American Vacuum Society 2008; Boston, 19-25.10.08

98. **Wang, Bao-Xiang; Zhou, Min; Rozynek, Zbigniew; Fossum, Jon Otto.** Guided Self-assembly of Nanostructured Titanium Oxide. Materials Research Society 2008 MRS Fall Meeting; Boston, 1-5-12.08

99. **Wang, Bao-Xiang; Zhou, Min; Rozynek, Zbigniew; Fossum, Jon Otto.** Guided Selfassembly of Titanium Oxide Nanowires and Nanorods. Nanotech 2008; Boston, 1.6.08

100. **Zhou, Hailong; Dasa, Lakshmi Narayana; Hoang, Thang Ba; Anthonysamy, Fervin Moses; Fimland, Bjørn-Ove; Weman, Helge; Van Helvoort, Antonius; Liu, L.; Harmand, J.C.** Growth, structural and optical characterizations of GaAs/AlGaAs core-shell nanowires. 3rd Int. Workshop on Nanowire Growth Mechanisms; Duisburg, 15-16.9.08

Scientific Posters

1. **Alme, Lars Ramstad; Fossum, Jon Otto; Meheust, Yves.** Transport of water in weakly-hydrated model clay soil. General Assembly 2008; Vienna, 13.4.08

2. **Chábera, Pavel; Naqvi, Kalbe Razi; Melø, Thor Bernt; Sliwka, Hans-Richard; Partali, Vassilia; Lockwood, Samuel F.; Nodolski, Geoff; Polivka, Tomas.** Excited-state propoerties of hydrophilic carotenoids. ESF Workshop "Novel Methods in Exploring Carotenoid Excited State Dynamics"; Nove Hrady, 21-25.9.08

3. **Dasa, Lakshmi Narayana; Patriarche, G.; Zhou, Hailong; Anthonysamy, Fervin Moses; Hoang, Thang Ba; Van Helvoort, Antonius; Harmand, J.C.; Fimland, Bjørn-Ove; Weman, Helge.** Growth and characterization of heterostructured III-V nanowires by molecular beam epitaxy. 1st Int. Nanosympo-sium@NTNU; Trondheim, 11-12.09.08

4. **Dasa, Lakshmi Narayana; Zhou, Hailong; Van Helvoort, Antonius; Fimland, Bjørn-Ove; Weman, Helge; Patriarche, G.; Harmand, J.C.** A novel effect of Sb on the crystalline structure of GaAs nanowires grown by MBE. 3rd Int. Workshop on Nanowire Growth Mechanisms; Duisburg, 15-16-9-08

5. **Eberg, Espen; Van Helvoort, Antonius; Soleim, Bjørn Gunnar; Monsen, Åsmund Fløystad; Tybell, Thomas; Holmestad, Randi.** Comparison of TEM specimen preparation of perovskite thin films by conventional Ar ion milling and tripod polishing. European Microscopy Society Meeting; Aachen, 1-5.9.08

6. **Eberg, Espen; Van Helvoort, Antonius; Soleim, Bjørn Gunnar; Monsen, Åsmund Fløystad; Wennberg, Lena C; Tybell, Thomas; Holmestad, Randi.** TEM specimen preparation of perovskite thin films. 1st Nanotechnology@NTNU International Symposium; Trondheim, 11-12.09.08

7. **Falnes, Johannes.** Havbølgjer kan gi oss varig alternativ energi. Forskingstorget, Forskingsdagane 2008; Trondheim, 26-27.9.08

8. **Helander, Linda; Gederaas, Odrun Arna; Hjelde, Astrid; Johnsson, Anders; Krokan, Hans Einar; Melø, Thor Bernt; Sæterbø, Kristin Grendstad.** Effects of hexyl 5-aminolevulinate and light in rat bladder cancer cells. 7th International Symposium on Photodynamic Therapy and Photodiagnosis in Clinical Practice, Brixen/Bressanone, Italia; 7-11.10.08

9. **Hemmen, H; Ringdal, Nils I; Azevedo, Eduardo N.; Hansen, Elisabeth L; Meheust, Yves; Fossum, Jon Otto; Engelsberg, Mario; Knudsen, Kenneth Dahl.** The Isotropic-Nematic Interface in Suspensions of Na-Fluorohectorite Synthetic Clay. Research Society 2008 MRS Fall Meeting; Boston, 1-5.12.08

10. **Klein, Dionne C.G.; Øvrebø, Kirsti Marie; Latz, Eicke; Espevik, Terje; Stokke, Bjørn Torger.** Toll-like receptor 9 and its ligand CpG-DNA studied with atomic force microscopy. Normic National User Meeting; Trondheim, 11-12.11.08

11. **Kobayashi, Takahiro; Zako, Tamotsu; Sakano, Masafumi; Lindgren, Mikael; Nilsson, K. Peter R.; Hammarström, Per; Maeda, Mizuo.** Structural Properties and Cytotoxicity of Novel Insulin 'Noodle'-like Filaments. Forty-sixth Annual Meeting of the Biophysical Society of Japan; Fukuoka, 3-5.12.08

12. **Li, He; Willibald, Julian; Rennebaum, Sandra; Melø, Thor Bernt; Ernst, Hansgeorge; Naqvi, Kalbe Razi; Partali, Vassilia; Sliwka, Hans-Richard.** Oxidation and antioxidation of carotenoids-Reaction and products. 15th Intenational symposium on carotenoids; Okinawa, 22-27.6.08

13. **Lindgren, Mikael; Zako, Tamotsu; Maeda, Mizuo; Hammarström, Per; Nilsson, K. Peter R.** Detection and diagnostics of amyloidic proteins using luminescent conjugated polymers. The 31st Annual Meeting of the Molecular Biology Society of Japan and the 81st Annual Meeting of the Japanese Biochemical Society; Kobe, 9-12.12.08

14. **Mehli, Hanne.** Blås bilen i gang!. Forsknings-torget, Forskningsdagene; Trondheim, 26-27.9.08

15. **Mo, Frode; Chernyshov, Dmitry; Thoresen, Lasse S.; Breiby, Dag Werner; Tybell, Thomas.** X-ray study of the impact of a weak electric field on the domain structure in PbTiO3 thin films. 1st Nano-technology Symposium; Trondheim, 11-12.09.08

16. **Nerbø, Ingar Stian; Kildemo, Morten.** Characterisation of tilted nanocones by ellipsometry. 1st European School on Ellipsometry; Ostuni, 21-26.9.08

17. **Nordmark, Heidi; Holmestad, Randi; Walmsley, John C; Di Sabatino, Marisa; Øvrelid, Eivind.** TEM studies of grain boundaries and precipitation in multicrystalline silicon. SCANDEM conference; Copenhagen, 2-4.6.08

18. **Olderøy, Magnus Østgård; Strand, Berit Løkensgard; Andreassen, Jens-Petter; Sikorski, Pawel.** Alginate Gel Beads as Model System for Biomineralization. Nanotechnolog NTNU 2008; Trondheim, 11-12.09.08

19. **Olderøy, Magnus Østgård; Strand, Berit Løkensgard; Andreassen, Jens-Petter; Sikorski, Pawel.** Nanoscale Control of Mineral Deposition Within Polysaccharide Gel Networks. Biofysikkmøtet Kongsvold 2008; 27-29.2.08

20. **Rozynek, Zbigniew; Wang, Bao-Xiang; Fossum, Jon Otto.** Wide Angel Scattering Studies of Dynamic Chain Formation in Na-FLHC. 5th Nordic Workshop on Scattering from Soft Matter; Trondheim, 6-7.2.08

21. **Rørvik, Per Martin; Almli, Åsmund; Van Helvoort, Antonius; Holmestad, Randi; Tybell, Thomas; Grande, Tor; Einarsrud, Mari-Ann.** Hydrothermal synthesis of PbTiO3 nanorod arrays. 1st Nanotechnology@NTNU International Symposium; Trondheim, 11-12.09.08

22. **Rørvik, Per Martin; Almli, Åsmund; Van Helvoort, Antonius; Holmestad, Randi; Tybell, Thomas; Grande, Tor; Einarsrud, Mari-Ann.** Hydrothermal synthesis of PbTiO3 nanorod arrays. Zing Conference on Solid State Chemistry; Cancun, 10-13.3.08

23. **Samuelsen, Emil J; Breiby, Dag Werner; Andreasen, Jens W.; Levon, Kalle.** Self-organisation of semi-conducting conjugated polymers. Nanotechnology at NTNU; Trondheim, 11-12.09.08

24. **Samuelsen, Emil J; Breiby, Dag Werner; Andreasen, Jens Wenzel; Levon, Kalle.** Self-Organi-sation of Semi-Conducting Conjugated Polymers in Thin Layers and in Bulk. European Physical Society Condensed Matter 22nd Conference; Roma, 25-29.8.08

25. **Skrøvseth, Stein Olav; Bartlett, Stephen D.** Quantum Phase Transistions in Cluster Chains. Gordon Research Conferences, Quantum Information Science; Montana, 31.8-5.9.08

26. **Stovner, Lars Jacob; Straume, Aksel; Oftedal, Gunnhild; Johnsson, Anders.** Nocebo asa headache trigger: Evidence from a double-blind, sham-controlled provocation study with RF fields. European Headache and Migraine Trust Conference; London, 4-7.9.08

27. **Strandberg, Rune; Reenaas, Turid Worren.** Investigation of an alternative intermediate band solar cell design. 23rd European Photovoltaic Solar Energy Conference; Valencia, 1-5.9.08

28. **Strandberg, Rune; Reenaas, Turid Worren.** Modelling of the Electron Concentration in an Intermediate Band. 33rd IEEE Photovoltaic Specialists Conference; San Diego, 11-16.5.08

29. **Sæterli, Ragnhild; Wang, Guozhong; Van Helvoort, Antonius; Rørvik, Per Martin; Einarsrud, Mari-Ann; Grande, Tor; Holmestad, Randi.** TEM characterisation of lead titanate nanorods. 1st Nanotechnology@NTNU International Symposium; Trondheim, 11-12.09.08

30. **Torsæter, Malin; Vissers, Rene; Marioara, Calin D; Andersen, Sigmund J; Holmestad, Randi.** Simulation and Modelling: Crystal Structure Determination of the Q' and C-type Plate Precipitates in Al-Mg-Si-Cu (6xxx) Alloys. ICAA 11; Aachen, 22-26.9.08

31. **Walle, Lars Erik; Plogmaker, Stefan; Borg, Anne; Sandell, Anders.** Growth of Au on Single Crystalline Anatase TiO2 (101) and (001): Probing Under-Coordinated Sites with Core Level Photoelectron Spectroscopy. MAX-lab Summer School 2008; Lund, 26.5-2.6.08

32. **Wang, Bao-Xiang; Rozynek, Zbigniew; Zhou, Min; Fossum, Jon Otto.** Wide Angel Scattering Study of Organic Modified Fluorohectorite Electrorheological Suspensions. 5th Nordic Workshop on Scattering from Soft Matter at NTNU in Trondheim; 6-7.02.08

33. **Zhou, Min; Wang, Bao-Xiang; Rozynek, Zbigniew; Fossum, Jon Otto.** Self-assembly of Silver Oxide Nanoparticles to Micro-spindles, Micro-ricesandMicro-dendrites. Materials Research Society (MRS) International Materials Research Conferences; Chongqing, 9-12.6.08

34. **Øpstad, Christer Lorentz; Partali, Vassilia; Sliwka, Hans-Richard; Melø, Thor Bernt.** Easy synthesis of stable anionic carotenoid radicals. 15th International symposium on carotenoids; Okinawa, 22-27.6.08

Popular Scientific Talks

1. **Andersen, Jens Oluf.** Big Bang og universets utvikling. Trondheim Astronomiske forening; Trondheim, 26.3.08

2. **Andersen, Jens Oluf.** Svarte hol. Eksotiske objekt i verdsrommet. Etterutdanningskurs for lærarar i VGS (Verdensrommet); Trondheim, 21.10.08

3. **Bungum, Berit.** Kreative kriser og salige sammenbrudd: Erfaringer med å hanskes med teori, metode og empiri i et avhandlingsarbeid. Nasjonal forskerskole i realfagsdidaktikk, høstsamling; Hadeland, 3-5.11.08

4. **Bungum, Berit.** Kreativitet i oppfinnelser og vitenskap. Videreutdanningskurs: Teknologi og entreprenørskap II; Trondheim, 6.3.08

5. **Bungum, Berit.** Læreplanen i Teknologi og forskningslære. Bakgrunn, intensjoner og innhold. Nytt fag i den videregående skolen. Seminar om Teknologi og Forskningslære; Trondheim, 4.3.08

6. **Falnes, Johannes.** Havbølgjeenergi: Status og framtidsveg. Lunsjkollokvium i fornyeleg energi; Trondheim, 29.10.08

7. **Falnes, Johannes.** Havbølgjer: Elektromagnetisk energi på avvege. Elektroteknisk Landsmøte 2008; Bergen, 22-23.9.08

8. **Falnes, Johannes.** Havbølgjer mot energigalskap. Åpent møte Trondhjems Polytekniske Forening; Trondheim, 30.1.08

9. **Hunderi, Ola.** Nanoteknologi. Møte i Gløshaugen akademiske klubb; Trondheim, 2.10.08

10. **Leganger, Lars Erlend.** Kvantefysikk for ikke-fysikere (med sleivspark til kvantemedisin). Pop.vit. foredrag i regi av Studentenes Skeptikerlag ved NTNU ; Trondheim, 28.2.08

11. **Lindmo, Tore.** Fysiske prinsipper for medisinsk avbildning. Fagdag i fysikk; Trondheim, 30.10.08

12. **Mo, Frode.** The Swiss-Norwegian Beamlines - multifunctional beamlines for complex in-situ XRD and XAS experiments. Fagdag om nanovitenskap og -teknologi ved Inst. for fysikk; Trondheim, 27.11.08

13. **Strandberg, Rune.** Intermediate Band Solar Cells. SFFE-seminar; 10.12.08

PHYSICS PRESENTATION THROUGH MEDIA

1. **Breiby, Dag Werner.** Schrödingers Katt (NRK-TV), Teknomagasinet. 03.04.08

2. **Fossheim, Kristian.** Kor viktig er matematikk i skulen? Firda 2008

3. **Fossheim, Kristian.** Matematikk som stormakts-instrument. Kronikk i Adresseavisen 05.05.08

4. **Fossheim, Kristian.** Universalgeniet Johan Daniel Berlin. Kronikk i Adresseavisen 31.07.08

5. **Iversen, Tor-Henning; Beisvaag, Tor; Johnsson, Anders.** Første frø dyrket i verdensrommet. Universitetsavisa 31.03.08

6. **Lindgren, Mikael; Tunstad, Hege J.** Detektiv med laser - et molekyl jakter på Alzheimers. Gemini: Nr. 3 September 2008

7. **Olaussen, Kåre.** CERN-prosjekt sluker ikke jorda. TV-Adressa 10.09.08

8. **Reenaas, Turid Worren; Krüger, Sverre.** Skal fange energien i varmen fra sola - Ny teknologi skal gjøre solcellene mer effektive. NRK 1 31.01.08

9. **Sikorski, Pawel.** Fremtiden er mikroskopisk. Oslo (Newspaper) 08.11.08

10. **Tanem, Bjørn Steiner; van Helvoort, Antonius.**
Schrödingers katt (NRK-TV), "Tre blir råstoff for ny satsing på nanoteknologi". 17.04.08

Student studying fluid transport in clays using X-rays in the Laboratory for Soft and Complex Matter Studies.
(Foto: G. Kallestad, NTNU Info)

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* Frankfurt University, FIAS, Germany (Hiro Abuki, Dirk Rischke, and Harmen Warringa)

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* Department of Synchrotron Radiation Physics, Lund University, Sweden (prof. J. N. Andersen and docent E. Lundgren)

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* University of Konstance, Department of Physics (Wolfgang Belzig) (Tyskland)

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* Swiss Light Source, Paul Scherrer Institute, Switzerland (Dr. O. Bunk)
* Physik Department, Technical University of Munich, Germany (Prof. C. Papadakis)
* Max Planck Institut für Polymerforschung, Mainz, Germany (Prof. K. Müllen, Dr. W. Pisula, Dr. D. Andrienko)
* TU Eindhoven, Netherlands (R.A.J. Janssen)

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* Göteborgs Universitet, Institutionen för pedagogik och didaktik, Sweden (Dr. Anita Wallin)
* Univers

Espy, P.:
* The British Antarctic Survey, Physical Sciences Division (Mark Clilverd), Cambridge, UK.
* The Max Planck Institute for Solar System Research, Department of Planets and Comets (Paul Hartogy), Katlenburg-Lindau, Germany.

Fossum, J.O.:
* Universite Paris 7,Paris, France, (Prof. Paul Dommersnes)
* Ecole Normal Superieure, Paris, France (Prof. Daniel Bonn)
University of Amsterdam, Netherlands (Prof. Daniel Bonn)
*Universite de Rennes 1: Geosciences Rennes, France (Professor Yves Meheust)
*Maxlab Lund University, Sweden (Dr. Tomas Plivelic)

Hansen, A.
* Universite de Nice-Sophia Antipolis, France (Batrouni)
* Université Louis Pasteur, Strasbourg, France (Schmittbuhl)
*Université de Rennes I, Rennes, France (Bideau, Davy)
*Ecole Normale Supérieure, Cachan, France (Hild, Roux)
*ETH, Zürich, Switzerland (Herrmann)
*SAHA Institute for Nuclear Physics, Kolkata, India (Chakrabarti).
*Institute for Mathematical Sciences, Chennai, India (Ray).
*Universidade Federal do Céara, Fortaleza, Brazil (Andrade).

van Helvoort, A.T.J.
* CNRS-LPN, Marcoussis, France (G. Patriarche)

Holmestad, R.:
* TU Delft, Netherlands (H. Zandbergen, J. Janssen)
* Rouen University/CNRS, France (F Danoix, W Lefebvre)
*University of Milano Bicocca, Italy (S. Binetti)

Hunderi, O.:
* TU-Berlin (Prof. Wolfgang Richter) Surface Optics
* University of Nijmegen (Prof. Theo Rasing) Magnetooptics
* University of Liverpool (Prof. Peter Weightman) Surface Optics

Høye, J.S.:
* Instituto de Quimica Fisica Rocasolano, CSIC, c/Serrano 119, 28006 Madrid, Spain (Enrique Lomba)

Johnsson, A.:
* Department of Radiation Physics, Umeå University (K. Hansson Mild, J. Wilén), Biophysics.
* Institut für Biologie, Tübringen (W. Engelmann, Biophysics

Kachelriess, M.:
* APC (Laboratoire AstroParticule et Cosmologie), Paris, France (D. Semikoz)
* Institute for Nuclear Research, Moscow, Russia (V. Berezinsky, D. Semikoz)
* Laboratori Nazionali del Gran Sasso, Assergi, Italy (V. Berezinsky)
* MPI für Astrophysik, Garching, Germany (K. Dolag) * University Hamburg, Germany (R. Tomas)
* University of Aarhus, Denmark (A.Cuoco, S.Hannestad, T.Haugbolle)

Kildemo, M :
* Ecole Polytechnique (Paris), A. De Martino, Polarimetry
* E. Søndergård, UMR 125 Unité mixte CNRS/Saint-Gobain
Laboratoire Surface du Verre et Interfaces, France, nanostructured surfaces
* CERN (Geneva), S. Calatroni, CLIC
* Dr. Christoph Cobet, VUV – synchrotron ellipsometry, ISAS - Institute for Analytical Sciences Department Berlin Albert-Einstein-Str. 9, 12489 Berlin, Germany

Kjeldstad, B:
* University of Hannover, Germany (UV radiation)

Lindgren, M.:
* Linköpings Universitet, IFM (Per Hammarström, Peter Nilsson)
* Kungliga Tekniska Høgskolan, Polymer Technology, Stockholm (Eva Malmström)
* Umeå Universitet, Organisk kemi, Umeå (B. Eliasson)
* Totalförsvarets forskningsinstitut, Linkøping (Ove Steinvall)
* Université Claude Bernard (Lyon1), Laboratoire des Multimatériaux et Interfaces (Stephane Parola)

Mathiesen, R.:
* University Paul Cezanne - Aix Marseille III, L2MP, France (H.N. Thi, B. Billia)
* Catholic University Leuven, Belgium (L. Froyen)
* Techn University Berlin, Germany (F. Garcia-Moreno, J. Banhart)
* DLR - German Aerospace Center, Germany (L. Ratke, M. Kolbe, A. Griesche)
* ACCESS e.V. Aachen, Germany, (G. Zimmermann, L. Sturtz)
* University College Dublin, Ireland (D. Browne)
* Brunel University, London (L. Granasy)
* KTH, Sweden (J. Ågren)
* Technical University Clausthal, Germany (B. Ton)
* University Loeben, Austria, (A. Ludwig)
* Technical University Dresden, Germany (C. Schroer)

Melø, T.B., Naqvi, K. R.:
* Biological Research Center, Hungarian Academy of Sciences, Szeged, Hungary (G. Garab, T. Jávorfi, E. Hideg)
* ITQB, Universidade Nova de Lisboa, Oeiras, Portugal (E. Melo)
* Instituto de Recursos Naturales y Agrobiología, CSIC, Salamanca, Spain (J.B. Arellano)
* Department of Physiology of Microorganisms, Moscow State University, Moscow, Russia (M.N. Merzlyak)
* Czech Academy of Sciences, Czech Republic (T. Polívka)

Olaussen, K.:
* Max-Planck-Institute für Metallforschung, Stuttgart (Anna Maciolek)
* IEEC/CSIC, Campus UAB, Barcelona (Sergei Odintsov)
* NORDITA, Stockholm

Reenaas, T.W.:
* Chalmers University of Technology (Mahdad Sadeghi and Shumin Wang) Department of Microtechnology and Nanoscience
* Linköping University (Per-Olof Holtz) Materials Science

Samuelsen, E.J.:
AGH-University of Science and Technology, Krakow, Poland (W. Luzny), Solid State Physics

Sikorski, P.:
* Department of Biochemistry, School of Life Sciences, University of Sussex, UK
(Dr. L.C. Serpell). Biophysics

Skagerstam, B.S.;
* AXSESS, Molde (P.K. Rekdal)
* Chalmers Tekniska Högskola , Gøteborg, Sverige (G. Johansson, G. Wendin, V. Shumeiko)
* NORDITA and Stockholm University, Stockholm (I. Bengtsson)

Stokke, B. T.:
* La Sapienza University, Roma, Italia (M. Dentini), Biophysics
* Munchen Techn. Univ., Tyskland (A. Bausch, E. Sackmann), Biophysics
* Univ. Joseph Fourier, Grenoble, Frankrike (E. Geissler), Biophysics

Sudbø, A.:
* Universita di Catania, Italia (prof. Giuseppe Angilella)
* Freie Universitaet Berlin (dr. Flavio S. Nogueira)
* Kunglega Tekniska Høgskolan (prof. Mats Wallin)

Valberg, A.:
* Tambartun Centre for the Visually Impaired, Melhus (Per Fosse)
* University of Oslo, Art Conservation Study (Tine Frøysaker).

Wahlström, E.:
* Chalmers tekniska högskola (Maj Hanson, Janusz Kanski) Teknisk fysik.
* Lund University (Janusz Sadowski)
* University of Aarhus (Philip Hoffman)

Walmsley, J.:
* Cambridge University, Cambridge, UK (P. Midgley)

AMERICA

Andersen, J.O.:
* Gettysburg College, Gettysburg, PA, USA (Michael Strickland)

Brataas, A.:
* UCLA, Department of Physics (Yaroslav Tserkovnyak) (USA)
* New York University, Department of Physics (Andy Kent) (USA)

Davies, C.:
* Harvard Medical School Boston, USA (R.K. Jain Y. Boucher)

Espy, P.:
*Hampton University, Center for Atmospheric Sciences (James M. Russell III), Virginia, USA.

Fossum, J.O.:
* Universidade Federal de Pernambuco, UFPE, Recife, Brazil (Prof. Mario Engelsberg and Prof. Ricardo Souza)
* LNLS, Campinas, Brazil (Dr. Roosevelt Droppa)
* University of Brasilia, UnB, Brasilia, Brazil (Prof. Geraldo Jose da Silva and Prof. Kleber Mundim)
*Universidade Federal de Campina Grande, UFCG-PB Brazil (Prof. Suedina Silva)

Hansen, A.:
* Univesitade Federal do Ceara, Fortaleza, Brazil (Soares)

Holmestad, R.
* University of Illinois, Urbana-Champaign, USA (JM. Zuo)
* Arizona State University, USA (J. Spence)
* McMaster University, Ontario, Canada (G. Botton)

Høye, J.S.:
* Stony Brook University, New York, USA. (G. Stell), Theoretical Physics
* Oklahoma University, Norman, Oklahoma, USA (K. A. Milton), Theoretical Physics

Kachelriess, M.:
* Fermi National Accelerator Laboratory, Batavia, USA (P. Serpico)

Lindmo, T.:
* Beckman Laser Institute, University of California, Irvine (B. Tromberg, J. S. Nelson, Z. Chen), Biomedical optics

Matheisen, R.:
* U Iowa, USA, (C. Beckermann)

Skagerstam, B.S.:
* University of Florida, USA (J.R. Klauder)
* Syracuse University, N.Y., USA (A.P. Balachandran).

Støvneng, J.A.:
* California Institute of Technology, USA (A. C. T. van Duin)

Sudbø, A.:
* University of California, Riverside (prof. C.M. Varma)
* Johns Hopkins University (prof. Z. B. Tesanovic)
* University of Toronto (prof. John Wei)

Valberg, A.:
* State University of New York (SUNY) and Max Planck Institute of Biophysical Chemistry, Göttingen (Barry B.Lee)

ASIA

Fossum, J.O.:
*Gwangju Institute of Science and Technology, South Korea (Prof. Do Young Noh)
* Pohang Accelerator Laboratory, South Korea (Prof. Do Young Noh)
*Postech Pohang, South Korea (Dr. Kanak Parmar)
*Xuzhou Noral University, China (Prof. Zhou Min)

Hansen, A.:
* Institute of Mathematical Sciences, Chennai, India (Ray)
* Saha Institute of Nuclear Physics, Kolkata, India (Chakrabarti)

Holmestad, R.
* Toyoma University, Graduate school of Science and Engineering, Japan (K Matsuda)
*Tokyo National College of Technology, Tokyo, Japan (Hiroshi Nagayoshi)

Johnsson, A.:
* J. Nehru Centre for Advanced Scientific Research, Bangalore, India (V. Sharma, S. Visu), Biophysics
* Department of Developmental Biology and Neurosciences, Tohoku University, Sendai (K. Nishitani, T. Hoson), Biophysics

Kjeldstad, B.:
* Tribhuvan University, Kathmandu, Nepal (Sapkota, B. , Bhattarai,B)
* Lhasa University, Tibet, China. (Gelsor,N.)

Lindgren, M.:
* Department of Applied Physics, Faculty of Engineering, Osaka University, Japan
* Riken Institute, Wako, Saitama, Japan

Naqvi, K.R.:
* The Aga Khan University, Karachi, Pakistan (C. W. Vellani)
* Yarmouk University, Irbd, Jordan (Y.A. Yousef)
* Department of Chemistry, Kyoto University, Japan (A. Osuka)
* People's University of China, Beijing (J.-P-Zhang)
* Institute of Botany, Chinese Academy of Sciences (C. Yang)

Sikorski, P.:
* Department of Biomaterials Sciences, Graduate School of Agricultural and Life Sciences,The University of Tokyo, Japan. (Dr. M. Wada). Biophysics.

Stokke, B.T.:
* Osaka Prefecture Univ., Osaka, Japan (S. Kitamura), Biophysics
* Institute of Biomaterials and Bioengineering, Tokyo Medical and Dental University, Tokyo, Japan (K. Akiyoshi) Biophysics

Sudbø, A:
*Department of Applied Physics, Nagoya University, Japan.

Wahlström, E:
* Department of physics, Fudan University Shanghai (Shiming Zhou) China.

AUSTRALIA

Davies, C.:
* Cancer Biology Laboratory, Peter Mac Callum Cancer Centre, Melbourne (Robin Anderson)

National cooperation

* Naturfagsenteret (Nasjonalt senter for naturfag i opplæringen)
* NAROM (Nasjonalt senter for romrelatert opplæring)
* University of Oslo, Physics Education Research Group
*Hydro Aluminium Research Centre, Sunndalsøra (Jostein Røyset, Oddvin Reiso)
* Department of Chemistry, Biotechnology and Food Science, Norwegian University of Life Sciences, Ås, Norway (Prof. V.G.H. Eijsink)
* Institute for energy technology, Kjeller, Norway (senior scientists Arne Skjeltorp, Geir Helgesen, Kenneth D. Knudsen, Bjørn Hauback, Mark Pitt)
* Photocure ASA, Oslo
* Division of Biophysics and Medical Technology, Radium Hospital, Oslo (Ø. Bruland, A. Skretting, D.R. Olsen)
* Statoil Research Centre, Trondheim (F. Antonsen, H. Widerøe, Erling Rytter)
* University of Oslo (J.M. Leinaas, A. Dahlback, E.G. Flekkøy, K.J. Måløy, Johan Taftø, Øystein Prytz, H. Fjellvåg, O. Nilsen, Måløy)
* University of Bergen (J.Stamnes, P. Osland)
* Optomed (R.Ellingsen, D.R. Hjelme, B. Falch)
* FMC Biopolymers (E. Onsøyen)
* Norwegian Radiation Protection Authority (Bjørn Johnsen, Terje Christensen)
* Tambartun National Resource Center for the Visually Handicapped, Melhus (P. Fosse)
* Centre for Viking and Medieval Studies, University of Oslo
* Høgskolen I Finnmark (D. A. Lysne)
*Numerical Rocks AS, Trondheim (Øren)
* Høgskolen I Sør-Trøndelag, HiST (E. Munkeby)
* Vestfold University College (K.E. Aasmundtveit)
* The Norwegian Polar Institute, (Kim Holmén), Tromsø Norway.
* Department of Oncology, St.Olav's Hospital (T. Strickert, J. Frengen)
* Høgskolen i Sør-Trøndelag, HIST (G. Oftedal, S. Ramstad)
* SINTEF (C. Marioara, S. Andersen, B.S. Tanem, R. Fagerberg)
* Institute of Neuroscience, St. Olav Hospital Norsk Lysteknisk komité
* Trondheim Science Centre
* SINTEF Energiforskning
* SINTEF Materials and Chemistry (R. Bredesen)
* Sør-Trøndelag University College, Faculty of Technology (T.M. Thorseth)
* Sør-Trøndelag University College, Faculty of Teacher Education (E. Munkebye, K. Feren, J. Cyvin)
* Finnmark University College (D.A.Lysne, B.T. Esjeholm)
* Paper and Fiber Research Institute-PFI (G.Chinga)

EDUCATION

SUBJECTS AND STUDENT ATTENDANCE

Some subjects were self-study courses in 2008

Subjects		*Student Attendance*
M.Sc. Technology 1st and 2nd year.		
TFY4102	Physics for Product Design Engineering, Marine Technology, Earth Sciences and Petroleum Engineering (incl. lab)	183
TFY4106	Physics for Civil and Transport Engineering, Industrial Economics and Technology Management, Product Design and Manufacturing	296
TFY4115	Physics for Electronics Engineering, Engineering Cybernetics (incl. lab)	123
TFY4120	Physics for Chemical Engineering and Biotechnology, Materials Science and Engineering (incl. lab)	75
TFY4125	Physics for Computer Science, Communication Technology	156
TFY4145	Mechanical Physics (incl. lab)	122
TFY4155	Electromagnetism (incl. lab)	127
TFY4160	Wave Physics (incl. lab)	126
TFY4165	Thermal Physics (incl. lab)	83
TFY4180	Physics for Energy and Environment (incl. lab)	112
TFY4215	Chemical Physics and Quantum Mechanics	73
TFY4330	Nano Tools	26
TFY4335	Nano Life Science	25
M.Sc. Technology 3rd year.		
TFY4170	Physics 2 for Electronics Engineering	62
TFY4185	Measurement Techniques (incl. lab)	86
TFY4190	Instrumentation (incl. lab)	40
TFY4195	Optics (incl. lab)	50
TFY4205	Quantum Mechanics	55
TFY4230	Statistical Physics	59
TFY4240	Electromagnetic Theory	54
TFY4250	Atomic and Molecular Physics	37
TFY4260	Cell Biology and Cellular Biophysics (incl. lab)	22
M.Sc. Technology 4th year.		
TFY4200	Optics, Advanced Course (incl. lab)	5
TFY4210	Applied Quantum Mechanics	13
TFY4220	Solid State Physics (incl. lab)	39
TFY4225	Nuclear and Radiation Physics (incl. lab)	32
TFY4235	Computational Physics	35
TFY4245	Solid State Physics, Advanced Course	15
TFY4255	Materials Physics (incl. lab)	11
TFY4275	Classical Transport Theory	4
TFY4280	Signal Processing (incl. lab)	11
TFY4292	Quantum Optics	17
TFY4300	Energy and Environmental Physics	42
TFY4305	Non-linear Dynamics	9
TFY4310	Molecular Biophysics (incl. lab)	6
TFY4315	Biophysics (special)	7
TFY4320	Medical Physics (incl. lab)	7
TFY485x	Experts in Team, Interdisciplinary Project	43

M.Sc. Technology 5th year.

TFY4265	Biophysical Micromethods (incl. lab)	5
TFY4500	Biophysics, Specialization Project	7
TFY4505	Biophysics, Specialization Course	7
TFY4510	Physics, Specialization Project	27
TFY4515	Physics, Specialization Course	14
TFY4900	Physics, Master's Thesis	54

B.Sc.

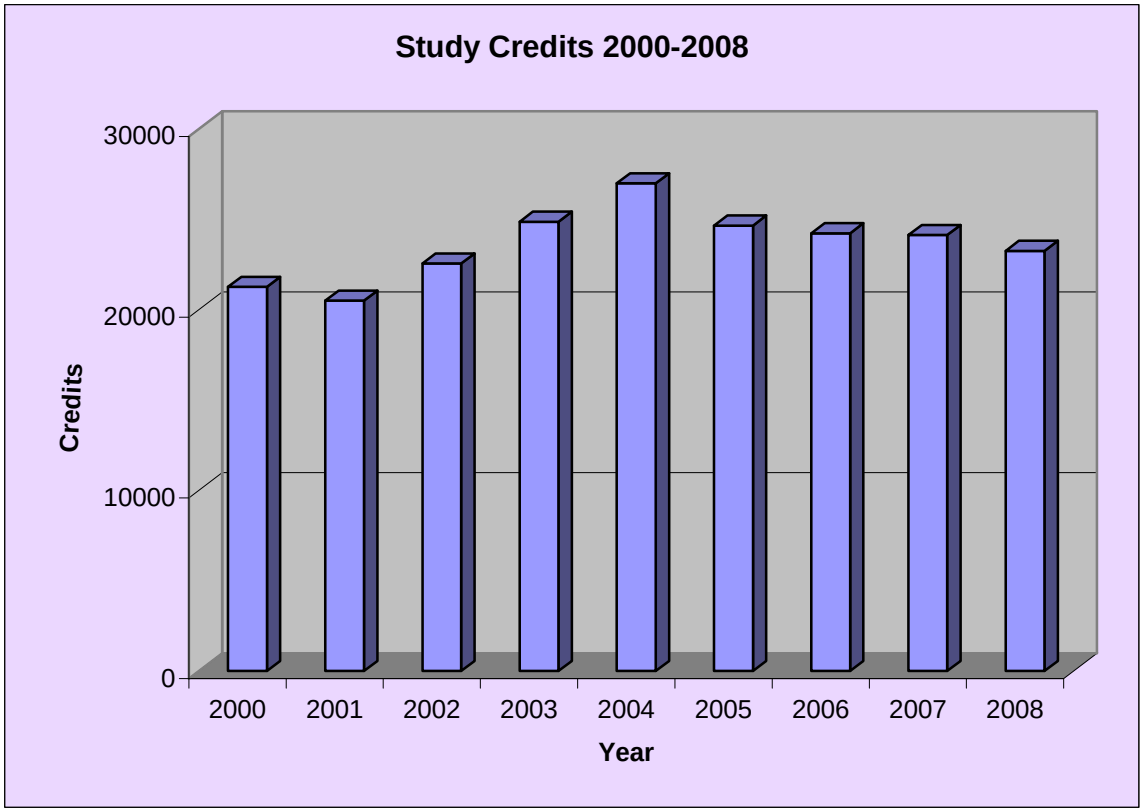
FY0001	Service Course in Physics (incl. lab)	32
FY1001	Mechanical Physics (incl. lab)	47
FY1002	Wave Physics (incl. lab)	16
FY1003	Electricity and Magnetism (incl. lab)	26
FY1004	Introduction to Quantum Physics (incl. lab)	23
FY1005	Thermal Physics (incl. lab)	24
FY2045	Quantum Physics	14
FY2302	Biophysics (incl. lab)	5
FY2450	Astrophysics	19
FY3020	Space Technology I	37

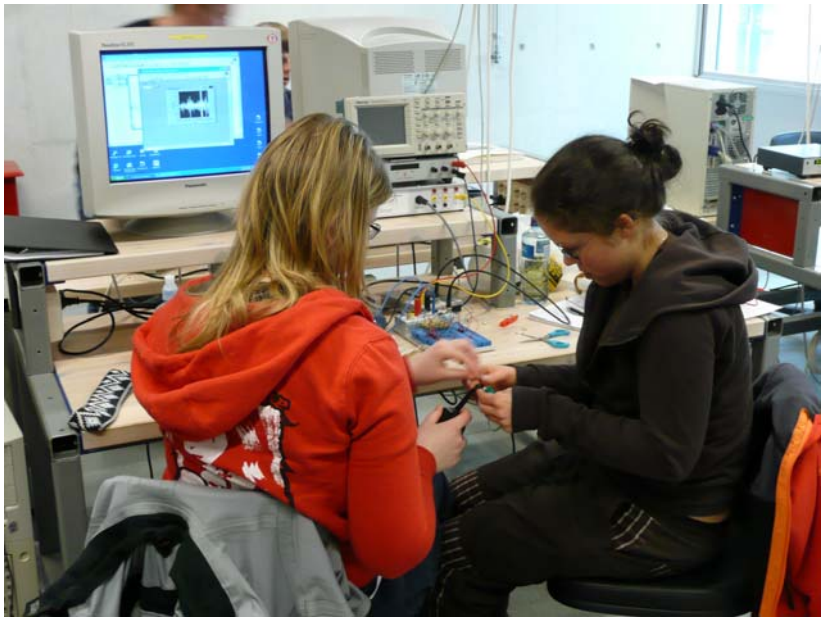
M.Sc.

RFEL3092	Research Methods in Science	12
FY2290	Energy Resources	13
FY3006	Sensors and Transducers	8
FY3021	Space Technology II	8
FY3070	Light, Vision, Colour (incl. lab)	12
FY3114	Functional Materials	11
FY3201	Atmospheric Physics and Climate Change	8
FY3402	Subatomic Physics	19
FY3452	Gravitation and Cosmology	12
FY3464	Quantum Field Theory I	16
FY3466	Quantum Field Theory II	3
FY3900	Master Thesis in Physics	13

PhD

FY8100	Characterization of Solid Surfaces	9
FY8102	Electron Microscopy and Diffraction	5
FY8200	Advanced Statistical Physics	1
FY8203	Soft Condensed Matter	3
FY8302	Quantum Theory of Solids	1
FY8303	Phase Transitions and Critical Phenomena	2
FY8304	Mathematical Approximation Methods in Physics	12
FY8305	Functional Integral Methods in Condensed Matter Physics	4
FY8407	Magnetic Resonance Imaging	2
FY8908	Quantum Optics	2





Students doing lab work.
Photo: Irene Aspli

THESES – GRADUATE STUDIES

Master of Science in Technology - Applied Physics and Mathematics

Afadzi, Mercy
Ultrasound Stimulated Release of Liposomes
Supervisor: Catharina Davies/Bjørn Angelsen

Andersen, Jonathan Borenstein
Photoluminescence characterization of molecular beam epitaxy grown Cd(x)Hg(1-x)Te thin films dopet with Ag, In and hg-vacancies
Supervisor: Ola Hunderi/Randi Haakenaasen

Berntsen, Andreas Nicolas
Using X-ray CT and low-field NMR to quantify formation damage and filter cake failure
Supervisor: Tore Lindmo/Audun Bakk

Bjerke, Ida Kathrine
Simulation study of latching-control strategies for one heaving and one pitching wave-energy converter
Supervisor: Knut Arne Strand/Alain Clement

Brox, Håkon
Single Events in Quantum Theory: A Study of the Quantum Measurement Problem
Supervisor: Arne Brataas

Dragland, Ingunn
Ligh Scattering and Adjacency Effect in the Atmosphere. Numercial Simulations for use in Hyperspectral Image Analysis
Supervisor: Ola Hunderi/Torbjørn Skauli

Dahl, Julie
Calculating Diffraction Patterns of Partially Ordered Perylene-Diimide Structures
Supervisor: Dag Werner Breiby

Einarsrud, Kristian Etienne
The effect of detaching bubbles on aluminium-cryolite interfaces: An experimental and numerical investigation
Supervisor. Johan Skule Høye/Iver Håkon Brevik

Ellevseth, Peter
D*ynamics of Free Falling Submerged Bodies, Simulated Using Flow3D*
Supervisor: Alex Hansen/Ingar Fossan

Ellingsen, Christine
Dynamic Contrast-Enhanced MR Imaging of Human Cervical Carcinoma Xenografts Compared with Histology
Supervisor: Einar K. Rofstad

Ersland, Christer Honore
Molecular dynamics simulations of liquid flow in single and double nanopores
Supervisor: Jon Otto Fossum/Paul Dommersnes

Fernandez Cuesta, Harald
Freeze-Fracture Microscopy of Carbon Nanodiscs in Dimethyl Sulfocide
Supervisor: Arnljot Elgsæter

Fjærestad, Janne Siren
Microstructure and lifetime in multicrystalline silicon
Supervisor: Ola Hunderi/Gaute Stokkan

Flisnes, Kathrin Mork
Ray-tracing of electromagnetic fields in conductive media – a theoretical and numerical study of asymptotic ray theory
Supervisor: Ola Hunderi/Lars O. Løseth

Gihleengen, Britt Elin
Transient out-of-plane deformation of aluminium plates during dynamic impact test
Supervisor: Erik Wahlstrøm/Tore Børvik

Gjerden, Knut
Quark stars: Effects of the strange quark mass
Supervisor: Jens Oluf Andersen

Grimsrud, Kim Anja Gowers
X-ray Diffraction Studies of Oriented CdSe Nanoparticles
Supervisor: Dag Werner Breiby

Grønsberg, Sondre
Transmission Electron Microscopy Characterization of GaAs Nanowires with GaAsSb Insert
Supervisor: Antonius Theodorus Johannes Van Helvoort

Gundersen, Paul
Electrical characterization of HgTe nanowire using conductive atomic force microscopy
Supervisor: Anne Borg/Kjell-Ove Kongshaug

Gustavsen, Åse Katrine Bues
Streamer Initiation in Dielectric Liquids with Applied Pre-Stress
Supervisor: Tore Høe Løvaas/Lars Lundgaard

Hagen, Susanne Wilhelmsen
SEM and AFM image analysis of nanostructured GaSb, compared to MME measurements
Supervisor: Morten Kildemo

Hansen, Elisabeth Lindmo
Colloidal Dispersions of Clay Nanoplatelest – Optical Birefringence and X-Ray Scattering Studies of Nematic Phases
Supervisor: Jon Otto Fossum

Hansen, Yngve Hofstad
Frigjøring og transport av liposomalt calcein i sfæroider av osteosarcomceller ved bruk av ultralyd
Supervisor: Catharina Davies/Bjørn Angelsen

Haugland, Christopher Collins
Electrical and Thermal Properties of Polyolefines Aged at High Temperatures in Dry and Wet Conditions
Supervisor: Tore Høe Løvaas

Henøen, Veronica Charlotta
Numerical Calculations of Water Ingress in Polymeric Cable Insulation
Supervisor: Tore Høe Løvaas,/Svein Magne Hellesø

Herland, Egil Vålandsmyr
Theoretical studies of two-component interacting Bose-Einstein condensates
Supervisor: Asle Sudbø

Hovda, Åsne Johanne Karlsen
IMRT-verification with a 2D ionisation chamber array: dosimetric evaluation and comparison with film measurements
Supervisor: Tore Lindmo/Jomar Frengen

Hynne, Borgny Kvam
Applications of Auger spectroscopy and imaging to silicon solar cell materials
Supervisor: John Walmsley/Ragnar Fagerberg

Jacobsen, Arnhild
Transport in Graphene Nanostructures
Supervisor: Randi Holmestad/Klaus Ensslin

Kjelling, Bård Martin
Order and Disorder of Water Intercalated States in Fluorohectorite Clay
Supervisor: Jon Otto Fossum

Kristjansdottir, Nora Borghildur
Spin Currents and their Detection in Semiconductor Nanowires
Supervisor: Arne Brataas/Sigurdur Erlingsson

Letnes, Paul Anton
Beam Scraping in SPS for LHC Injection: Efficiency and Robustness Studies
Supervisor: Jan Myrheim/Helmut Burkhardt

Levinsen, Yngve Inntjore
Studies on DC Electrical Behavior Supporting Material Selection in the CLIC Accelerating Cavities
Supervisor: Morten Kildemo/Sergio Calatroni

Lindgaard, Henrik
Possibilities of establishing an integrated pyroprocessing chain for a closed cycle heavy water reactor utilizing thorium
Supervisor: Tore Lindmo/Jon Samseth

Magnus, Knut
Experimental Research on Fractures in Gel
Supervisor: Jon Otto Fossum

Mellesdal, Ståle Ingarson
Prebreakdown Phenomena in Hydrocarbons
Supervisor: Tore Høe Løvaas/Stian Ingebrigtsen

Mongstad, Trygve Tveiterås
Scattering of light from dielectric films deposited on randomly rough substrates: A theoretical study
Supervisor: Ingve Simonsen

Natvig, Ingrid
Intersitial fluid pressure and extracellular pH in human cervical carcinoma xenografts
Supervisor: Einar K. Rofstad

Nilssen, Trond Bergh
Thermodynamic Properties Near the Onset of Loop-Current Order in High-Temperature Superconduting Cuprates
Supervisor: Asle Sudbø

Nord, Joakim
Inversion and Interpretation of Magnetotelluric Data in One Dimension. Analysis of Data From an Area Containing a High Resistive Structure
Supervisor: Ola Hunderi/Ketil Hokstad

Nordal, Roger
Computer program for analysis of partial discharges
Supervisor: Tore Høe Løvaas/Gunnar Berg

Ringdal, Nils Ivar
Experimental Studies of Self-Organized Liquid Crystalline Phases from Clay Nanoplatelets in Water: Birefringence and Structure
Supervisor: Jon Otto Fossum

Rødseth, Silje
What has Inspired the Physics Student? An Empirical Study on 1st Year Students at NTNU
Supervisor: Berit Bungum

Raaen, Kristine
Optimalization of Dynamic Contrast Enhanced MRI Method for Computation of Vascular Input Function on 7.0 T
Supervisor: Tore Lindmo

Skjerping, Hallvard Olsen
Concept design and prototyping of near-infra-red Mueller Matrix imaging system, for application in biomedicine and related topic
Supervisor: Morten Kildemo

Sperstad, Iver Bakken
Thermodynamics and transport in ferromagnetic superconductors and S/F heterostructures
Supervisor: Asle Sudbø

Stokke, Amund
Optical Response of Periodically Nanostructured Metal Surfaces: A Numerical Study
Supervisor: Simonsen, Ingve

Stokke, Andreas Alexander Vasli
Load Demand Tariffs in a Scandinavian Context
Supervisor: Alex Hansen/Gerard Doorman

Svanem, Johan Pååaho
Tissue characterisation with the use of SURF Imaging: Diagnosing prostate cancer
Supervisor: Catharina de Lange Davies/Bjørn Angelsen

Sæbø, Are Opstad
Precipitation in Al-Mg-Si(-Cu) alloys - influence of solution temperature, intermediate storage temperature and storage time
Supervisor: Randi Holmestad/Calin Marioara

Tegnander, Karianne Birgitte Vatnar
Radiation Doses to PET-Personnel in Norway
Supervisor: Tor Wøhni

Thoresen, Lasse Somdalen
X-Ray Reflectometry and Diffraction of Thin Films
Supervisor: Dag Werner Breiby

Thorstensen, Jostein Bruun
Comparative studies on multiple stage amplification of diode laser pulses in Yb-doped polarization maintaining fibers
Supervisor: Ola Hunderi/Jens Geiger

Tysnes, Jørgen
An Investigation and Application of Nonlinear Regression on Financial Time Series Using Kernel Dimension Reduction Techniques
Supervisor: Alex Hansen/Erik Alpkvist

Valdem, Øystein
Investigations of Sound Sources Based on DC Airflow
Supervisor: Erik Wahlstrøm/Lars Henrik Morset

Ve, Torbjørn Andersen
Verification of Numerical Calculations on Water Diffusion
Supervisor: Tore Høe Løvaas/Sverre Hvidsten

Vesterås, Eivind Rødnes
Photo Detection and Image Processing in the Human Eye
Supervisor: Bo-Sture Skagerstam

Yang, Aileen Xiao Qio
Quantitativ in vivo proton MR Spectroscopy of the rat brain at 7 T
Supervisor: Øyvind Risa/Oddbjørn Sæther

Øvrebø, Kristi Marie
How Representative are the Representative Doses? DAP Calibration in the Norwegian National Health Service
Supervisor: Tor Wøhni

Aanes, Gjert
Control and validation of instrumentation for an International Space Station payload. A study of the European Modular Cultivation System experiment MULTIGEN-1
Supervisor: Anders Johnsson

Aas, Paul Fredrik Sandvik
Mie scattering of electromagnetic field from an electric dipole in conductive media
Supervisor: Ingve Simonsen/Lars O. Løseth

Master of Science in Physics

Bakken, Kim Vidar
The effect of Mechanical Deformation in Al-Mg-Si(-Cu) Alloys
Supervisor: Randi Holmestad

Hansen, Brith Lundemo
Diskrete symmetrier for ladede og nøytrale spinn-1/2 fermioner innen 2^{nd}-kvantisert
Supervisor: Kåre Olaussen

Hemmen, Henrik
Experimental studies of nanostructured clay gels
Supervisor: Jon Otto Fossum

Hompland, Tord
Collagen as a possible diagnostic parameter in cancer studied by the second-harmonic generation
Supervisor: Catharina Davies

Kristoffersen, Kjartan
Direct ultraviolet radiation, studies of aerosols and effects on ultraviolet radiation on ground level
Supervisor: Berit Kjeldstad

Nielsen, Kjetil Liestøl
Theoretical studies of adsorption of atoms and small molecules on an oxygen terminated (0001) surface of alpha-chromium oxide
Supervisor: Jon Andreas Støvneng

Nordam, Tor
Various aspects of the Casimir effect.
Supervisor: Jens Oluf Andersen

Pedersen, Janne
Interfaces In The Theory Of General Relativity
Supervisor: Kåre Olaussen

Master of Science in Condensed Matter Physics

Gupta, Suresh Pasad
TEM studies of quantum dot materials for intermediate band solar cells
Supervisor: Randi Holmestad/Turid Worren Reenaas

Haldolaarachchige, Neel Saman Kumara
Hydrogen Storage and Desorption by Carbon Nanocone
Supervisor: Steinar Raaen

Hettiarachchilage, Kalani
Modeling of Multiple Quantum Well Solar Cells
Supervisor: Turid Worren Reenaas

Karna, Sanjay Kumar
Study of surface interactions, desorption and hydrogen storage on carbon nanocones
Supervisor: Steinar Raaen

Wickremasinghe, Don Athula Abeyarathna
Models for Dynamical Polarization in Electrodynamics
Supervisor: Kåre Olaussen

Master of Science in Natural Science Education

Andersen, Solveig
Sensitivity of Jurkat Cells to high Temperatures. A Flow Cytometry Study
Supervisor: Anders Johnsson/Thor Bernt Melø

Frisk, Ola
Parametrization of Force Field in ReaxFF
Supervisor: Jon Andreas Støvneng

Hansson, Sigrid
Experience with a Catapult. What can it bring to science education?
Supervisor: Berit Bungum

Johannessen, Bård Olav
Construcution of Centrifuge for simulation of low g-levels
Supervisor: Anders Johnsson

Nes, Brit
Technology as Part of Physics Upper Secondary School. Development and Evaluation of a Teaching Project on Electronic Sensors.
Supervisor: Berit Bungum/Nils Kristian Rossing

Søby, Magne Inderberg
Force Field Parametres for ReaxFF with H, C, Si and Ge
Supervisor: Jon Andreas Støvneng

THESES - DOCTORAL STUDIES

Børkje, Kjetil
Theoretical Studies of Unconventional Order in Quantum Many-Particle Systems
Supervisor: Asle Sudbø

Chikukwa, Actor
Modelling of a Solar Stove: Small Scale Concentrating System with Heat Storage
Supervisor: Berit Kjeldstad and Jørgen Løvseth

Dahl, Eskil Kulseth
Theoretical studies of condensed matter systems with multiple broken symmetries
Supervisor: Asle Sudbø

Erikson, Arne
Investigating the importance of collagen in cancer diagnosis and drug delivery using laser-based microscopy
Supervisor: Catharina Davies

Evensen, Tom Richard
Nanoparticles in dilute solution: A numerical study of rotational diffusion
Supervisor: Arnljot Elgsæter

Fonseca, Davi de Miranda
Phase Separation and Orientational Ordering of Synthetic Na-fluorohectorite Clay Particles in Saline Aqueous Suspensions
Supervisor: Jon Otto Fossum

Foros, Jørn
The transport phenomena of nanoparticles; fundament and theory
Supervisor: Arne Brataas

Grønsleth, Martin Sigurd
Theoretical Studies of Unconventional Superconductors
Supervisor: Asle Sudbø

Hansen, Henning Frydenlund
The Physics of Interacting Humans: Aspects of Sociology and Finance
Supervisor: Alex Hansen

Morten, Jan Petter
Coherent and Correlated Spin Transport in Nanoscale Superconductors
Supervisor: Arne Brataas

Reistad, Ole Christen
Analyzing Russian Naval Nuclear Safety and Security by Measuring and Modeling Reactor and Fuel Inventory and Accidental Releases
Supervisor: Tore Lindmo

A master student working on an AFM.
(Foto: G. Kallestad, NTNU Info)

PARTICIPATION IN COMMITTEES

Evaluation committees:

Borg A.:
* Preexaminer of PhD thesis by Taina Laiho, University of Turku , June 2008.
* Preexaminer of PhD thesis by Marko Ahonen, University of Tampere, October 2008.

Espy, P.:
* Opponent for PhD defence of Hilde Nesse Tyssøy, Department of Physics, University of Bergen, January 2008.
* Chair of PhD evaluation committee for Bodil Karlsson, Department of Meteorology, Stockholm University, April 2008.
* Member of PhD evaluation committee for Linda Megner, Department of Meteorology, Stockholm University, June 2008.

Holmestad, R.:
* Evaluation committee for the Swedish Research Council: Senior Research Position in Electron Microscopy Imaging and Chemical Analysis with Atomic Resolution in Structural Chemistry and Nanoscience.

Høye, J. S.
*Opponent for PhD defence by Trygve Buanes, Dept. of Physics and Technology, Univ. of Bergen, November 2008.

Holmestad, R.:
* Evaluation committee for the Swedish Research Council: Senior Research Position in Electron Microscopy Imaging and Chemical Analysis with Atomic Resolution in Structural Chemistry and Nanoscience

Johnsson, A.:
***** Opponent at PhD defence: Bob van Oort, "Biological Rhythms in Reindeer. Circadian clocks become redundant in polar photoperiods." University of Tromsø, Januar 2008.

Olaussen, K.:
Administrator for PhD defence of Kjetil Børkje. Opponent for PhD defence of Mats Hersdal, UiO.

Skagerstam, B.S.:
* Member of the Norwegian Physical Society Committee on Nuclear Power, 2008.
***** Administrator of Ph.D. exam evaluation committee on a thesis in physics, Department of Physics, Norwegian University of Science and Technology, Norway, August 22, 2008.

International committees

Borg, A.:
* Member of the "Beredningsgrupp 2" under the Committee of Research Infrastructure (KFI), The Swedish Research Council, Sweden.
* Member of the IUPAP (International Union of Pure and Applied Physics) Working Group on Women in Physics.
* Member of the board of MAX-lab, Lund University, Sweden.
* Member of the board of The Nanometer Consortium, Lund University, Sweden.
* Member of the evaluation committee for Academy Research Fellowships, The Academy of Finland, January 2008.
* Member of the international organizing committee of "3rd IUPAP International Conference on Women in Physics", Seoul, South Korea, October 8-10, 2008

Bungum, B.:
* Editor of scientific journal NorDiNa (Nordic Studies in Science Education).
* Member of the board for the 9th Nordic Research Symposium on Science Education, Reykjavik June 2008.
* Coordinator of the organizing committee for Nordic-Baltic research training course in science education, Göteborg, November, 16-21.

Fossum, J. O.:
* Member of the 2008 Physics evaluation panel of FCT - Fundacao para a Ciencia e a Tecnologia; Ministeiro Ciencia, Tecnologia e Ensino Superior, Portugal- The Foundation for Science and Technology in Portugal for evaluation of all physics groups/activities in Portugal

Hansen, A.:
* Secretary to the Board of European Physical Society's Computational Physics group.
* Member of the prize committee for European Physical Society's Berni Alder Prize in Computational Physics.
* Member of the International Union of Pure and Applied Physics (IUPAP), Commission of Statistical Physics (C3) (term ending 2008).
*Member of the IUPAP's Working group on nanoscience (WG8) (term ending 2008).
*Member of the International Union of Pure and Applied Physics (IUPAP), Commission of Computational Physics (C20) (term beginning in 2008).

*Member of the Scientific Advisory Board to the Center of Excellence in Computational systems Research, Helsinki University of Technology
*Member of the ESF Network “Exploring the Physics of Small Devices” steering committee.
*Member of the Editorial board of the European Journal of Physics
*Member of International Scientific Committee of CCP2008, Ouro Preto, Brazil.
*Member of International Scientific Committee of CCP2009, Taiwan.

Holmestad, R.:
* Member of the board of the Scandinavian Electron microscopy society, SCANDEM.

Hunderi, O.:
* Editorial board for scientific journals.
* Editorial Board, New Journal of Physics 2002-
* Member of the publication Council, The optical Society of America 2007-
* Member of the organising committee for EPIOPTICS 10, Erice, Italy, June 2008.
* Member of the organising committee for LPHYS 08, Trondheim, June 08.

Kachelriess, M.:
* Member of the steering committee of "ISAPP: International School on AstroParticle Physics European Doctorate School".

Kjeldstad, B.J.:
***** Member of World Meteorological Organisation, Scientific advisory Group for Ultraviolet Radiation measurements (WMO UVSAG).

Lindmo, T.:
* Member of evaluation committee for the research area Applied physics and medical technology at KTH, Stockholm, as part the KTH Research Assessment Exercise.

Stokke, B.T.:
* Editorial Advisory Board – Biopolymers (Wiley).
* Member of administrative group of NORDTEK.
* Member of Administrative Council of SEFI.
* Board of Directors, CESAER.

A. Sudbø:
*Steering Committee Member, European Science Foundation Network on Nanoscience and Engineering in Superconductivity (NES).

Valberg, A.:
* Norwegian Representative in Commission Internationale de l'Eclairage (CIE), Division I, Vision and Colour.
* Member of Tecnical Committee TC1-37 of the CIE.

National committees

Andersen, J.O.:
* Member of the board of the group for subatomic and astrophysics in the Norwegian Physical Society.

Borg, A.:
* Chair of ”Programme for Synchrotron Research”, Research Council of Norway.

Brataas, A.:
* Member of ”Ressursfordelingskomiteen for tungregning”, Norwegian Research Council.

Bungum, B.:
* Member of the board for “Nasjonalt nettverk for naturfagutdanning” (National network for science education).

Davies, C. de L.:
* Node leader within the FUGEII supported nation network “Norwegian Molecular Imaging Consortium”.

Holmestad, R.:
* Member of the board of ‘Bardalfondet’ (Fond for belønning av fremragende studentarbeid innen økologiske aspekt av materialteknologi ved NTNU)

Johnsson, A.:
* Member of “Norsk Fysikkråd”.
* Member project of steering group (Norwegian Defence Research Establishment) for project “Electromagnetic fields and human reproduction health” (Univ. of Bergen).

Kjeldstad, B.J.:
* Member of advisory board of Sintef, Material and Chemistry
* Member of the Board of University of Svalbard
* Education committee for geophysical courses at University of Svalbard.
* Substitute member, Board of Sør Trøndelag University College, Faculty of Technology.

Lindmo, T.:
* Chairman of Norwegian national committee for the evaluation of professor competence in physics.

Reenaas, T.W.:
* Board member International Solar Energy Society Norway (“Solenergiforeningen”).

Skagerstam, B.S..:
* Member of the Condensed Matter with Atomic Physics Division of the Norwegian Physical Society.
* Member of "Thorium-Utvalget" of the Norwegian Physical Society.

Stokke, B.T.:
* Chairman of the board, NANOMAT Research Program, The Norwegian Research Council
* Chairman, National council for technological education, The Norwegian Association of Higher Education Institutions.
* "Publiseringsutvalget", The Norwegian Association of Higher Education Institutions.

A. Sudbø:
*Member, National Working Group for FUNMAT.

University and Departmental committees

Andersen J.O.:
* Chairman of the committee for public outreach (formidlingsutvalet) at the dept. of physics, NTNU.

Borg, A.:
* Member of FUS ("Forvaltningsutvalget for sivilingeniørutdanningen") at NTNU.
* Vice dean on education, Faculty of Natural Sciences and Technology.
* Member of FUL ("Forvaltningsutvalget for Lærerutdanningen") at NTNU.
* Member of Educational Committee of NTNU
* Member, "Studieprogramråd for Lærerutdanningen i Realfag".

Brataas, A.:
* Chairman of the board of "Realfagsbiblioteket".

Bungum, B.:
* Member of the steering committee for TIGRIS – "Teknologi i grunnopplæringa i skolen".
* Leader, "Studieprogramråd for Lærerutdanningen i Realfag"

Davies, C.:
* Member of the board of the strategic areas Medical Technology.
* Member of the program committee in Bioinformatics.
* Member of "Formidlingsutvalget" at Dept. of physics.

Hansen, A.:
* Elected member of Departmental Council.

Holmestad, R.:
* Chair/co-chair of the TEM Gemini Centre .
* Elected member of Departmental Council.
* Chairman, "Studieprogramråd for MSc Condensed Matter Physics".

Johnsson, A.:
* Member, board of the Faculty of Natural Science and Technology.
* Member of "Studieprogramrådet for Fysikk".
* Member of "Committee for Space Science activities at NTNU".

Kjeldstad, B.:
* Head of the Department of Physics.
* Member, board Geminisenter for PV materials
* Member, board TEM Geminisenter
* Member of NT leadergroup

Lindgren, M.:
* Chairman, Division of Applied Physics and Didactic Physics
* Elected member of Departmental Council.
* Representant i studieprogramråd for fysikk og matematikk 2008-2010

Lindmo, T.:
* Chairman, Division of Biophysics and Medical Technology.
* Member, "Studieprogramråd for fysikk og matematikk".
* Chairman, "Studieprogramråd for MSc Medical Technology".

Mikkelsen, A.:
* Chairman, Division of Complex Materials

Olaussen, K.:
* Deputy Head of the Department of Physics.
* Member "Forskningsutvalget", Faculty of Natural Science and Technology.

Reenaas, T.W.:
* Member leader group "Senter for fornybar energi"
* Member, "Studieprogramråd for MSc Condensed Matter Physics and Biophysics"

Sikorski, P.:
* Acting chairman of detail planning committee for the bionanotechnology clean room, NTNU Nanolab.
* Member, Ledergruppen NTNU Nanolab.

Stokke, B.T.:
* Chairman of the board, NTNU Nanolab, NTNU.
* Dean of Engineering Education, NTNU; Chairman of the executive committee of engineering education, NTNU (FUS).

Støvneng, J.A.:
* Chairman, "Undervisningsutvalget ved institutt for fysikk".
* Member, "Studieprogramråd for MSc Fysikk og matematikk"

Sudbø, A.:
* Chairman, Division of Theoretical Physics.

Valberg, A.:
* Member of the board of the interdisciplinary Program for Master Studies in Neuroscience at NTNU.

Wahlstrøm, E.:
* Acting director NTNU NanoLab
* Chairman, detail planning committee for the physical clean room, NTNU Nanolab.
* Member, "Studieprogramråd for nanoteknologi".
* Member, "Undervisningsutvalget" at the Department of Physics

Øverbø, I.:
* Chairman, "Studieprogramrådet for Realfag".

Arrangement committees:

Bungum, B.:
* Organizer of study trip for teachers to the ASE conference (Association for Science Education), Liverpool, January 2008.
* Member of program committee for the NKUL conference 2009.

Fossum J.O.:
* In organizing committee of The 27th IUGG (International Union of Geodesy and Geophysics) International Conference on Mathematical Geophysics, June 15-20, 2008 in Longyearbyen on Spitsbergen
* Main organizer of 5th Nordic Workshop on Scattering from Soft Matter at NTNU in Trondheim, Norway, February 6&7 2008

Holmestad, R:
* Organiser of Workshop in Electron Diffraction in Trondheim, May 2008.

Kachelriess, M.:
* Convenor or the Icosahedron session of the "Neutrino Oscillation Workshop 2008".

Lindgren, M.:
* Co-chairing the conference: Optical materials in defence systems technology. Part of the SPIE Symposium "Defence and Security" Cardiff, 2008.
* Chair and local organizer of workshop in Laser Physics LPHYS'08 in Trondheim, June-July, 2008.

Olaussen, K.:
Chairman, "Nordforsk Netework" – meeting in Trondheim November 3-5.
* Chairman, Committee for Institute Day, November 27.

Stokke, B.T.
* Chairman, organising committee NORDTEK 2008 Conference, Spitsbergen, 28 June – 1 July 2008
* Program committee member 36th Annual conference of European Society for Engineering Education, SEFI, 2-5 July 2008, Aalborg, Denmark
* Co-chairman, 1st International Nanotechnology@NTNU symposium, Kavli Laureates, 11-12 september 2008, Trondheim, Norway
* Organising committee, Scandinavian Scanning Probe user meeting, 30-31 october 2008, The Norwegian University of Science and Technology, Trondheim, Norway.

The Natural Sciences Building, seen from below.
Photo: Irene Aspli

FRIDAY COLLOQUIUM - "Fredagskollokviet i fysikk"

Convenors: Randi Holmestad and Michael Kachelriess (spring)
Johan Skule Høye and Arne Mikkelsen (autumn)

Programme – spring term

18. January, Kenneth Ruud, Institutt for kjemi, Universitetet i Tromsø: Molecular properties: Bridging the gap between theory and experiment

25. January, Turid W. Reenaas, Institutt for fysikk, NTNU: Can solar cells contribute to the global electricity supply in the future?

1. February, Ingve Simonsen, Institutt for fysikk, NTNU: Power Blackouts and the Domino Effect: Real-Life Examples and Modeling

8. February, Solfrid Hjøllo, Institute of Marine Research and Bjerknes Centre for Climate Research, Bergen: Inside the imperfect and crucial blackbox of "Climate modeling"

15. February, Hans Pecseli, Physics, Universitetet i Oslo: Turbulence is important for the feeding rate of micro-organisms in the oceans

22. February, Tamio Ikeshoji, Research Institute for Computational Sciences (RICS), Tsukuba, Japan: Electrochemical systems simulated by first principles method

7. March, Alessandro Treves, SISSA- Cognitive Neuroscience, Trieste, Italy: Freezing memories and melting thoughts: the physics of cortical networks

14. March, Eddy Ardonne, NORDITA, Stockholm: Quantum computation with anyons

28. March, B.S. Sathyaprakash, Cardiff University, UK: Gravitational Astronomy: The New Frontier

4. April, Jan Petter Hansen, Universitetet i Bergen: Attosecond and strong laser physics

11. April, Morten Kildemo, Institutt for fysikk, NTNU: Optical response from nanostructured surfaces

18. April, Magnus Langseth,Structural Impact Laboratory (SIMLab), NTNU: Large Scale Impact Testing and Analyses of Aluminium Automotive Structures

25. April, Marianne Houbiers, StatoilHydro: The Physics of Seismic Imaging

9. May, Sergei Odintsov, ICREA and IEEC, Barcelona: Cosmology and modified gravity

Programme – autumn term

26. September, Ola Kai Ledang, Institutt for musikk, NTNU: Altmuligmannen Johan Daniel Berlin

3. October, Are Raklev, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, England: On the eve of the LHC

10. October, Patrick Espy, Institutt for fysikk, NTNU: Noctilucent clouds: Clouds at the edge of space

24. October, Patrick Norman, Department of Physics, Chemistry and Biology, Linköpings Universitet: Light control with heavy atom compounds: a need for relativistic quantum chemical approaches

31. October, Nils Erland Haugen, SINTEF Energiforskning AS: CO2-fri forbrenning fra fossil brensel. / CO2-free combustion from fossil fuel

7. November, Hallvard Ødegård, Institutt for vann- og miljøteknikk, NTNU: Hvordan løses ferskvannsutfordringene i verdens mest urbaniserte områder? / Facing the freshwater challenges in highly urbanized areas.

21. November, Peter Nilsson, IFM-Department of Chemistry, Linköping University, Sweden: Luminescent Conjugated Polymers: Illuminating the Dark Matters of Biology and Pathology

28. November, Audun Bakk, Avd. for formasjonsfysikk, SINTEF Petroleumsforskning AS: Rock Physics @ SINTEF Petroleum Research: Stressing the rocks

5. December, Bo-Sture Skagerstam, Institutt for fysikk, NTNU: Nobelprisen i fysikk 2008

Annual Report for Department of Physics 2008

NTNU
Innovation and Creativity

NTNU – Innovation and Creativity

The Norwegian University of Science and Technology (NTNU) in Trondheim represents academic eminence in technology and the natural sciences as well as in other academic disciplines ranging from the social sciences, the arts, medicine, architecture to fine arts. Cross-disciplinary cooperation results in ideas no one else has thought of, and creative solutions that change our daily lives.

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