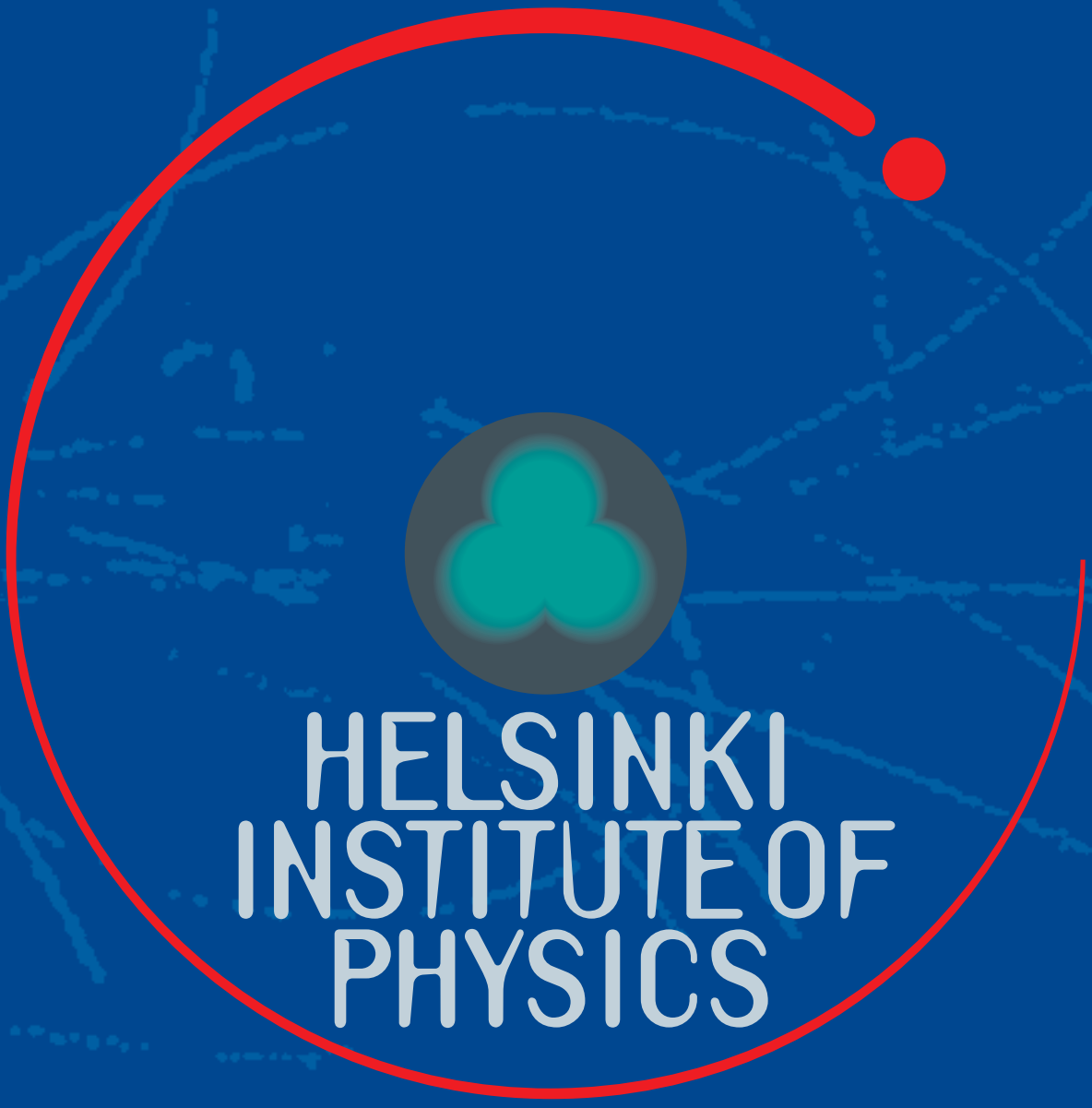
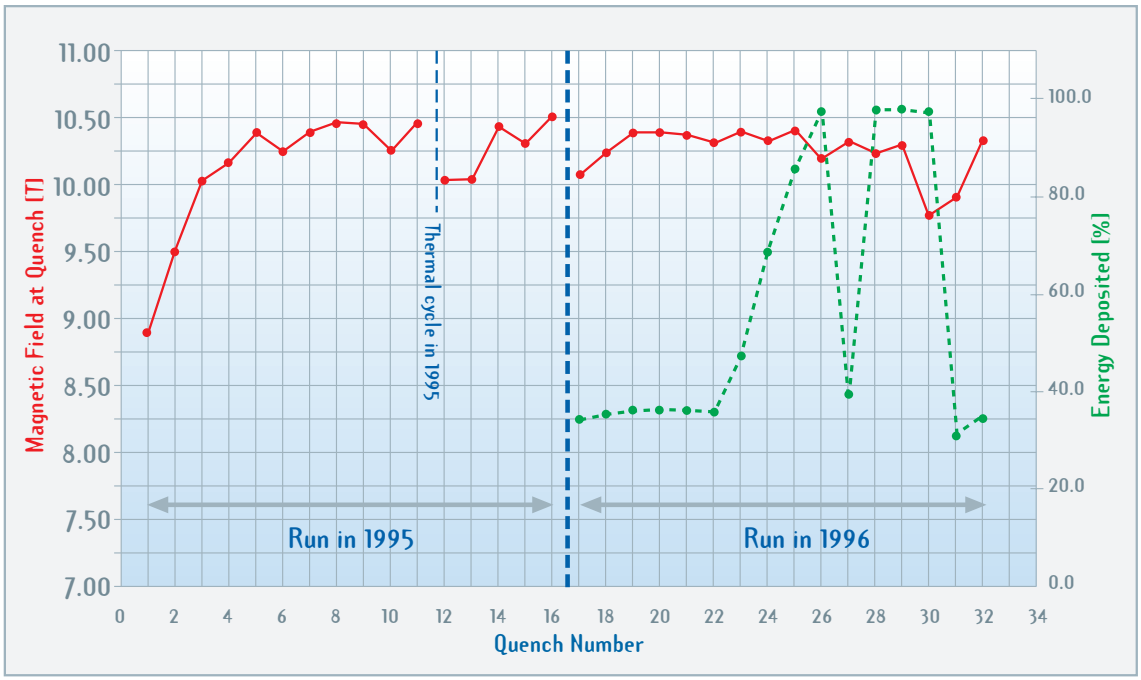
Annual Report 1997



HELSINKI INSTITUTE OF PHYSICS



The magnetic field of the Finnish LHC dipole magnet prototype. The dipole magnet, built by a Finnish group, was measured in 1995 and again at the end of 1996. The field 10.52 T is a world record for this type of superconducting dipole magnets. Another remarkable result was the high performance (over 10 T before first quench) after being stored at room temperature for more than a year. The Finnish design forms the basis for the most important component of the LHC.

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Introduction

Eero Byckling

The Helsinki Institute of Physics (HIP) is the national research institute for theoretical and particle physics in Finland. It was founded in September 1996 and began full-scale operations on January 1, 1997. The main fields of research are high- and low-energy theoretical physics, experimental particle physics and technological research related to particle accelerators. The Institute also supports graduate education at universities and training at CERN.

HIP is an independent national institute and is governed jointly by the University of Helsinki and Helsinki University of Technology. The highest decision-making body is the Board of the Institute. HIP funding is decided as a separate item during the annual planning of the Finnish governmental budget. The Institute also obtains funding from other sources: Ministries, the Academy of Finland, the Technology Development Centre of Finland (TEKES) and companies. HIP has offices and laboratories at three locations: The University of Helsinki in the centre of Helsinki, Helsinki University of Technology in Espoo and CERN in Geneva. The Institute has the responsibility of coordinating Finland's relations with CERN and other international accelerator centres.

When HIP was founded, most of the research activities were inherited from three merged institutes: the Research Institute for Theoretical Physics (TFT), Research Institute for High Energy Physics (SEFT) and Institute of Particle Physics Technology (HTI). As described below, the main topics of research have been mathematical physics, quantum optics, statistical physics, experimental particle physics at CERN, design of parts of the CMS experiment for the forthcoming LHC accelerator and technological developmental work on a project and document management system for the LHC project.

The CERN accelerator ring is 27 km in circumference

A Scientific Advisory Board (SAB) was nominated in Spring 1997. The SAB held its first meeting on September 4, 1997 in Helsinki. The SAB made the following recommendations for further development of the HIP: 1) Longer-term and permanent contracts for a few key persons are needed to attract outstanding scientists. 2) A chair in experimental particle physics was proposed for the University of Helsinki. 3) The laboratory infrastructure must be strengthened. 4) Resource allocation should be moved towards LHC physics. 5) The theory group is of high level and its ties to experiments should be encouraged. 6) Experimental high-energy physics research outside the LHC should be kept active. 7) The technology program is regarded as strong and beneficial.

A Research Plan 1998 has been approved by the Board. It implements a number of actions that are in accordance with recommendations formulated by the SAB. In late 1997, several changes were carried out regarding content and organization of the research. The size of the HIP budget in 1998 is the same as in 1997.

HIP collaborates with university departments and has highly qualified personnel and fruitful contacts with CERN. These have provided a good basis for an active graduate education and student training program. HIP scientists have given lecture courses at the graduate level and supervised thesis work. The Institute has offered undergraduate and graduate students research positions and a stimulating environment and has coordinated the Graduate School in Particle and Nuclear Physics, in which the physics departments of universities in Helsinki and Jyväskylä have participated. The Institute has organized international seminars and conferences, and has had an extensive visitors' program. Undergraduate and graduate students have been chosen as trainees to CERN.

During the first year of operation of the Institute, several significant results have already brought HIP scientists to the attention of the international scientific community. The Institute has taken its place at the forefront of Finnish research.

Main Research Results

Theory

The existence of knotlike soliton solutions to the field equations of a certain nonlinear sigma model was established numerically. Interesting new results in the passive scalar model of turbulence and in Chern-Simons field theories were achieved. The following systems have been studied: wave packet dynamics in molecular systems and Bose-Einstein condensates, Hartree-Fock and many-body methods for confined Bose-Einstein condensates, output couplers for atom lasers, adiabatic processes in atomic and molecular 3-level systems and a new approach to cold atomic collisions in light fields. A new formalism to calculate diffusion and transport coefficients in strongly interacting systems has been developed. The kinetic roughening of slow combustion in disordered materials has been predicted theoretically and confirmed experimentally.

High Energy Physics

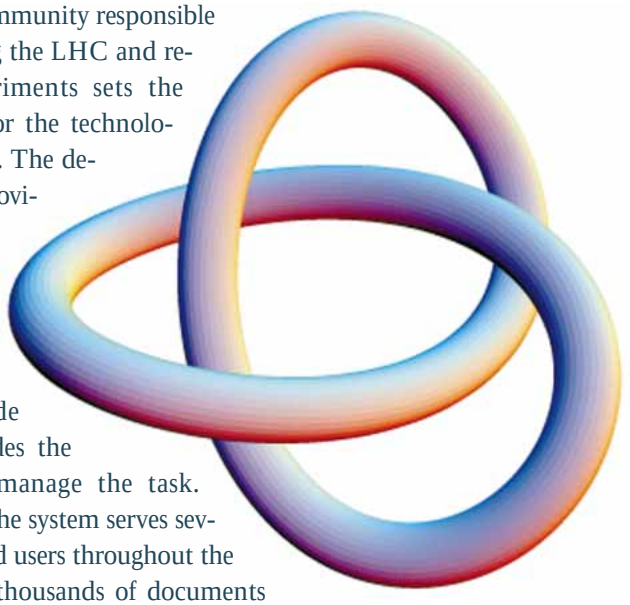
In electron-positron collisions at LEP, measurements of record precision on the rare decay models of beauty quarks have been accomplished. Our group's new approach for reconstructing complete quark-gluon final states with their colour structures could change the way hard scattering processes are perceived experimentally. The phenomenology group set new limits on the Higgs boson mass and produced testable predictions for the present and future colliders. New results on an alternative approach to a fundamental theory of particle interactions have been obtained by the group. The detector research and development project has constructed a test set-up for MicroStrip-GasChambers (MSGC) to be used in LHC experiments. With this set-up twelve MSGC's can be irradiated and monitored simultaneously. During 1997 the group has been responsible for manufacturing the anode readout and data acquisition modules for the upgraded DELPHI experiment at CERN.

LHC

The HIP LHC program is preparing for the scientific exploitation of the CERN LHC proton-proton collider by setting up the CMS experimental apparatus. Significant contributions were made in the development of the software for the CMS, particularly in detector simulation tools, in the evaluation of the physics potential of the detector design, in prototyping and testing of detector modules and of the mechanical support for the Tracker as well as in the design and development of the Data acquisition and Trigger system of the CMS. Two important milestones in the construction of the CMS detector were achieved, namely the completion of a full-size silicon barrel tracker prototype and the prototype of the mechanical support of the MSGC barrel tracker. For the forthcoming tests of these and other prototypes the HIP Silicon Beam Telescope was upgraded.

Technology

Controlling and disseminating all engineering-related documents within the global research community responsible for building the LHC and related experiments sets the challenge for the technology program. The developed Tuovi-WDM application relying on the Internet and World Wide Web provides the means to manage the task. Currently, the system serves several hundred users throughout the world and thousands of documents are being managed by the system. The Tuovi-WDM has been chosen to be the official WWW interface for all engineering data at CERN. The system is also in use at DESY in Hamburg and in the Max Planck Institute in Munich. Several industrial companies in Finland are evaluating the system. In addition the program has generated several academic theses and articles published in prominent international journals.



A numerically constructed knot solution to the Faddeev field theory model

Theory Program

Stig Stenholm

Mathematical physics

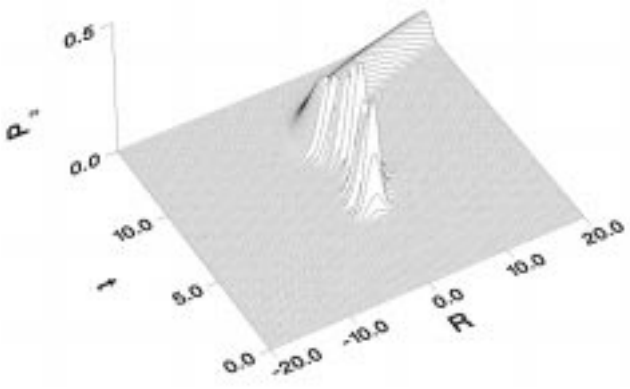
Knotted structures are of interest in many areas of physics. To study the physics of knotlike structures, one needs a theoretical model where knots emerge as stable finite energy solutions to a set of nonlinear field equations. In 1975, L.D. Faddeev proposed that closed, knotted vortices could be constructed in the nonlinear O(3) sigma model with a stabilizing fourth-order term. Such solutions have now been uncovered in an extensive numerical analysis of the model, and the properties of the simplest knot-solitons have been elucidated.

One of the basic open problems in fully developed hydrodynamical turbulence is the origin of the observed violations of the Kolmogorov scaling. The violations indicate the presence of strong short-distance intermittency in the turbulent cascade, i.e. of frequent occurence of large fluctuations on short distances. Recently, we achieved progress in the understanding of the analogous problem for the passive advection of a scalar quantity by a random velocity field. The anomalous scaling of the scalar in this problem has been related to zero modes of differential operators describing the stochastic evolution of the flow. The short-distance intermittency is due to the presence of slow collective modes in the otherwise super-diffusive evolution of the Lagrangian trajectories of fluid particles.

Despite the progress solving the quantum Chern-Simons field theory with a compact gauge group, much remains to be done in the case of non-compact groups. Physical motivations for the study are the interpretation of 2+1-dimensional quantum gravity as the Chern-Simons theory with a non-compact gauge group and the identification of the Hilbert space of physical states of the Chern-Simons theory with gauge group SL(2,R) with the space of Virasoro conformal blocks. Major progress was achieved by performing the quantization of the Teichmüller space of punctured surfaces with Weil-Petersson symplectic structure. In the problem of quantum corrections to Chern-Simons field theories, an important result is the two-loop finiteness of Chern-Simons field theory in the background field method. In Yang-Mills theory with extended supersymmetry, results have been achieved on the general conditions on the central charges for the existence of short and intermediate representations, useful for establishing dualities.

Laser physics and quantum optics

Laser pulses in a counterintuitive sequence induce new effects in atomic and molecular systems involving 3 or more energy levels - several important aspects of these systems have been studied. A novel application (APLIP) of this technique to molecular wave packet dynamics was also discovered. We have confirmed the validity of the description of weak wave packet excitation as decay into a continuum, and looked into various aspects of wave packet excitation.



With ultrashort laser pulses one can create molecular wave packets, i.e., coherent superpositions of dissociative states. Here the evolution of such a wave packet on a dissociative potential surface is inhibited during the pulse by rapid Rabi oscillations, and dissociation (motion to large R) can begin only after the laser pulse has disappeared.

The aim of these studies is to provide tools for controlling chemical reactions. We have also studied wave packet dynamics with Bose-Einstein condensates and demonstrated that by shaking the trap centre one can split the condensate into two separate parts.

Bose-Einstein condensation is one of the major scientific discoveries of 1990's. We have studied the condensate by using the Hartree-Fock approach and other many-body methods. Our results obtained for double condensate situations have aroused interest among the experimentalists, as well as the previously mentioned shaking study. We have also found an analytic solution to the basic multistate output coupling problem, which has importance

in the atom laser related condensate experiments. We organised a highly successful minisymposium on Bose-Einstein condensation in Helsinki in March 1997.

We have also successfully concluded the development of the semiclassical optical Bloch equation method for treating cold atomic collisions in light fields. This provides crucial savings in computer time compared to the fully quantum Monte Carlo approach. The cold collision studies are an important aspect in laser cooling and trapping of neutral atoms (1997 Nobel prize). In 1997 we have also revived our earlier activity in the field of quantum information and quantum computation, and in 1998 we shall establish this promising new field more permanently at HIP.

Statistical physics and materials science

These activities have concentrated on the theory of equilibrium and nonequilibrium critical phenomena and dynamics in strongly interacting many-body systems, in particular as applied to complex systems, polymers, disordered materials, and surface physics. Several projects are supported in part by the Academy of Finland, including two national MATRA consortiums. Collaborations exist with leading domestic and international groups.

Part of the research is concerned with diffusion, chemical reactions, and growth and spreading on surfaces. Regarding the general theory of many-particle diffusion, we have developed two methods to evaluate diffusion coefficients under conditions where interaction effects are dominant. The first approach, called the Dynamical Mean Field (DMF) theory, uses a combination of static and dynamic quantities to estimate diffusion and neglecting memory effects. To improve on the DMF theory, we have developed a novel memory function expansion for the diffusion coefficients (exact decomposition of the autocorrelation functions). We have also studied the phenomenon of stochastic resonance in the case of Brownian particles diffusing in a periodic potential in external time-dependent electric fields.

In the model system O/W(110), we have concentrated on the coverage and temperature dependence of the diffusion coefficients of the oxygen adatoms. The results reveal several novel features when adatom interactions are pronounced. We have also studied the diffusion on flexible chainlike molecules on smooth surfaces.

We have developed a model for the study of unstable growth of isolated step edges (ledges) under typical MBE conditions. The model is motivated by adatom diffusion and energetics during the growth of steps on Si(001) surfaces. We have also done microscopic calculations of surface processes occurring at and in the vicinity of step edges based on the effective medium theory and using quantum-mechanical first principles methods.

The second major research topic has been dynamical processes in complex and structurally disordered systems. We have continued work on the properties of disordered fibre networks and on the dynamics of fronts in such systems. We have also studied the dynamics of interfaces in complex, nonlinear systems using continuum phase-field and discrete lattice models.

Studies of deposition models of fibers are motivated by unusual properties of paper sheets. Percolation properties and spatial correlations of simple models of 2D continuum deposition of fibers on a plane were studied. Another deposition model describes the growth of flexible fibers in 3D. The important parameters in the model are fiber length and flexibility. The kinetic roughening is given by the Kardar-Parisi-Zhang (KPZ) equation.

A continuum phase-field model was previously derived for the dynamics and kinetic roughening of slow combustion fronts in disordered media. The kinetic roughening follows the KPZ equation. Extensive studies of the dynamics and kinetic roughening of fronts in simple lattice models of 'forest fires' are also relevant for spreading of epidemics, population dynamics, etc.

In conjunction with the theory work, we have been closely involved in carrying out experiments of the kinetic roughening of slow combustion fronts in paper. The results show that the KPZ universality class of kinetic roughening can be realised in a driven system. We have also developed a theory for the kinetics of imbibition (paper wetting).

High Energy Physics Program

Risto Orava

The mission of the HEP Program is the search for fundamental knowledge on the origins of mass and on the strong force, e.g., colour confinement and quark interactions. The Standard Model (SM) describes the experimentally observed properties of fundamental particles and their interactions exceedingly well. As a theory, however, the SM is incomplete and does not answer questions such as: Why are there only three families of quarks and leptons? How do the basic building blocks of matter acquire their measured masses? What is the general framework for unifying gravity with the interactions treated by the SM and for particle classification in such a superstructure? The strategy of investigating these basic questions of today's high energy physics is based on active participation in leading experiments, in their construction, operation, data analysis and, finally, in physics analysis. The analysis group must (1) be active, gaining its expertise and ideas from hands-on participation in detector construction, (2) interact with phenomenologists and (3) be supported by an adequately equipped experimental laboratory.

Electron-Positron Physics

Large accelerator facilities are needed for experimental measurements of the phenomena occurring at the enormous energy densities resembling the origins of the universe and birth of matter. The Large Electron Positron Collider (LEP) is a key instrument in studying matter and its interactions by colliding e^+ and e^- beams at the highest energy ever achieved. By building essential parts of the DELPHI detector and by developing tools for data analysis of the DELPHI and L3 experiments at the LEP, the group has gained the necessary basis for physics contributions. In 1997 the Finnish group continued its analysis of *Z* decays to hadrons and began analysing the higher-energy LEP2 data. The millions of events collected at *Z* mass are the basis of the group's investigation of the rare decay processes of those hadrons containing *b*-quarks (Fig. 1) and a search for a *b->s+ gluon* transition. Both analyses provide the most accurate measurements of this kind to date. Recently, the group has developed a unique method with which to analyse colour confinement of quarks and gluons event by event (Fig. 2) and techniques for jet flavour tagging. These have been applied to the study of gluons, *W* decays, and in searching for Higgs bosons. Two Ph.D. theses have been completed in 1997 by group members.

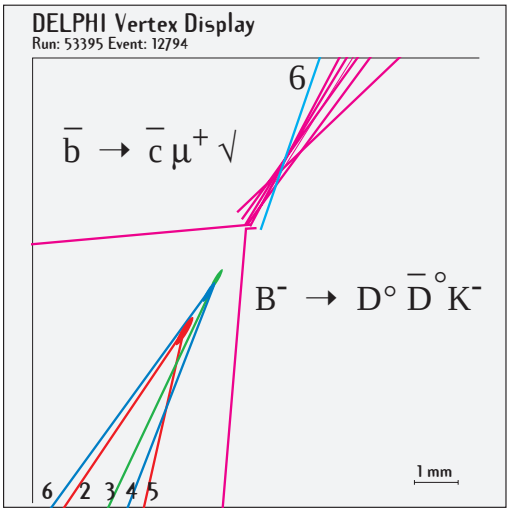


Fig. 1. **A fully reconstructed decay of a *B* meson to two charmed mesons and a kaon. The combined use of the DELPHI silicon vertex detector and hadron identification gives detailed information on the heavy hadron decays and enables a precision study of their properties.**

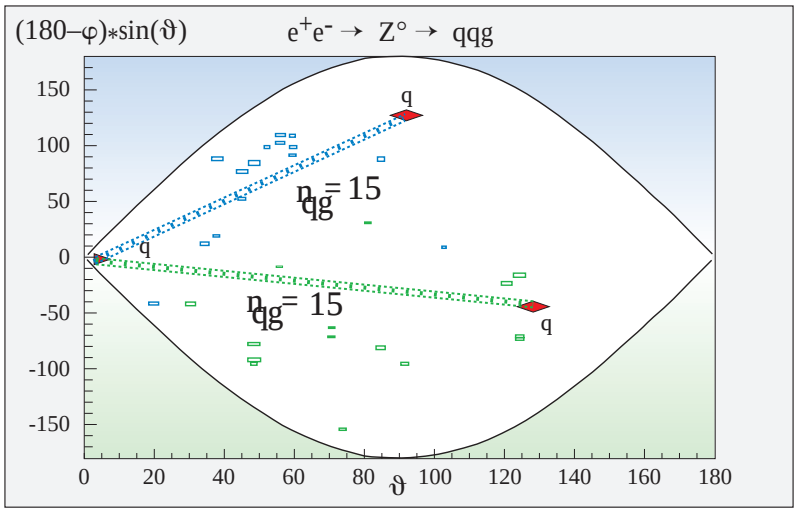


Fig. 2. **An electron-positron collision event in which a Z^0 boson decays into a quark, antiquark and gluon. The complete colour structure of the event is reconstructed and shows that a "colour string" is attached between the quark and gluon and another between the antiquark and the gluon, but no string between the quark-antiquark pair.**

Phenomenology

The nature of electroweak symmetry breaking and supersymmetry pose some of the most burning questions of today's high-energy physics. If the experimental hints of a nonvanishing neutrino mass are proved to be correct, the left-right versions of the electroweak models (LRM) must be taken seriously. The Finnish phenomenology group has special expertise on left-right models.

Supersymmetric LRMs include new heavy-mass scales. In spite of these, we have found that one of the Higgs bosons remains light for most of the parameter space, which is interesting in view of the experiments at the LEP and at future e^+e^- and pp colliders. The well-defined structure of the scalar potential has allowed us to set constraints on the model parameters by requiring conservation of colour and electromagnetism.

In the minimal supersymmetric standard model with an explicit breaking of R-parity, extremely tight constraints on the products of R-parity violating couplings have been found by using muon-electron conversion.

The production of novel doubly charged scalars at the LHC, as predicted by the LRM, has been studied by the group. At a linear collider, the diagonal lepton number violating couplings have been investigated. The LRM has been implemented into the CompHEP software code by group. The group members are active participants of the DESY linear collider working group.

The quantum group with non-commutative geometry may provide new approaches to a fundamental theory having no divergences and comprising all known interactions. It is a viable alternative to the string and brane models. Promising results on this and topologically massive Yang-Mills theories and their two-loop finiteness have been obtained.

Detector Research & Development

To participate in the next generation of particle physics experiments, a vigorous research and development program on semiconductor detectors and on gas-filled radiation detectors has been established at the Institute.

At present, developmental work is concentrated on microstrip gas chambers (MSGC) and their long-term stability performance. A special test environment has been constructed for monitoring operational parameters of MSGCs during long periods of X-ray irradiation. Twelve small MSGCs (Fig. 3) can be irradiated and monitored simultaneously for possible influence of three different compounds on detector performance.

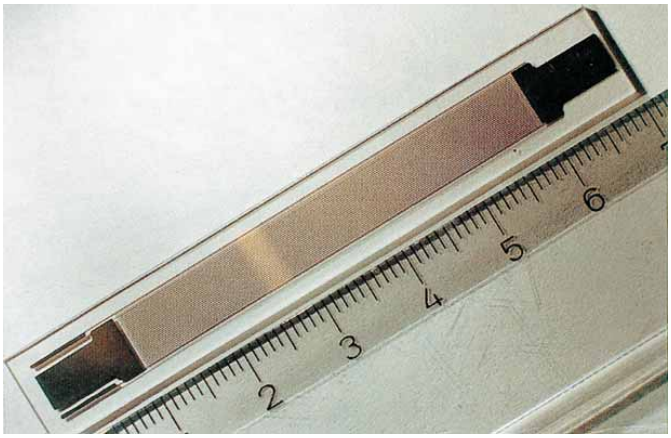


Fig. 3. A small microstrip gas chamber electrode made for ageing studies.

The highly sensitive gas analysis facility which is based on gas chromatograph and cryotrap units forms a key installation of the laboratory and is used for gas purity analysis and for outgassing studies of detector materials. With this unique facility, stable chemical compounds created by the gas avalanches can be investigated for finding clues to the processes causing wire chamber ageing. In 1997, the analysis facility was completed by adding a mass spectrometer to better identify the various compounds under investigation.

In 1997 the laboratory has continued to make important contributions to DELPHI hadron calorimeter upgrade. Both front-end electronics for the anode readout of the streamer tubes and the DAQ fastbus cards were manufactured by the laboratory.

LHC Program

Jorma Tuominiemi

The year 1997 marked the completion of the basic design of the CMS detector. Technical Design Reports (TDR) for the Superconducting Solenoid Magnet, the Hadron Calorimeter, the Electromagnetic Calorimeter and the Muon Spectrometer were submitted for approval to the CERN LHC Committee. The reports are based on the prototype milestones set by the LHC Committee and completed by the CMS Project in 1997. At the same time facilities are being set up to test the prototypes and the final parts of the CMS detector at CERN and in participating laboratories.

Simulation and event reconstruction

A vast amount of computer-simulation effort has been dedicated to the development of the design of the CMS detector. In 1997, considerable progress was yet achieved in the development of the simulation and event reconstruction software, organized in the CMSIM program package, the coordination of which is under the responsibility of the HIP software team. In April, CMSIM version 111 was released which formed the basis for the simulation work for the Hadron Calorimeter TDR. In October, the next version 112 was the basis for the TDR of the Electromagnetic Calorimeter. The latest version 113 includes the optimized design of the Tracker and is being used as the basis for the Tracker TDR. New, rapid methods have been developed for reconstruction of particle interaction vertices. Writing of the Tracker simulation and performance section of the TDR, due in April 1998, was initiated.

As the design of the CMS detector is being refined, it is important to check with simulation studies that the discovery potential of the detector is maximized. The HIP software and physics team carries the responsibility of studying in particular the capability of the CMS experiment to detect Higgs bosons, the most important goal of the LHC project. In 1997 new results were obtained for the tau-lepton decay channel of the Higgs bosons in the Minimal Standard Supersymmetric Model. This is an interesting and important channel, as it allows extension of the Higgs search in a wide region of the MSSM parameter space. An algorithm was developed to identify tau-jets in the CMS detector using the CMSIM simulation package. The tau-jets turned out to be useful also from an another point view. Hard pions from tau decays can provide a means of calibrating the hadron calorimeter by comparing the calorimetric energy measurement with the precise momentum measurement from the Tracker.

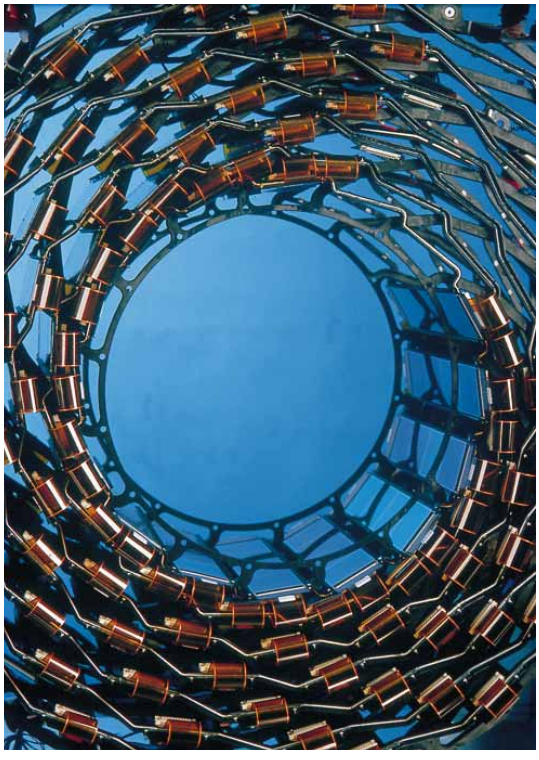


Fig.1. Prototype of the silicon barrel tracker.

Prototype of the Tracker

In construction of the CMS Tracker, an important step was achieved with the completion of a full-size prototype of the silicon barrel tracker, with one sector equipped with working baseline detectors. This was a milestone set up by the LHC Committee. Detector modules were assembled at Selmic Oy in Kemi from detectors processed at the Technical Research Centre of Finland (VTT) and mounted on the barrel wheel built in Pisa, in addition to detector modules produced in 6 other CMS institutes. Preparations were made in cooperation with the CERN silicon tracker group for testing of the prototype and final detector modules to be initiated at CERN in 1998.

Another milestone was achieved in construction of the microstrip gas chamber (MSGC) tracker, to be installed around the silicon tracker. The HIP mechanical engineering team is developing the support structure of the MSGC tracker barrel. In 1997 the main effort was focused, in cooperation with the CERN group, on manufacturing of the first barrel support prototype (B1, LHC Committee milestone), design of the final MSGC barrel wheel and on development of an internal alignment method for the MSGC barrel. The central problem in the design is to optimize the precision and stiffness of the supporting structure while using only a minimum amount of material to avoid interactions of the particles in the supports. The B1 prototype consisting of a fully equipped sector of the final MSGC barrel was successfully completed. It will be equipped with actual detector modules and will be tested with cosmic ray particles in 1998. The design of the final structure is progressing well and will be completed for the Tracker Design Report in April 1998.

The HIP mechanics team also developed an extremely accurate, low-cost straightness measurement system based on use of a stretched wire and capacitive pickup. Due to its outstanding performance its applicability to the alignment of other parts of the CMS Tracker will be investigated.

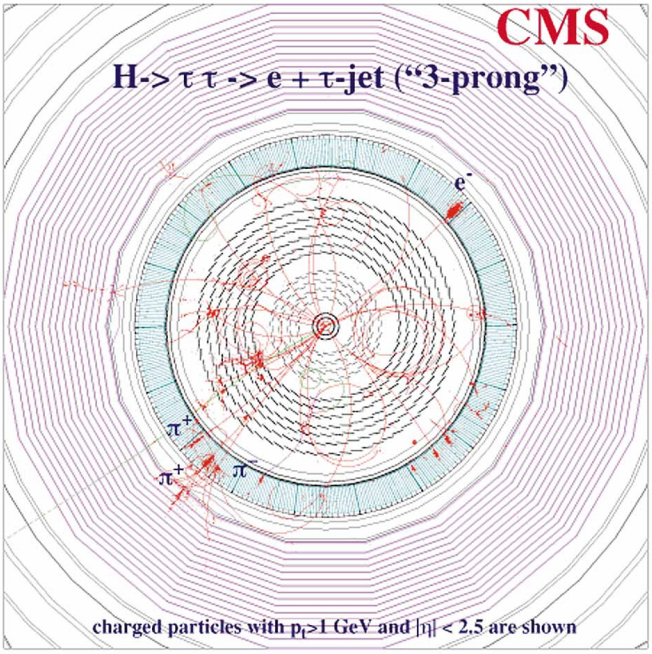


Fig. 2. Simulation of the decay of a Higgs boson into two tau leptons in the CMS Tracker and electromagnetic and hadronic calorimeters.

Silicon Beam Telescope

An important contribution of HIP to the CMS project is the Silicon Beam Telescope (SiBT) in the CERN H2 beam, which provides a reference track for the detector systems being tested there. In 1997 the telescope was entirely rebuilt. New DC-coupled detectors were installed to increase the area covered by the telescope. The new detectors were processed at VTT and were bonded to front-end electronics at Selmic Oy. The read-out electronics of the SiBT was also rebuilt to allow the use of an external trigger for selection of interesting events.The Roxi read-out boards were used to read out and preprocess the signals from the detectors. The new system was installed in the H2 beam in July and was fully operational in September, when it was used for tests of two protype silicon-strip detector structures.

The off-line software for the SiBT was upgraded and new on-line software with several features allowing fast-event quality control was developed. Work was initiated to rewrite the off-line software in Object-Oriented (OO) form as a pilot project for the use of OO-programming techniques in the CMS. The HIP team also joined the international, interdisciplinary group rewriting the GEANT software package in an OO framework.

Technology Program

Ari-Pekka Hameri

More than 30 countries are collaborating at CERN in a project to produce the most complicated scientific instrument ever built. Engineering and design work is occurring on a global scale and results in drawings and documents and other project-related information are distributed through the Internet and World Wide Web (WWW). A special WWW-based document management system has been developed to interface between the global community and document databases. The system, called the TuoviWDM, has gained momentum and is currently being studied and tested by several other research centres and industrial companies producing one-of-a-kind or made-to-order products requiring tailored engineering and design work. Experience shows that the WWW overcomes many obstacles that retard development towards document-integrated collaboration among geographically scattered organizations and industrial networks.

Distributed Document Management

The TuoviWDM system has been developed to fulfill the needs of the LHC project at CERN. It supports distributed design work by providing engineers with simple means for storing their documents and making them universally accessible to remote collaborators. The system allows one to store, search and retrieve documents through use of a WWW browser. It is thus suitable for a wide range of document management needs and has been made generally available to CERN projects.

The TuoviWDM is a universal data management tool that allows designers and engineers to access their data through a simple interface regardless of what in-house or commercial document management system is the background host.

The system is also capable of using the local file system of the WWW server as a data vault. The key functions of the system are given in Table 1.

The basic set of functions provides a distributed engineering and design project with simple means of working across geographical distances and apply basic document life cycle procedures. A project engineer can create the project structure either on-line or using special project management software, e.g. MS Project. He can also create empty containers and document descriptions that will be filled in later by designers and engineers.

The engineers will author and draw the design information and attach it to the appropriate document containers. During the project flow, an automatic notification mechanism informs the appropriate users about changes and the project engineer is able to call for progress follow-up reports based on document changes and accesses.

Project Structure Management	• Hierarchical structure, Product Breakdown Structure (PBS) • Online creation and modification of PBS and Work Breakdown Structure (WBS) • Integration to project management software, e.g. MS-Project
Data and Document Management	• Submission and retrieval of documents through WWW • Multiple document formats • Visual document status indicator
Information Search	• Navigation according to a breakdown structure • Document attributes and content indexed and searchable (PS, PDF, RTF, MS-Office, etc.) • Gradually focusing queries
Time and Resource Management	• Online creation and modification of WBS • Integration to project management software, e.g. MS Project • Online collection of progress reports • Automatic notification of changes and milestones
Progress Follow-up	• Document usage analysis • Notification system for changes • Communication network analysis

Table 1. Key functions of the TuoviWDM system.

Fig.1. The TuoviWDM Web interface.

Experiences

The TuoviWDM toolset is used by a number of pilot projects. Some of the pilot projects are carried out at CERN with the LHC Accelerator project and the ATLAS and CMS experiments. Some of the pilot projects are open for global access. Readers are encouraged to see the system in full use by logging in as a guest user at the following address: http://tuovi.cern.ch/

The system serves several hundred users throughout the world and hosts several thousand documents of engineering information. Two in-depth industrial pilots are used at companies carrying out global design and engineering activities. These pilots have demonstrated that

- the amount of key documents concerning all partners in a product delivery process is surprisingly low, and better control of these documents already improves the overall project performance;
- inside the companies about 70% of the documents are disseminated and retrieved electronically, yet between third-parties only 25% are so handled, the rest being delivered by conventional and manual means;
- Internet-based protocols in addition to the Web interface overcome problems related to various computer platforms, but focus on document formats is of great importance;
- the WWW-based TuoviWDM interface has been successfully integrated into several in-house and commercial engineering document systems; thus the technology is flexible and already highly applicable;
- security aspects with strict user authentication and authorization indicate that the applied medium is highly secure and reliable, even for distributing financial information.

Future activities

Present focus in the systems industry is mainly on in-house developmental efforts and third-party and supply chain integration are at present largely ignored. Some electronic document management system vendors have realized this and several are already providing WWW interfaces. In contrast to this trend, the TuoviWDM is proceeding towards a full document management system that can be used as a stand-alone system or in association with other systems. Future development is guided by comments both from industry and the high-energy physics community.

The following aspects are being implemented:

- scheduling support for distributed operations, including viewing project timetables on-line from the WWW;
- work package and budget management for geographically scattered projects;
- fully distributed software protocols for truly networked document sharing.

Currently, the TuoviWDM effort is directed towards the high-energy physics community, which by default operates in a distributed manner, and in Scandinavia where the industrial pilots are being established. To date a total of 20 man-years of developmental effort has been expended on the system. Currently, the Tuovi team employs 15 full-time researchers of which five are in Finland and the rest at CERN.

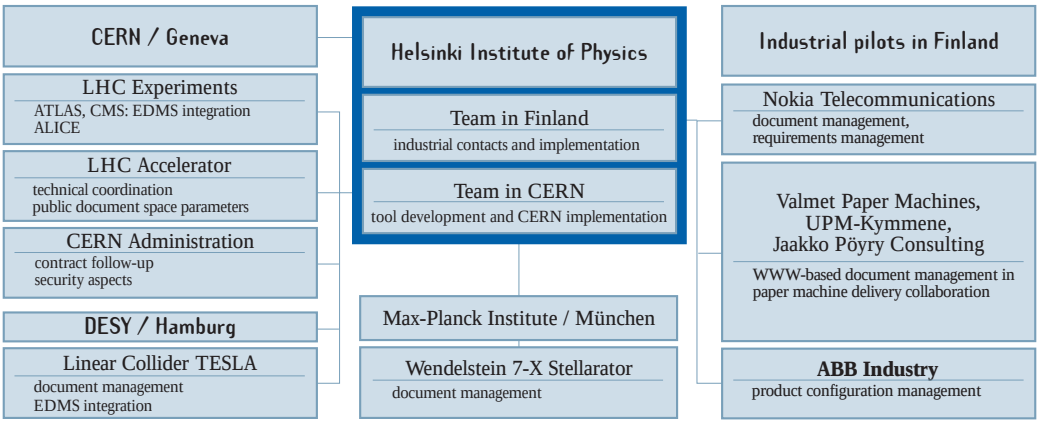
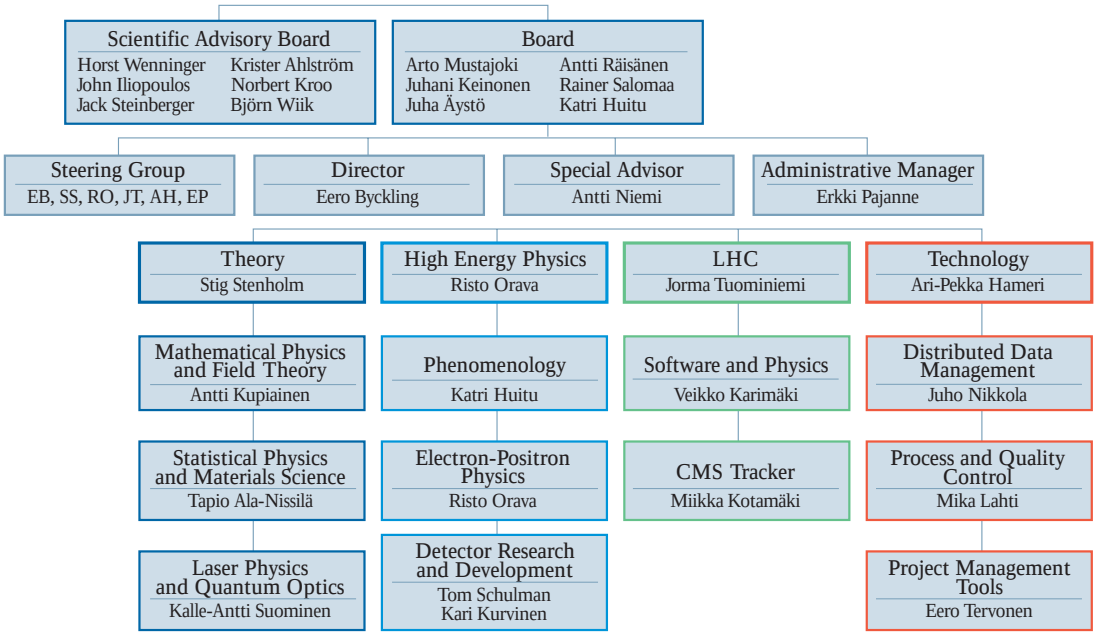


Fig. 2. The partners of the TuoviWDM project.

Organization and Personnel

Organization



The Institute Board

Chairman: **Arto Mustajoki**, Vice Rector (University of Helsinki)
Vice Chairman: **Antti Räisänen**, Vice Rector (Helsinki University of Technology)
Members: **Juhani Keinonen**, Professor (University of Helsinki)
Rainer Salomaa, Professor (Helsinki University of Technology)
Juha Äystö, Professor (University of Jyväskylä, Appointed by the Ministry of Education)
Katri Huitu, Docent (Chosen by personnel of HIP)

The Scientific Advisory Board

Chairman: **Horst Wenninger**, Research and Technical Director (CERN)
Members: **Krister Ahlström**, President and CEO (A. Ahlström Corporation)
John Iliopoulos, Professor (Ecole Normale Superiore)
Norbert Kroo, Director (Institute for Solid State Physics, Hungarian Academy of Sciences)
Jack Steinberger, Professor (CERN, Nobel Prize in Physics in 1988)
Björn H. Wiik, Director General (DESY)

The Board: Räisänen, Salomaa, Huitu, Mustajoki, Äystö, Keinonen

The Scientific Advisory Board: Steinberger, Wiik, Iliopoulos, Ahlström, Wenninger, Kroo.

Personnel

Theory Program

S. Stenholm, professor,
program director

Mathematical Physics and Field Theory

A. Kupiainen, professor, proj. leader
L. Faddeev, academician, senior scientist
A. Volkov, senior scientist
C. Montonen, senior scientist
R. Kashaev, scientist
W. Chen, scientist
T. Kärki, grad. student
J. Lukkarinen, grad. student
M. Rost, senior scientist
S. Virtanen, grad. student

Laser Physics and Quantum Optics

S. Stenholm, professor, proj. leader
K.-A. Suominen, docent
A.M. Green, adj. senior scientist
M. Mallalieu, senior scientist
N. Lütkenhaus, senior scientist
J. Calsamiglia, grad. student
N. Vitanov, senior scientist
C. Engdahl, scientist
J. Piilo, grad. student
E. Andersson, grad. student
M. Havukainen, grad. student
P. Pennanen, grad. student
P. Öhberg, grad. student
J. Martikainen, student
A. Paloviita, grad. student

Statistical Physics and Material Science

T. Ala-Nissilä, docent, proj. leader
M. Dubé, senior scientist
I. Koponen, senior scientist
J. Vinnurva, student
J. Merikoski, senior scientist
K. Laasonen, professor, adj. senior scientist
P. Salo, scientist
J. Heinonen, grad. student
T. Hjelt, grad. student
R. Linna, grad. student
S. Majaniemi, grad. student
I. Vattulainen, grad. student
M. Kuittu, student
E. Kuusela, student
T. Asikainen, student
J. Vinnurva, student

High Energy Physics Program

R. Orava, docent, program director

Phenomenology

K. Huitu, docent, proj. leader
M. Chaichian, professor,
adj. senior scientist
R. Vuopionperä, scientist (at CERN)
K. Puolamäki, grad. student
J. Laitinen, student
P. Rahkila, student
D. Zhang, scientist

Electron-Positron Physics

R. Orava, docent, proj. leader (at CERN)
V. Nomokonov, scientist (at CERN)
P. Eerola, adj. senior scientist
H. Saarikko, adj. senior scientist
M. Sarakinos, senior scientist (at CERN)
M. Battaglia, grad. student (at CERN)
K. Honkavaara, grad. student (at CERN)
A. Kiiskinen, grad. student (at CERN)
R. Ostonen, grad. student (at CERN)
K. Österberg, grad. student
S. Czellar, lab. engineer (at CERN)
K. Väisänen, student (at CERN)

Detector Research and Development

T. Schulman, MSc, proj. leader
K. Kurvinen, lab. engineer
R. Lauhakangas, lab. engineer
J. Heino, grad. student
A. Lumme, technician
M. Luoma, technician
A. Numminen, technician
A.K. Agyei, student
Y. Opoku Boafo, student

LHC Program

J. Tuominiemi, assoc. prof., program director

LHC Experiments

J. Tuominiemi, assoc. prof., proj. leader
V. Karimäki, senior scientist (at CERN)
R. Kinnunen, senior scientist (at CERN)
M. Kotamäki, senior scientist (at CERN)
E. Pietarinen, senior scientist
C. Eklund, grad. student
M. Heikkinen, grad. student (at CERN)
K. Banzuzi, student
H. Saarikoski, grad. student
K. Skog, grad. student (at CERN)
N. Eiden, grad. student (at CERN)
J. Välimaa, student
K. Suurpää, student
K. Tammi, student
S. Ruotsalainen, grad. student (at CERN)
T. Mäenpää, student
A. Autio, student
J. Klem, grad. student (at CERN)

Technology Program

A-P. Hameri, DrTech, program director

Process and Quality Control

J. Nihtilä, MSc, proj. leader (at CERN)
E. Tervonen, senior scientist (at CERN)
J. Rehn, scientist
K. Pelto-Aho, scientist
M. Tuisku, scientist
L. Eronen, scientist (at CERN)
N. Raudasoja, scientist
M. Lahti, proj. leader (at CERN)
A. Asplund, scientist
M. Niskanen, student
M. Uusitalo, scientist

Distributed Data Management

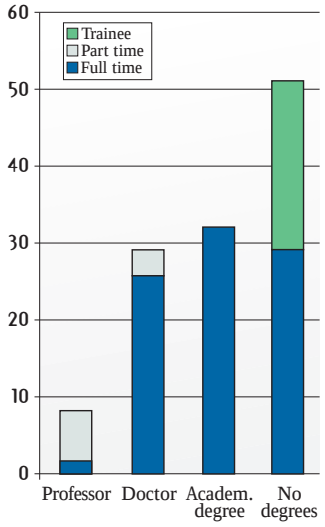
J. Nikkola, proj. leader (at CERN)
T. Kunnas, scientist (at CERN)
R. Puittinen, scientist (at CERN)
M. Silander, scientist (at CERN)
J. Leppänen, scientist (at CERN)
M. Puittinen, student (at CERN)
J. Hahkala, student (at CERN)
P. Heikkurinen, scientist (at CERN)

Administration and Support

E. Byckling, professor, director
A. Niemi, professor, advisor
to the director
E. Pajanne, docent, administrative
manager
H. Luutonen, financial manager
K. Hakala, secretary
M. Flygar, secretary (at CERN)
M. Rauhamäki, secretary (proj.)
T. Vallius, secretary (proj.)
C. Sivori, secretary trainee
(at CERN)
M. Nurmi, librarian
S. Tuominen, secretary trainee
(at CERN)
M. Merikoski, student (at CERN)
T. Vehviläinen, lab. engineer
O. Vuola, adj. scientist (at CERN)
M. Syrjälahti, student
R. Rinta-Filppula, scientist
H. Tuohela, ADP. assistant

Summer Trainees at CERN

J. Heino, J. Huuskonen,
M. Haapakorpi, J. Laitinen,
J. Koivisto, K. Lindfors
A. Jääskeläinen, T. Huukkonen
T. Oksanen, T. Rüppel
L.K. Salmi, L.T. Salmi, K. Suurpää
M. Syrjälahti, K. Tammi,
O. Toivanen



The number of persons in various competence categories

Seminars, Conferences and Visits

Seminars held in Helsinki

January 14th A. Yu. Morozov (ITEP, Moscow)
Witten-Dijkgraaf-Verlinde-Verlinde (WDVV) equations in Seiberg-Witten Theory I.

January 15th A. Yu. Morozov (ITEP, Moscow)
Witten-Dijkgraaf-Verlinde-Verlinde (WDVV) equations in Seiberg-Witten Theory II.

January 21st S. Stenholm (HIP)
Can you really see a wavefunction?

January 28th K. Enqvist (Academy of Finland)
Magnetic turbulence in the early universe

February 4th J.Tuominiemi (SEFO/HIP)
Why and how to see the Higgs boson?

February 11th M. Dubé (HIP)
Macroscopic quantum effects in magnets

February 11th M. Anselmino (INFN, Torino)
Spin effects in high or intermediate energy processes

February 18th J. Krug (Essen, Germany)
First passage statistics of Non-Markovian stochastic processes: the case of interface fluctuations

February 20th Yu. M. Pis'mak (University of St.Peterburg, Russia)
Analytic results in the Bak-Sneppen model of self-organized criticality

February 25th P. N. Pandita (NEHU, Shillong, India)
Search for Higgs boson: standard model and supersymmetry

February 27th A. Zeilinger (University of Innsbruck, Austria)
Entanglement and the foundations of quantum physics

March 3rd D. Diakonov (St. Petersburg Nuclear Physics Institute, Russia)
Nonperturbative nucleon parton distributions in the large N_c limit

March 4th R. Ostonen (HIP)
The first physics results from LEP2

March 10-12th
5th Nordic Meeting on Supersymmetric String and Field Theories

March 11th P. Di Vecchia (Nordita)
Boundary states in string theory

March 18th P. Hoyer (Nordita)
Physics at the Continuous Beam Electron Accelerator ELFE

March 25th N. Bogoliubov (HIP)
Integrable models and exponential phase operators

March 25th-27th
Mini-symposium: Bose-Einstein Condensation

April 8th K. Huitu (HIP)
Supersymmetric models with R-parity breaking

April 15th C. Montonen (HIP)
Electric and magnetic charges in supersymmetric Yang-Mills theory

April 22nd A. Paloviita (Nokia Research Centre, Tampere)
Wave packet description of laser induced molecular excitation

April 24th A. Demichev (Institute of Nuclear Physics, Moscow State University)
Some topics in quantum group symmetries

April 28th D. Chakraborty (Fermilab,USA)
Top physics at Fermilab

April 29th K. Kainulainen (SEFO)
Supersymmetric electroweak phase transition

May 6th A. Eskreys (Institute for Nuclear Studies, Cracow, Poland)
Some recent results from ZEUS experiment at HERA

May 7th M. Frank (Concordia University, Montréal, Canada)
Lepton-flavour violating decays in the left-right supersymmetric model

May 13th N. Mitskievich (University of Guadalajara, Mexico)
Solutions of Einstein's equations and the problem of their interpretation

May 20th F. Lenz (University of Erlangen, Germany)
Quantum chromodynamics at finite extension

May 20th W. Schleich (University of Ulm, Germany)
Atom optics as a test of quantum chaos

May 22nd K. Sneppen (NORDITA, Kobenhavn)
Applications of physical models in biology

May 29th P. Spillantini (INFN sez. di Firenze and Universita' di Firenze, Italy)
The WIZARD collaboration and the PAMELA experiment for the direct detection of cosmic rays in space

June 2nd-5th
Graduate School Workshop on Adatom Dynamics and Diffusion on Surfaces

June 3rd E. Keski-Vakkuri (Caltech, USA)
Lessons on black hole physics from string theory

June 10th K.Elder (Oakland University, Rochester, Michigan, USA)
State selection in accelerated systems

June 18th K. Nishijima (Nishina Memorial Foundation, Tokyo, Japan)
Representations of BRS algebra

August 5th H. J. He (DESY, Germany)
Testing the strong electroweak symmetry breaking physics at the LHC and linear colliders

August 7th A. Likhoded (Scientific Center of the Institute for Nuclear Physics, Protvino, Russia)
Probing quartic couplings through three gauge boson Production at an e^+e^-- linear collider

August 12th J. M. Kosterlitz (Brown, USA)
Edge effects in frustrated junction arrays with modulated couplings.
August 13th H. Fogedby (Aarhus, Denmark)
August 18th R. Bishop (UMIST, UK)
A microscopic theory of magnetic order in strongly correlated quantum spin lattices
August 19th J. Merikoski (Brown, USA/HIP)
Mass transport on a stepped surface
August 21st M. Noga (Comenius University, Bratislava, Slovakia)
Destructive interference of fluctuations in super-conductors
August 25th C. Carlson (William and Mary, USA)
Measuring polarized gluon and quark distributions with meson photoproduction
August 26th P. Pasanen (Univ. of Texas, Austin, USA)
The second string revolution - a short introduction to dualities, branes and all that
September 2nd I. Vattulainen (HIP)
Some aspects of surface diffusion within a lattice-gas description
September 3rd Nobel Laureate J. Steinberger (CERN and Scuola Normale Superiore, Pisa)
50 years of particle physics
September 16th H. Koskinen (Department of Physics)
Plasma physics from auroras to the solar system and beyond.
September 19th U. Garg (University of Notre Dame, USA)
Description of superdeformed bands in terms of incremental alignments and predictions of new superdeformed bands in the A=150 region.
September 23rd A.Kupiainen (HIP/Department of Mathematics)
Universality in turbulence
September 30th K.Huitu, H.Saarikko and J.Tuominiemi (HIP)
Reports on the International Europhysics Conference on High Energy Physics in Jerusalem August 19-26
September 30 th R. Orava (HIP)
High Energy Physics Program in Finland
(an invited presentation in the ECFA meeting)
October 2nd J. Schukraft (CERN)
Heavy ion physics at the LHC and the ALICE experiment
October 7th R. Nieminen (HUT/Finnish Academy)
Computing complex materials
October 14th H. Kurki-Suonio (Department of Physics)
What has happened to the crisis in light element nucleosynthesis?
October 21st Conference Reports
J. Peltoniemi (FL) Workshop on weak interactions and neutrinos
M. Sainio (TFO) Meson physics
K.-A. Suominen (HIP/Finnish Academy) Laser physics
A. M. Green (TFO/HIP) Lattice 97
October 28th H. Hamidian (Stockholm University)
Quantum critical behaviour in three-dimensional gauged Higgs-Yukawa theories
Novembery 4th K. Kajantie (CERN/TH)
Screening in finite temperature gauge theories
November 11th A. Rajantie (TFO)
Effective theory of SU(5) GUT at finite temperature
November 18th R. Kashaev (HIP/Finnish Academy)
Combinatorial quantization of SL(2,R)
Chern-Simons theory
November 25th P. Prešnajder (Bratislava, Slovakia)
Simple applications of a noncommutative geometry
November 28th K. Eggert (CERN)
Felix, a full acceptance detector for the LHC
December 2nd T. Kärki (HIP)
Path integral localization and Selberg's trace Formula
December 9th M. Rost (HIP)
Dynamics of surface structures in crystal growth
December 16th P. Törmä (Innsbruck, Austria)
Physics of trapped ions - from quantum computers to quantum chaos

Seminars held at other institutes

April 8th Vuopionperä in Delphi Analysis Week, CERN,
Theoretical aspects of charged supersymmetric (MSSM) Higgs production $e^+e^- \rightarrow H^+H^-$ at LEP2
April 18th J. Tuominiemi at Department of Physics, University of Jyväskylä
CMS experiment at the CERN LHC
April 24th R. Orava in the Material Physics Conference at the Estonian Physics Institute's 50th Anniversary, Tarto, Estonia
Novel Semiconductor Detectors for Medical Imaging (an invited review talk)
June 5th R. Vuopionperä at CERN
Particle physics phenomenology and new physics
June 30th R. Vuopionperä in Delphi Analysis Week, CERN
New VFT (Offline Analysis) NTUPLES
September 22nd R. Vuopionperä in Ustron, Poland
On the LR-model and its implementation to the CompHEP program
October 27th R. Vuopionperä in Delphi Analysis Week, CERN
Measurement of pixel efficiency using tracks in the overlaps

Visitors

Institute visitors to Helsinki

Kevin Mulligan (Switzerland)	2. - 5.10.
Jürgen Schukraft (CERN)	1. - 3.10.
Norbert Kroo (Hungary)	3. - 5.9.
Jack Steinberger (CERN)	3. - 5.9.
Horst Wenninger (CERN)	3. - 5.9.
John Iliopoulos (France)	3. - 5.9.
Björn Wiik (Germany)	3. - 5.9.
Steven Chu (USA)	17.12
William D. Phillips (USA)	17.12.

Institute visitors to CERN

Ilkka Hyvärinen (HY)	26. - 28.10.

Theory Program

Statistical Physics and Material Science

Mikko Haataja (Canada)	30.12.96 - 8.1.97, 1. - 5. 6., 16. - 20.6.
Ken Elder (USA)	15.12.96 - 4.1.97, 25.5. - 25.6.,
Nick Provatas (USA)	16. - 18.2. 17. - 27.6.
Andal Narayanan (India)	8.2. - 1.3.
Joachim Krug (Germany)	16. - 19.2.
See-Chen Ying (USA)	23.5. - 16.6.
Liao Chen (USA)	23.5. - 6.6.
Ari Seitsonen (Germany)	23.5. - 6.6.
Kim Sneppen (Denmark)	20. - 23.5.
J. Michael Kosterlitz (USA)	2. - 23.8.
Hans Fogedby (Danmark)	11. - 14.8.
V. Martinez (Spain)	15. - 16.8.
Catalina Mayol (Spain)	15. - 16.8.
Matti Alatalo (USA)	29.9. - 17.10.
Corrado Boragno (Italy)	6. - 9.11.

Laser Physics and Quantum Optics

Anton Zeilinger (Austria)	25. - 27.2.
Paul Julienne (USA)	22. - 28.3.
Wolfgang Ketterle (USA)	25. - 29.3.
Maciej Lewenstein (France)	24. - 28.3.
Martin Wilkens (Germany)	25. - 28.3.
Juha Javanainen (USA)	24. - 28.3.
Gora V. Shlyapnikov (Russia)	24. - 28.3.
Anna Sanpera (France)	24.3 - 4.4.
Emil Lundh (Sweden)	25. - 27.3.
Christer Engdahl (Sweden)	15. - 21.3., 15.9. - 31.12.
Razmik Unanyan (Armenia)	7. - 25.5.
Wolfgang Schleich (Germany)	17. - 20.5.
Barry Garraway (UK)	7. - 18.6.
Milan Noga (Slovakia)	2.8. - 30.8.
Päivi Törmä (Germany)	16. - 19.12.

Mathematical Physics and Field Theory

Kaupo Palo (Estonia)	17. - 22.1., 7. - 12.2.
A. Morozov (Russia)	13. - 17.1., 10. - 14.3.
Yuri Pis'mak (Russia)	19. - 22.2.
David Olive (U.K.)	9. - 16.3.
Yuri Makeenko (Russia)	9. - 16.3.
Olav Tirkkonen (Denmark)	6. - 19.5., 14. - 18.6.
Esko Keski-Vakkuri (USA)	30.5. - 14.6., 29.9. - 12.10.
J. Bricmont (Belgium)	18. - 30.11.

LHC Program

LHC Experiments

Andrzej Eskreys (Poland)	3. - 6.5.
Igor Golutvin (Russia)	11. - 13.5.
CMS Management Board, Finance Board	12. - 13.5.
Juergen Schukraft (CERN)	2.10.
Sung-Keun Park (Korea)	14. - 17.12.
S. J. Hong (Korea)	14. - 17.12.
Youngsang Kim (Korea)	14. - 17.12.
Kyungsei Lee (Korea)	14. - 17.12.

High Energy Physics Program

Phenomenology

Victor Saurin (Russia)	5. - 18.1.
Mauro Anselmino (Italy)	10. - 12.2.
Pran Pandita(India)	6.2. - 6.3.
Andrei Demichev (Russia)	7. - 25.4., 5.8. - 1.9.
Mariana Frank (Canada)	6. - 10.5.
Dhiman Chakraborty (USA)	27. - 29.4.
Nikolai Mitskievich (Mexico)	5.5. - 1.6.
Khosrow Chadan (France)	16.06. - 1.7.
Petr Kulish (Russia)	3.6. - 31.8.
Kazuhiko Nishijima (Japan)	14.5. - 28.6.
Martti Raidal (Spain)	8. - 11.7.
Hong-Jian He (Germany)	2. - 7.8.
Andrei Likhoded (Russia)	2. - 18.8.
Keiji Igi (Japan)	17. - 24.8.
Homayoun Hamidian (Sweden)	26.10. -2.11.
Peter Presnajder (Slovakia)	13.10.-28.11.
Andrei Demichev (Russia)	4. - 30.11.
Vladimir Fainberg (Russia)	6.11. - 12.12.
Valery Khoze	

Technology Program

Kalevi Keto (Helsinki)
Jukka-Pekka Numminen (Helsinki)

Conference Participation and Visits by Personnel

THEORY PROGRAM

Laser Physics and Quantum Optics

Fundamentals of Quantum Optics IV, 12-17 January, Kühtai, Austria (S. Stenholm, P. Öhberg, K.-A. Suominen)

"Hot topics in quantum optics" -meeting, 29-30 January, London, UK (S. Stenholm)

Caltech, University of Berkeley and Stanford, 2-21 February, CA, U.S.A. (S. Stenholm)

Department of Physics, University of Jyväskylä, 20-21 February, Jyväskylä, Finland (K.-A. Suominen)

XXXI Annual Meeting of the Finnish Physics Society, 13-15 March, Helsinki, Finland (S. Stenholm, E. Andersson, P. Öhberg, K.-A. Suominen, M. Havukainen, A. Paloviita)

Minisymposium on Bose-Einstein Condensation, 25-27 March, Helsinki, Finland (S. Stenholm, M. Mallalieu, E. Andersson, P. Öhberg, K.-A. Suominen, M. Havukainen, A. Paloviita)

National Institute of Standards and Technology, 11-24 April, Gaithersburg, MD, U.S.A. (K.-A. Suominen)

Ultrafast processes in chemistry and biology, 16-17 April, London, UK (S. Stenholm)

1997 Joint April meeting of the American Physical Society (APS) and the American Association of Physics Teachers (AAPT), 18-21 April, Washington D.C., USA (K.-A. Suominen)

Cavity QED TMR network meeting, 21-25 April, Les Houches, France (S. Stenholm)

5th Central European Conference on Quantum Optics, 21-25 April, Prague, Czech Republic (S. Stenholm)

Weizmann Institute of Sciences, 26-29 April, Rehovot, Israel (M. Mallalieu)

The Blackett Laboratory, Imperial College, 6-16 May, London, U.K. (M. Havukainen)

Ørsted Laboratory, 24-28 May, Copenhagen, Denmark (K.-A. Suominen)

Commissariat à l'Energie Atomique, DSM/DRECAM/SPAM, Centre d'Etudes de Saclay, 30 May - 8 June, Gif-sur-Yvette, France (K.-A. Suominen)

Nobel symposium on fundamental processes in physics, 13-17 June, Sweden (S. Stenholm)

New Frontiers in Laser-Atom Interactions -summer school, 25 June - 3 July, Sandbjerg Manor, Denmark (S. Stenholm, E. Andersson, P. Öhberg, K.-A. Suominen, M. Havukainen)

European Research Conference on Bose-Einstein Condensation, 12-17 July, Castelvecchio Pascoli, Italy (S. Stenholm, P. Öhberg, K.-A. Suominen)

NorFA Nordic Summer School on Non-Linear Optics, Hensbacka Herrgard, 31 June - 6 August, Munkedahl, Sweden (E. Andersson, P. Öhberg, M. Havukainen)

Department of Physics, University of Jyväskylä, 1 August, Jyväskylä, Finland (K.-A. Suominen)

National Institute of Standards and Technology, 12-24 August, Gaithersburg, MD, U.S.A. (K.-A. Suominen)

European Research Conference on Quantum Optics, 13-18 September, Castelvecchio Pascoli, Italy (S. Stenholm, E. Andersson, P. Öhberg, K.-A. Suominen)

University of Oxford, 4 October, Oxford, U.K. (K.-A. Suominen)

Tutorial Workshop on Quantum Information, 17-19 October, Almagro, Spain (J. Calsamiglia, N. Lütkenhaus, K.-A. Suominen)

University of Ulm, 22-30 October, Ulm, Germany (K.-A. Suominen)

Ulm-Konstanz meeting on Quantum Gases, 23-24 October, Ulm, Germany (K.-A. Suominen)

Department of Physics, University of Jyväskylä, 31 October, Jyväskylä, Finland (J. Martikainen)

Royal Society Meeting: Quantum Computation, 5-6 November, London, UK (J. Calsamiglia, N. Lütkenhaus, K.-A. Suominen)

Novartis Foundation Meeting on Quantum Computation, 7 November, London, UK (K.-A. Suominen)

Nordita and Ørsted Laboratory, 10-16 November, Copenhagen, Denmark (K.-A. Suominen, J. Piilo)

University of Kaiserslautern, 11-18 November, Kaiserslautern, Germany (N. Vitanov)

NorFA Network meeting "Coherent Laser-Atom Interactions", 12-13 November, Lund, Sweden (S. Stenholm, J. Piilo, K.-A. Suominen)

Institute of Physics, Slovak Academy of Sciences, 30 November - 19 December, Bratislava, Slovakia (M. Havukainen)

University of Stockholm and KTH, 3-8 December, Stockholm, Sweden (K.-A. Suominen)

Current Trends in Laser Cooling, 4-5 December, Stockholm, Sweden (J. Piilo, K.-A. Suominen, S. Stenholm)

Mathematical Physics and Field Theory

Nonequilibrium systems, 6-12 January, Oberwolfach, Germany (A. Kupiainen)

Fifth Nordic Meeting on Supersymmetric Field and String Theories, 10-12 March, Helsinki, Finland (C. Montonen)

XXXI Annual Meeting of the Finnish Physical Society, 13-15 March, Helsinki, Finland (C. Montonen)

First Caribbean Workshop on Quantum Mechanics, Particles and Fields, CIMAF '97, 24-28 March, Havana (C. Montonen)

Mathematical physics conference, 25 March - 1 April, Atlanta, USA (A. Kupiainen)

Turbulence semester, 1-30 April, IHES, France (A. Kupiainen)

Isaac Newton Institute for Mathematical Sciences, 15-20 April, Cambridge, UK (C.Montonen)

Fourth Irish Quantum Field Theory Meeting, 23-25 May, Trinity College, Dublin, Ireland (C. Montonen)

Visit to IHES, 1-30 June, France (A. Kupiainen)

Confinement, Duality and Non-perturbative Aspect of QCD, 23 June - 4 July, Cambridge, UK (J. Lukkarinen)

The Second International Mathematica Symposium, IMS'97, 30 June - 4 July, Rovaniemi, Finland (S. Virtanen)

Field, String and Quantum Gravity, 18-26 July, University of British Columbia, Vancouver, Canada (W.-F. Chen)

Disordered systems, 8-12 September, Cambridge, UK (A. Kupiainen)

Functional integration semester, Inst.H.Poincare, 15 October - 15 November, Paris, France (A. Kupiainen)

Seventh Nordic Meeting on Supersymmetric Field and String Theories, 24-26 November, Uppsala, Sweden (C. Montonen)

Statistical Physics and Material Science

Brown University, 6 January - 11 March, Providence R.I., USA (T. Hjelt)

Brown University, 6-22 January, Providence R.I., U.S.A. (T. Ala-Nissilä)

Canadian Institute of Advanced Research, 24 January - 9 February, Toronto, Canada (M. Dubé)

31 January - 14 March, Edinburgh, Scotland (R. Linna)

International Workshop on Physics of Structurally Disordered Materials, 14-16 February, University of Jyväskylä, Finland (T. Ala-Nissilä, M. Dubé, J. Heinonen, I. Koponen, E. Kuusela, M. Kuittu, S. Majaniemi I. Vattulainen, J. Vinnurva)

Brown University, 24 February - 8 March, Providence, USA (I. Vattulainen)

26-27 February, Berlin, Germany (T. Ala-Nissilä)

University of Illinois at Urbana-Champaign, Oakland, USA, McGill Univ., Montréal, Canada, 26 February - 26 March (S. Majaniemi)

27 February - 2 March, Copenhagen, Denmark (T. Ala-Nissilä, M. Dubé)

XXXI Finnish Physical Society, 13-15 March, Helsinki, Finland (T. Ala-Nissilä, M. Dubé, J. Heinonen, T. Hjelt, I. Koponen, E. Kuusela, M. Kuittu, I. Vattulainen)

IMEDEA, 24 March - 13 May, Palma de Mallorca, Spain (T. Ala-Nissilä)

IMEDEA, 21 April - 5 May, Palma de Mallorca, Spain (M.Dubé, S. Majaniemi)

Graduate School Workshop on Adatom Dynamics and Diffusion on Surfaces, 2-5 June, Helsinki Institute of Physics, Helsinki, Finland (T. Ala-Nissilä)

NORDITA, 11-15 June, Copenhagen and Hillerod, Denmark (T. Ala-Nissilä, I. Vattulainen)

11th Nordic Symposium on Computer Simulation, 13-15 June, Hillerød, Denmark (T. Ala-Nissilä)

COSA Workshop, University of Jyväskylä, 9-10 August, Jyväskylä, Helsinki (T. Ala-Nissilä, S. Majaniemi I. Vattulainen)

IX International Summer School on Fundamental Problems in Statistical Physics, 15-28 August, Altenberg, Germany (J. Heinonen, S. Majaniemi)

16-22 August, Humlebaek, Denmark (P. Salo)

ECOSS 17 - 17th European Conference on Surface Science, 16-19 September, Enschede, The Netherlands (T. Ala-Nissilä, J. Heinonen, T. Hjelt, I. Koponen, P. Salo, I. Vattulainen)

COSA Conference, 3-5 October, Seili, Finland (M. Dubé, M. Kuittu, S. Majaniemi, M. Rost)

23-31 October, Lehigh and Providence, U.S.A. (T. Ala-Nissilä)

Workshop on Current Issues in Non-equilibrium Statistical Mechanics and Materials, Lehigh University, 24-25 October, Lehigh, U.S.A. (T. Ala-Nissilä)

27 October - 2 November, Copenhagen, Denmark (M. Dubé)

Statphys Network Meeting and NORDITA, 26-29 November, Copenhagen, Denmark (I. Vattulainen)

Statphys Network Meeting and NORDITA, 27-29 November, Copenhagen, Denmark (M. Rost)

Statphys Network Meeting, 28-29 November, Copenhagen, Denmark (T. Ala-Nissilä)

Graduate School Workshop on Surface Reactions and Clusters at Surfaces, 12-14 December, University of Oulu, Finland (T. Ala-Nissilä, T. Hjelt, P. Salo, J. Heinonen, I. Koponen)

13 December 1997 - 19 January 1998, Detroit, USA and Montreal, Canada (M. Dubé)

HIGH ENERGY PHYSICS PROGRAM

Phenomenology

ACCU-meeting, 12 March, CERN, Geneva, Switzerland (K. Huitu)

XXXI Annual Meeting of the Finnish Physical Society, 13-15 March, Helsinki, Finland (K. Puolamäki, K. Huitu)
DELPHI analysis week, 8 April, CERN, Geneva, Switzerland (R. Vuopionperä)

Beyond the Standand Model V, 30 April - 5 May, Balholm, Norway (K. Huitu, K. Puolamäki)

ACCU-meeting, 11 June, CERN, Geneva, Switzerland (K. Huitu)

DELPHI analysis week, 30 June, CERN, Geneva, Switzerland (R. Vuopionperä)

Rockefeller University and the University of California at Irvine, 10-31 July, USA (M. Chaichian)

SLAC Summer Institute, 4-15 August, San Francisco, USA (K. Puolamäki)

EPS HEP, 19-26 August, Jerusalem, Israel (K. Huitu)

R-ECFA -meeting, 5 September, Helsinki, Finland (M. Chaichian, K. Huitu, K. Puolamäki)

ACCU-meeting, 17 September, CERN, Geneva, Switzerland (K. Huitu)

XXI School of Theoretical Physics, Ustron'97, 18-25 September, Ustron, Poland (R. Vuopionperä)

CMS Physics meeting, 9 December, CERN, Geneva, Switzerland (K. Huitu)

ACCU-meeting, 10 December, CERN, Geneva, Switzerland (K. Huitu)

Electron-Positron Physics

CERN, 1 January - 31 May and 8-10 June, Geneva, Switzerland (P. Eerola)

Advanced Detectors, 1-4 February, London, UK (R. Orava)

Presentations and Discussions on Parton Reconstruction, 24 February - 10 March, Chicago, San Francisco, USA (R. Orava)

R-ECFA -meeting, 28 February - 1 March, Madrid, Spain (P. Eerola)

Les Rencontres de Physique de la Vallee d'Aoste, 1-8 March, La Thuile, Italy (M. Battaglia)

ATLAS -collaboration meeting, 3-7 March, CERN, Geneva, Switzerland (P. Eerola)

XXXI Annual Meeting of the Finnish Physical Society, 13-15 March, Helsinki, Finland (K. Honkavaara)

Seminar at SLAC, Stanford, USA and Conference on B Physics and CP Violation, Honolulu, USA 16-28 March, (M. Battaglia)

1997 APS/AAPT Conference, 18-21 April, Washington D.C., USA (R. Ostonen)

EPS HEPPB -meeting, 18 April, Mulhouse, France (R. Orava)

R-ECFA -meeting, 24-26 April, Wien and Bratislava (P. Eerola)

Steering Committee -meeting, 23-31 May, Helsinki, Finland (R. Orava)

7th Pisa meeting on advanced detectors, 25-31 May, Isola d'Elba, Italy (K. Kurvinen)

Seminar on Parton Reconstruction, 20-21 June, Larnaca, Cyprus (R. Orava)

TESLA Test Facility -meeting, 25-27 June, Orsay, France (K. Honkavaara)

TESLA Test Facility -meeting, 26-27 June, Orsay, France (R. Orava)

HEP Project -meetings, 9-13 July, Helsinki, Finland (R. Orava)

International Conference on HEP, 19-26 August, Jerusalem, Israel (H. Saarikko)

EU Concerted Action, 28 August, Bruxelles, Belgium (R. Orava)

R-ECFA Presentation, SAB Presentation, Steering Committee and HEP Projects -meetings, 29 August - 15 September, Helsinki, Finland and DESY, Hamburg, Germany (R. Orava)

CERN Accelerator School, Intermediate Accelerator Physics, 1-12 September, Gjovik, Norway (K. Honkavaara)

RECFA -meeting, 4-11 September, Helsinki, Finland (M. Battaglia, R. Ostonen)

R-ECFA -meeting, 5-6 September, Helsinki, Finland (P. Eerola)

DELPHI Collaboration Meeting, 20-26 September, Santander, Spain (M. Battaglia)

Linear Collider International Workshop LC '97, 27 September - 3 October, Zvenigorod, Russia (M. Battaglia, K. Österberg)

HEP project -meeting, 2-6 October, CERN, Geneva, Switzerland (J. Heino, K. Kurvinen)

HERA-B -collaboration meeting, 8-11 October, DESY, Hamburg, Germany (P. Eerola)

DIPAC 97 (3rd European Workshop on Beam Diagnostics and Instrumentation for Particle Accelerators), 12-14 October, Frascati, Italy (K. Honkavaara)

TESLA Test Facility -meeting, 10-12 November, Zeuthen (Berlin), Germany (K. Honkavaara)

ATLAS -collaboration meeting, 17-20 November, CERN, Geneva, Switzerland (P. Eerola)

HEP Project -meetings, 25-30 November, Helsinki, Finland (R. Orava)

Advanced Detectors, 1-7 December, Chicago, USA (R. Orava)

R-ECFA -meeting, 4-5 December, CERN, Geneva, Switzerland (P. Eerola)

LHC PROGRAM

LHC Experiments

University of Bern, 17-22 January, Bern, Switzerland (J. Tuominiemi)

Korea University, 19 February - 1 March, Soul, Korea (E. Pietarinen)

International Workshop on LHC-CMS, 24-26 February, Korean Advanced Institute of Science and Technology, Daejong, Korea (E. Pietarinen)

Computing in High Energy Physics - CHEP'97, 7-11 April, Berlin, Germany (V. Karimäki)

Particle Accelerator Conference - PAC'97, 12-16 May, Vancouver, Canada (J. Klem)

Hadron Collider Physics XII, 5-11 June, Stony Brook, U.S.A. (R. Kinnunen, invited talk)

Symposium on CMS Trigger, Data Acquisition and Computing, 10-13 June, University of Padova, Italy (V. Karimäki, invited presentation)

University of Pisa, 24-25 July, Pisa, Italy (K. Skog)

International Conference on HEP, EPS HEP97, 19-26 August, Jerusalem, Israel (J. Tuominiemi, invited talk)

Microelectronics Laboratory, University of Oulu, 29 August - 2 September, Kemi, Finland (K. Skog)

LHC Workshop, 15-17 October, University of Stockholm, Stockholm, Sweden (K. Banzuzi)

University of Bern, 2-18 November, Bern, Switzerland (J. Tuominiemi)

Several Visits to CERN, Geneva, Switzerland (K. Banzuzi, C. Eklund, T. Mäenpää, E. Pietarinen, H. Saarikoski, J. Tuominiemi)

TECHNOLOGY PROGRAM

Process and Quality Control

Symposium of Le Club Européen d'Enterprises on "New Information Technologies, Intranet - Internet", 19 November, Louveciennes, France (Ari-Pekka Hameri)

Distributed Data Management

JavaOne Sun's 1997 Worldwide Java Developer Conference, 2-4 April, San Francisco, USA (T. Kunnas)

Sixth World Wide Web Conference (WWW6), 7-12 April, San Francisco, U.S.A. (T. Kunnas, R. Puittinen)

PDM Europe '97, 28-30 October, Noordwijk, The Netherlands (J. Nikkola, T. Kunnas)

ADMINISTRATION

CMS -meeting,, Steering Committee Meeting, 20-23 January, CERN, Geneva, Switzerland (Eero Byckling)

Steering Committee Meeting, 24 January, CERN, Geneva, Switzerland (Erkki Pajanne)

DESY, 23-24 January, Hamburg, Germany (Eero Byckling)

CERN, 21 March, Geneva, Switzerland (Erkki Pajanne)

DELPHI, Tuovi, Steering Group, ATLAS RRB, CMS RRB, Finland at CERN -meetings, 2-24 April, CERN, Geneva, Switzerland (Eero Byckling)

Interaktiivinen teknologia koulutuksessa, 4-5 April, Aulanko, Finland (R. Rinta-Filppula)

Steering Committee Meeting, 8 April, CERN, Geneva, Switzerland (Erkki Pajanne)

University of Jyväskylä, 6 May, Jyväskylä, Finland (Eero Byckling)

DESY, 8-9 May, Hamburg, Germany (Eero Byckling)

ALICE, Tuovi, CERN-management -meetings, 2-6 June, CERN, Geneva, Switzerland (Eero Byckling)

CERN-finances and Tuovi -meetings, interviews, 12-15 June, CERN, Geneva, Switzerland (Eero Byckling)

CERN, 17 June, Geneva, Switzerland (Erkki Pajanne)

NORDUnet '97 Conference, 29 June - 1 July, Reykjavik, Iceland (R. Rinta-Filppula)

Pedagogical Methods and Technical Solutions for Distance Learning III - Research Symposium, 16-17 October, Tampere, Finland (R. Rinta-Filppula)

ATLAS RRB, CMS RRB, ALICE RRB-meetings, 19-23 October, CERN, Geneva, Switzerland (Eero Byckling)

CERN, 28 October, Geneva, Switzerland (Erkki Pajanne)

Steering Committee, Tuovi, Celphi RRB -meetings, 10-14 November, CERN, Geneva, Switzerland (Eero Byckling)

Steering Committee -meeting, 8-12 November, CERN, Geneva, Switzerland (Erkki Pajanne)

Seminar on Technology Transfer, 27-30 November, CERN, Geneva, Switzerland (Eero Byckling)

Publications

Theory Program

Mathematical Physics and Field Theory

J. Bricmont and A. Kupiainen,
Infinite dimensional SRB measures,
Physica D 103 (1997) 18-33

M. Chaichian, W.-F. Chen and H. C. Lee,
Differential regularization of Chern-Simons spinor and scalar electrodynamics,
Phys. Lett. B 409 (1997) 325-330

L. D. Faddeev and A. J. Niemi,
Stable knot-like structures in classical field theory,
Nature 387 (1997) 58-61

R. M. Kashaev,
The hyperbolic volume of knots from the quantum dilogarithm,
Lett. Math. Phys. 39 (1997) 269-275

R. M. Kashaev and N. Reshetikhin,
Affine Toda field theory as a three-dimensional integrable system,
Commun. Math. Phys. 188 (1997) 251-266

T. Kärki and A. J. Niemi,
Supersymmetric quantum mechanics and the DeWitt effective action
Phys. Rev. D 56 (1997) 2080-2085

A. Yu. Volkov,
Beyond the "pentagon identity",
Lett. Math. Phys. 39 (1997) 393-397

Laser Physics and Quantum Optics

B. M. Garraway and N. Vitanov,
Population dynamics and phase effects in periodic level crossings,
Phys. Rev. A 55 (1997) 4418-4432

M.A.M. Marte and S. Stenholm,
Paraxial light and atom optics: the optical Schrödinger equation and beyond,
Phys. Rev. A 56 (1997) 2940-2953

A. Paloviita and K.-A. Suominen,
Molecular excitation by large-area ultrashort pulses,
Phys. Rev. A 55 (1997) 3007-3013

A. Paloviita, K.-A. Suominen and S. Stenholm,
Weisskopf-Wigner model for wavepacket excitation,
J. Phys. B 30 (1997) 2623-2633

S. Stenholm,
Field theoretic description of confined Bosons,
J. Mod. Opt. 44 (1997) 2533-2550

S. Stenholm,
Quantum theory of linear friction,
Revista brasileira de fisica 27 (1997) 214-237

S. Stenholm,
Self-consistent excitations in an inhomogeneous Bose condensate,
Ann. Phys. 254 (1997) 41-68

S. Stenholm and A. Paloviita
States prepared by decay
J. Mod. Opt. 44 (1997) 2533-2550

S. Stenholm and K.-A. Suominen,
The wave packet-a universal quantum object,
Acta physica Slovaca 47 (1997) 251-258

S. Stenholm and M. Wilkens,
Jumps in quantum theory,
Contemporary physics 38 (1997) 257-268

P. Törmä and I. Jex,
Two-mode entanglement in passive networks,
J. Mod. Opt. 44 (1997) 875-882

N. Vitanov and S. Stenholm,
Analytic properties and effective two-level problems in stimulated Raman adiabatic passage,
Phys. Rev. A 55 (1997) 648-660

N. Vitanov and S. Stenholm,
Population transfer by delayed pulses via continuum states,
Phys. Rev. A 56 (1997) 741-747

N. Vitanov and S. Stenholm,
Population transfer via a decaying state,
Phys. Rev. A 56 (1997) 1463-1471

N. Vitanov and S. Stenholm,
Properties of stimulated Raman adiabatic passage with intermediate-level detuning,
Opt. Comm. 135 (1997) 394-405

N. Vitanov and S. Stenholm,
Pulsed excitation of a transition to a decaying level,
Phys. Rev. A 55 (1997) 2982-2988

N. Vitanov and K.-A. Suominen,
Time-dependent control of ultracold atoms in magnetic traps,
Phys. Rev. A 56 (1997) R4377-R4380

P. Öhberg and S. Stenholm,
A Hartree-Fock study of a Bose condensed gas,
J. Phys. B 30 (1997) 2749-2760

P. Öhberg, E. L. Surkov, I. Tittonen, S. Stenholm, M. Wilkens and G. V. Shlyapnikov,
Low-energy elementary excitations of a trapped Bose-condensed gas,
Phys. Rev. A 56 (1997) R3346-R3349

Statistical Physics and Material Science

T. Hjelt, I. Vattulainen, J. Merikoski and T. Ala-Nissilä,
A dynamical mean field theory for the study of surface diffusion constants,
Surface science 380 (1997) L501-L505

J. Maunuksela and T. Ala-Nissilä,
Kinetic roughening in slow combustion of paper,
Phys. Rev. Lett. 79 (1997) 1515-1518

J. Merikoski, I. Vattulainen, J. Heinonen and T. Ala-Nissilä,
Effect of kinks and concerted diffusion mechanisms on mass transport and growth on stepped metal surfaces,
Surface science 387 (1997) 167-182

N. Provatas, S. Majaniemi and T. Ala-Nissilä,
Growth, percolation, and correlations in disordered fiber networks,
J. Stat. Phys. 87 (1997) 385-413

N. Provatas, S. Majaniemi and T. Ala-Nissilä,
Structural properties of disordered fibre networks,
Physica A 239 (1997) 304-313

I. Vattulainen, J. Merikoski and T. Ala-Nissilä,
Non-Arrhenius behaviour of surface diffusion near a phase transition boundary,
Phys. Rev. Lett. 79 (1997) 257-260

Other publications in the Theory Program

A. M. Green and S. Wycech,
η -nucleon scattering length and effective range,
Phys. Rev. C 55 (1997) R2167-R2170

A. M. Green, C. Michael and P. S. Spencer,
Structure of flux tubes in SU(2),
Phys. Rev. D 55 (1997) 1216-1225

P. Pennanen,
Continuum extrapolation of energies of a four-quark system in lattice gauge theory,
Phys. Rev. D 55 (1997) 3958-3965

P. Pennanen,
Four quarks from lattice to the continuum,
Nucl. Phys. B 53 (1997) 334-337

P. Pennanen, A.M. Green and C. Michael,
Flux-tube structure and beta-functions in SU(2),
Phys. Rev. D 56 (1997) 3903-3916

High Energy Physics Program

Phenomenology

G. Barenboim, K. Huitu, J. Maalampi and M. Raidal,
Constraints on doubly charged Higgs interactions at linear collider,
Phys. Lett. B 394 (1997) 132-138

M. Chaichian, A. P. Demichev and P. P. Kulish,
Quasi-classical limit in q-deformed systems, non-commutativity and the q-path integral,
Phys. Lett. A 233 (1997) 251-260

M. Chaichian and M. Hayashi,
Evolution of coupling constant in hot QCD,
Int. J. Mod. Phys. E 6 (1997) 45-64

M. Chaichian, R. Gonzalez Felipe and D. Louis Martinez,
Spinning relativistic particle in an external electromagnetic field,
Phys. Lett. A 236 (1997) 188-192

M. Chaichian, W. F. Chen and H. C. Lee,
Differential regularization of Chern-Simons-Maxwell spinor and scalar electrodynamics,
Phys. Lett. B 409 (1997) 325-330

K. Huitu, J. Maalampi, A. Pietilä and M. Raidal,
Doubly charged Higgs at LHC,
Nucl. Phys. B 487 (1997) 27-42

Electron-Positron Physics & Detector Research and Development

(M. Battaglia, S. Czellar, K. Kurvinen, R. Lauhakangas, R. Orava, H. Saarikko and K.Österberg in P. Abreu et al.)

P. Abreu et. al.,
A precise measurement of the B_d^0 meson lifetime using a new technique,
Zeit. Physik C 74 (1997) 19-32

P. Abreu et. al.,
Measurement of event shape and inclusive distributions at $\sqrt{s}$ = 130 and 136 GeV,
Zeit. Physik C 73 (1997) 229-242

P. Abreu et. al.,
Search for lepton flavour number violating Z° decays,
Zeit. Physik C 73 (1997) 243-251

P. Abreu et. al.,
Search for neutral heavy leptons produced in Z decays,
Zeit. Physik.C 74 (1997) 57-71

P. Abreu et. al.,
Search for new phenomena using single photon events at LEP1,
Zeit. Physik C 74 (1997) 577-586

P. Abreu et al.,
A study of the reaction $e^+e^- \rightarrow \mu^+\mu^-\gamma_{ISR}$ at LEP and search for new physics at annihilation energies near 80 GeV,
Zeit. Physik C 75 (1997) 581-592

P. Abreu et. al.,
Measurement of the $B_d^0 - \bar{B}_d^0$ oscillations,
Zeit. Physik C 76 (1977) 579-598

P. Abreu et. al.,
A measurement of α_s from the scaling g violation in e^+e^- annihilation,
Phys. Lett. B 398 (1997) 194-206

P. Abreu et. al.,
An upper limit for Br(Z° to ggg) from symmetric 3-jet Z° hadronic decays,
Phys. Lett. B 389 (1997) 405-415

P. Abreu et. al.,
Identified particles in quark and gluon jets,
Phys. Lett. B 401 (1997) 118-130

P. Abreu et. al.,
Measurement and interpretation of the W-pair cross-section in e^+e^- interactions at 161 GeV,
Phys. Lett. B 397 (1997) 158-170

P. Abreu et. al.,
Measurement of correlations between pions from different W's in $e^+e^- \rightarrow W^+W^-$ events,
Phys. Lett. B 401 (1997) 181-191

P. Abreu et. al.,
Measurement of the multiplicity of gluons splitting to bottom quark pairs in hadronic Z° decays,
Phys. Lett. B 405 (1997) 202-214

P. Abreu et. al.,
Measurement of the spin-density matrix for the r^o, $K^{*o}(892)$ and ϕ produced in Z^0 decays,
Phys. Lett. B 406 (1997) 271-286

P. Abreu et. al.,
Measurement of the transverse spin correlation in $Z \rightarrow \tau^+\tau^-$ decays,
Phys. Lett. B 404 (1997) 194-206

P. Abreu et. al.,
Search for Excited Leptons in e^+e^- Collisions at $\sqrt{s}$ = 161 GeV,
Phys. Lett. B 393 (1997) 245-260

P. Abreu et. al.,
Search for stable heavy charged particles in e^+e^- collisions at $\sqrt{s}$ = 130 to 136, 161 and 172 GeV,
Phys. Lett. B 396 (1997) 315-326

P. Abreu et. al.,
Search for the B_c meson,
Phys. Lett. B 398 (1997) 207-222

P. Abreu et al.,
Observation of charge-ordering in particle production in hadronic Z° decay,
Phys. Lett. B 407 (1997) 174-184

(R. Ostonen and M. Sarakinos in M. Acciarri et al.)

M. Acciarri et al.,
K_s^0 and Lambda production in quark and gluon jets at LEP,
Phys. Lett. B 407 (1997) 389-401

M. Acciarri et al.,
Measurement of hadron and lepton-pair production at 161 GeV<$\sqrt{s}$ <172 GeV at LEP,
Phys. Lett. B 407 (1997) 361-376

M. Acciarri et al.,
Cross section of hadron production in gamma gamma collisions at LEP,
Phys. Lett. B 408 (1997) 450-464

M. Acciarri et al.,
QCD studies and determination of α_s in e^+e^- collisions at $\sqrt{s}$ =161 GeV and 172 GeV,
Phys. Lett. B 404 (1997) 390-402

M. Acciarri et al.,
Inclusive J, ψ' and χ_c production in hadronic Z decays,
Phys. Lett. B 407 (1997) 351-360

M. Acciarri et al.,
Production of e, μ and τ pairs in untagged two-photon collisions at LEP,
Phys. Lett. B 407 (1997) 341-350

M. Acciarri et al.,
Production of single W bosons at LEP,
Phys. Lett. B 403 (1997) 168-176

M. Acciarri et al.,
Pair-production of W bosons in e^+e^- interactions at $\sqrt{s}$=161 GeV,
Phys. Lett. B 398 (1997) 223-238

M. Acciarri et al.,
Search for excited leptons in e^+e^- annihilation at $\sqrt{s}$=161 GeV,
Phys. Lett. B 401 (1997) 139-149

M. Acciarri et al.,
Measurement of $D_s^- \rightarrow \tau\nu_\tau$ and a new limit for $B^- \rightarrow \tau\nu_\tau$,
Phys. Lett. B 396 (1997) 327-337

M. Acciarri et al.,
Study of the weak charged hadronic current in b decays,
Phys. Lett. B 393 (1997) 477-486

M. Acciarri et al.,
Measurement of inclusive ω and η' production in hadronic Z decays,
Phys. Lett. B 393 (1997) 465-476

M. Acciarri et al.,
Search for exclusive B decays to J and η or π^0 with the L3 detector,
Phys. Lett. B 391 (1997) 481-490

M. Acciarri et al.,
Search for neutral B meson decays to two charged leptons,
Phys. Lett. B 391 (1997) 474-480

(P. Eerola in A. Airapetian et al.)

A. Airapetian et al. (ATLAS Collaboration),
ATLAS Inner Detector Technical Design Report Volume 1,
CERN/LHCC/ 97-16, ATLAS TDR 4

A. Airapetian et al. (ATLAS Collaboration),
ATLAS Inner Detector Technical Design Report Volume 2,
CERN/LHCC/ 97-17, ATLAS TDR 5

A. Airapetian et al. (ATLAS Collaboration),
ATLAS Magnet System Technical Design Report,
CERN/LHCC/ 97-18, ATLAS TDR 6

A. Airapetian et al. (ATLAS Collaboration),
ATLAS Barrel Toroid Technical Design Report,
CERN/LHCC/ 97-19, ATLAS TDR 7

A. Airapetian et al. (ATLAS Collaboration),
ATLAS End-Cap Toroids Technical Design Report,
CERN/LHCC/ 97-20, ATLAS TDR 8

A. Airapetian et al. (ATLAS Collaboration),
ATLAS Central Solenoid Technical Design Report,
CERN/LHCC/ 97-21, ATLAS TDR 9

A. Airapetian et al. (ATLAS Collaboration),
ATLAS Muon Spectrometer Technical Design Report,
CERN/LHCC/ 97-22, ATLAS TDR 10

LHC Program

LHC Experiments

M. Juntunen, V. Karimäki, R. Kinnunen, M. Pimiä, J. Tuominiemi and T. Tuuva in C. Albajar et al.,
Measurement of momentum and angular distribution of punchthrough muons at the RD5 experiment,
Nucl. Instr. Meth. in Phys. Res. 386 (1997) 421-430

M. Dzelalija, Z. Antunovic and R. Kinnunen,
Study of the associated production modes Wh, tth in the minimal supersymmetric standard model in CMS,
J. Phys. G 23 (1997) 1077-1084

Technology Program

E. Autio, A.-P. Hameri and M. Nordberg,
A framework of motivations for industry-big science collaboration: a case study,
J. Eng. Tech. Man. 13 (1997) 301-314

G. Bachy and A.-P. Hameri,
What to be implemented at the early stage of a large-scale project,
Int. J. Proj. Man. 15 (1997) 211-218

A.-P. Hameri,
Innovating from big science research,
J. Tech. Transf. vol. 22, no. 3 (1997) 27-36

A.-P. Hameri,
Project management in a long-term and global one-of-a-kind project,
Int. J. Proj. Man. 15 (1997) 151-157

A.-P. Hameri,
Technology transfer between basic research and industry,
Technovation 16 (1996) 51-57

A.-P. Hameri and J. Nihtilä,
Distributed new product development project based on Internet and World-Wide Web: a case study,
J. Prod. Inn. Man. 14 (1997) 77-86

A.-P. Hameri and J. Nikkola,
Case-Based Reasoning in Manufacturing Systems Design - Validating the Creative Inference Method,
Int. J. Manufacturing System Design vol. 2, no. 4 (1997) 297-305

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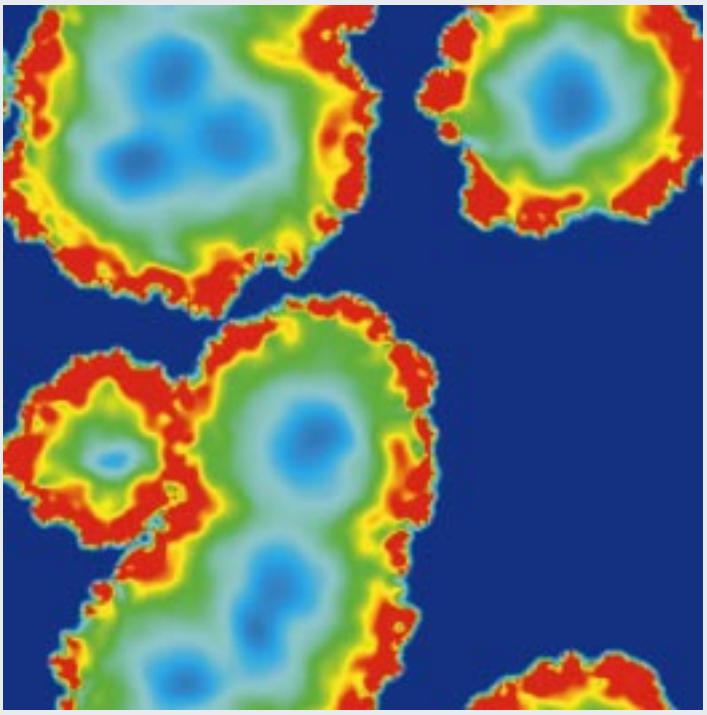
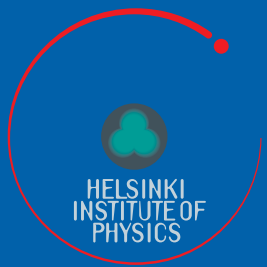


Propagation of randomly nucleating combustion fronts in a uniformly random background of reactants. Red denotes the region with the highest temperature where combustion takes place, while dark blue denotes the cool background. The kinetic roughening of the fire fronts is of the Kardar-Parisi-Zhang type (cf p. 7). This figure has been obtained by numerically solving a continuum phase-field model of slow combustion.



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