

# EDU @JSC

**SIAM CSE  
2011**

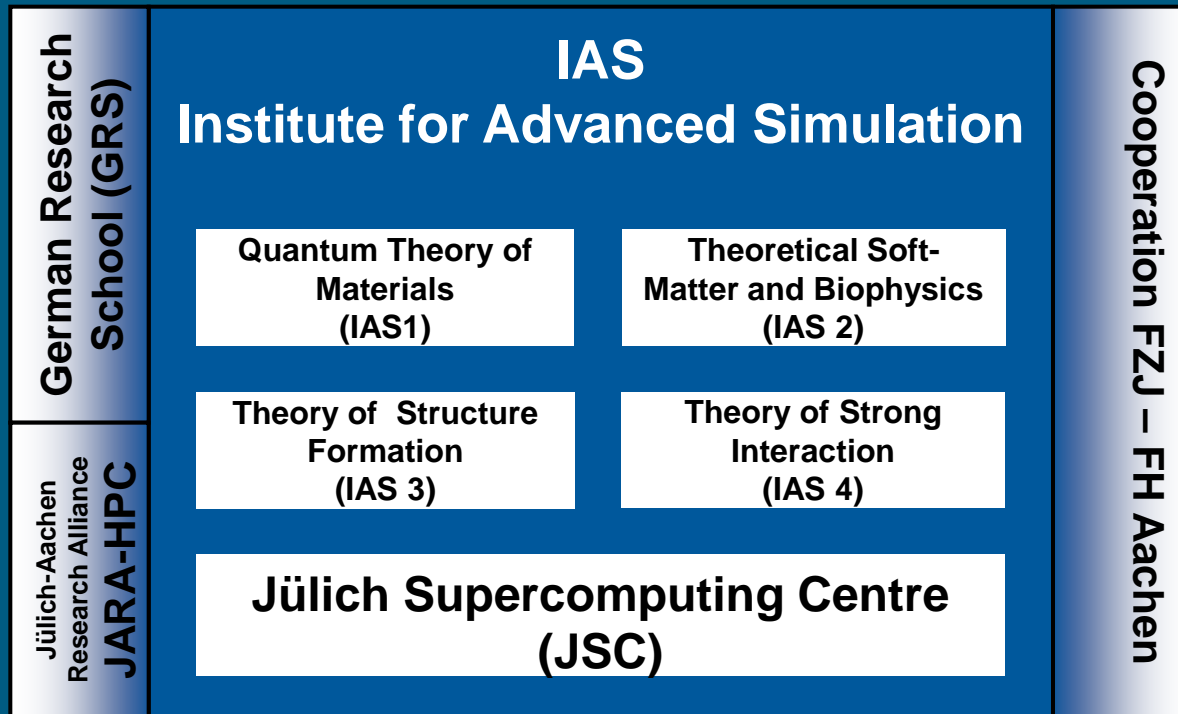
Johannes Grotendorst  
Jülich Supercomputing Centre (JSC)



# Outline

- Jülich Supercomputing Centre (JSC)
  - Domain-specific research and support
- JSC partners for education
- Degree programmes
  - Bachelor Scientific Programming
  - Master Technomathematics
- German Research School for Simulation Sciences (GRS)
- Guest student programme
- Summer/Winter schools

# IAS Structure and Partnerships

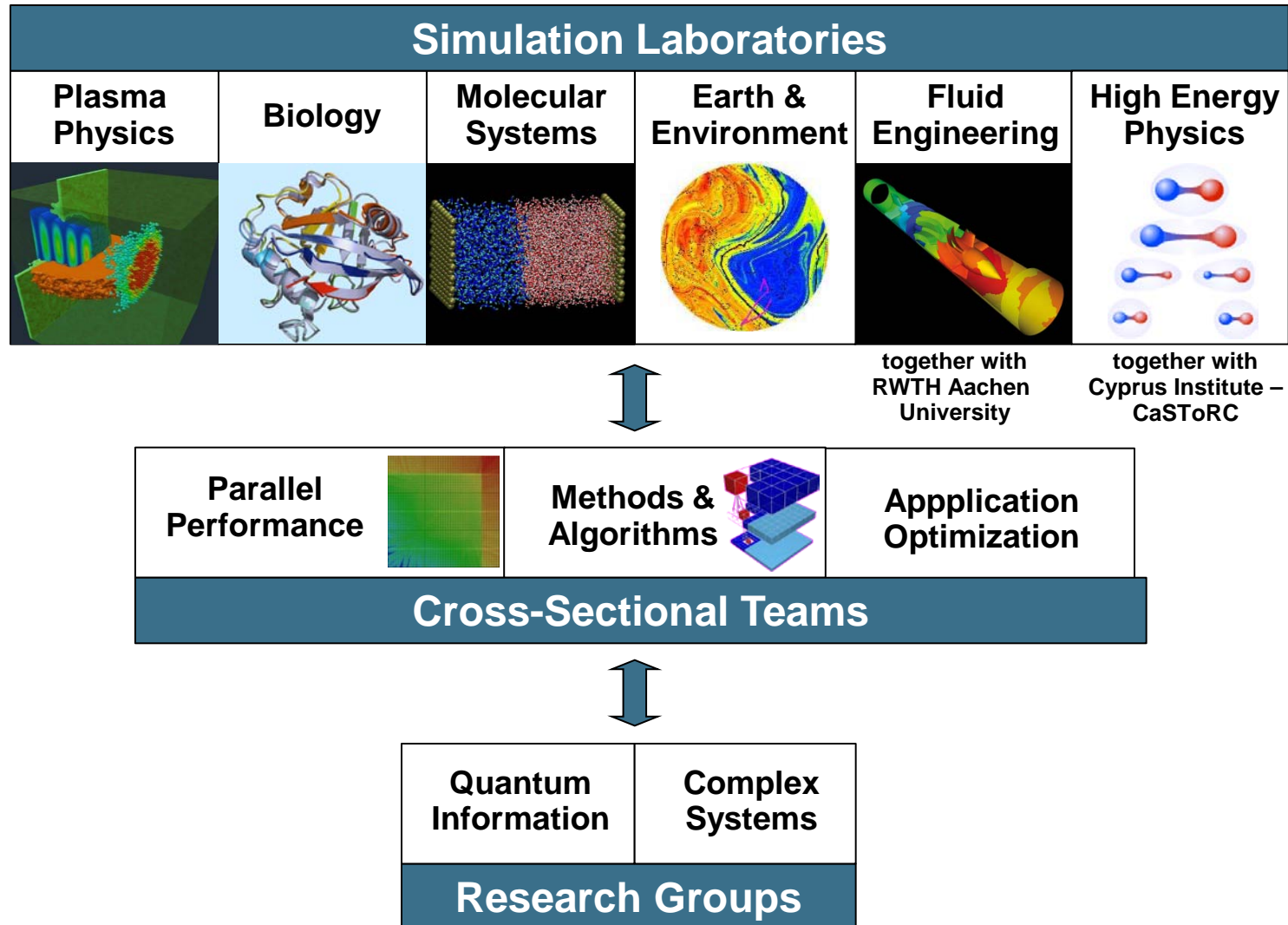


**Partnership for Advanced Computing in Europe (PRACE)**

## Main Tasks of JSC

- **Operation** of the supercomputers for local, national and European scientists
- **User support**: application tuning; domain-specific support through **simulation laboratories**
- **R&D**: architectures, algorithms, performance analysis and tools, GRID computing
- **Education** and training of students and users -> topic of the talk

# Domain-specific Research and Support



# Simulation Labs: Structure

## Personnel

- 1 senior scientist
- 1-2 postdocs
- 1-2 technical staff (software development, parallel programming)
- Jointly supervised PhD & MSc students

## Research

- Common/generic simulation methods
- Scalable algorithms
- Project work with partners

## Support

- Porting/tuning/benchmarking
- Algorithm scaling
- Training

# JSC Partners for Education

- Cooperations with universities
  - Joint Bachelor and Master courses
  - Joint appointments of professors by JSC and universities
    - RWTH Aachen University
    - Aachen University of Applied Sciences
    - University of Wuppertal
    - University of Regensburg
  
- European network CECAM

## CECAM Node in Jülich

### Centre Européen de Calcul Atomique et Moléculaire (CECAM)

- 8 nodes have been set up in France, Germany, Italy, Ireland, The Netherlands and UK
- The nodes promote and establish leading research activities in the fields of **molecular simulations, multi-scale modeling and algorithms**
- The nodes form a network structure, working together towards a European software and knowledge base

### Jülich joined CECAM as active node in 2010

- IAS will organize and run CECAM-specific activities, such as workshops, tutorials, schools and visitor programmes





# Bachelor Scientific Programming MATSE

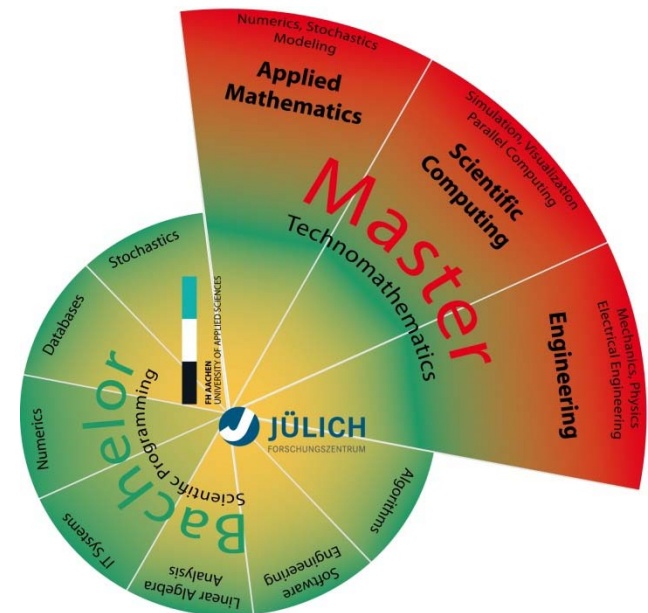
- Cooperation between JSC and Aachen University of Applied Sciences (FH Aachen) since 2007
- Dual integral education programme
  - Apprenticeship ‘Mathematical Technical Software Developer’ (MATSE)
  - Bachelor course Scientific Programming
- Curriculum
  - 50% mathematics and 50% computer science
  - Three-year course
- Lectures are organized by JSC
- Practical work at Jülich instituts or partner companies
- 30 students per year
- **More details by Oliver Bücker in the poster session**

# Bachelor Scientific Programming Curriculum

1st Semester Winter 30 CP	2nd Semester Summer 30 CP	3rd Semester Winter 30 CP	4th Semester Summer 30 CP	5th Semester Winter 30 CP	6th Semester Summer 30 CP
Programming in Java 5 + 5 CP		Databases 5 CP	Practical work 5 CP	Practical work 10 CP	Bachelor colloquium 3 CP
IT fundamentals 5 CP	Algorithms 10 CP	2nd Programming language 5 CP	IT systems 5 CP		General competencies 10 CP
Analysis 1 10 CP		Software engineering 10 CP	Computer networks 5 CP	Elective course 1 5 CP	
Mathematical fundamentals 5 CP	Analysis 2 10 CP		Numerics 10 CP		
Linear Algebra 5 + 5 CP		Stochastics 10 CP		Elective course 2 5 CP	Elective course 4 5 CP

# Master Technomathematics

- **Consecutive master** with focus on mathematical and computational know-how needed at FZ Jülich
  - Applied mathematics, simulation, scientific computing, engineering
- **Lecture courses**
  - held by professors and JSC senior scientists with lectureship
- Two-year master with a research-oriented final master project
- 30 students per year
- Education programme with the vocational qualification MATSE and the academic degrees Bachelor and Master is unique in Germany

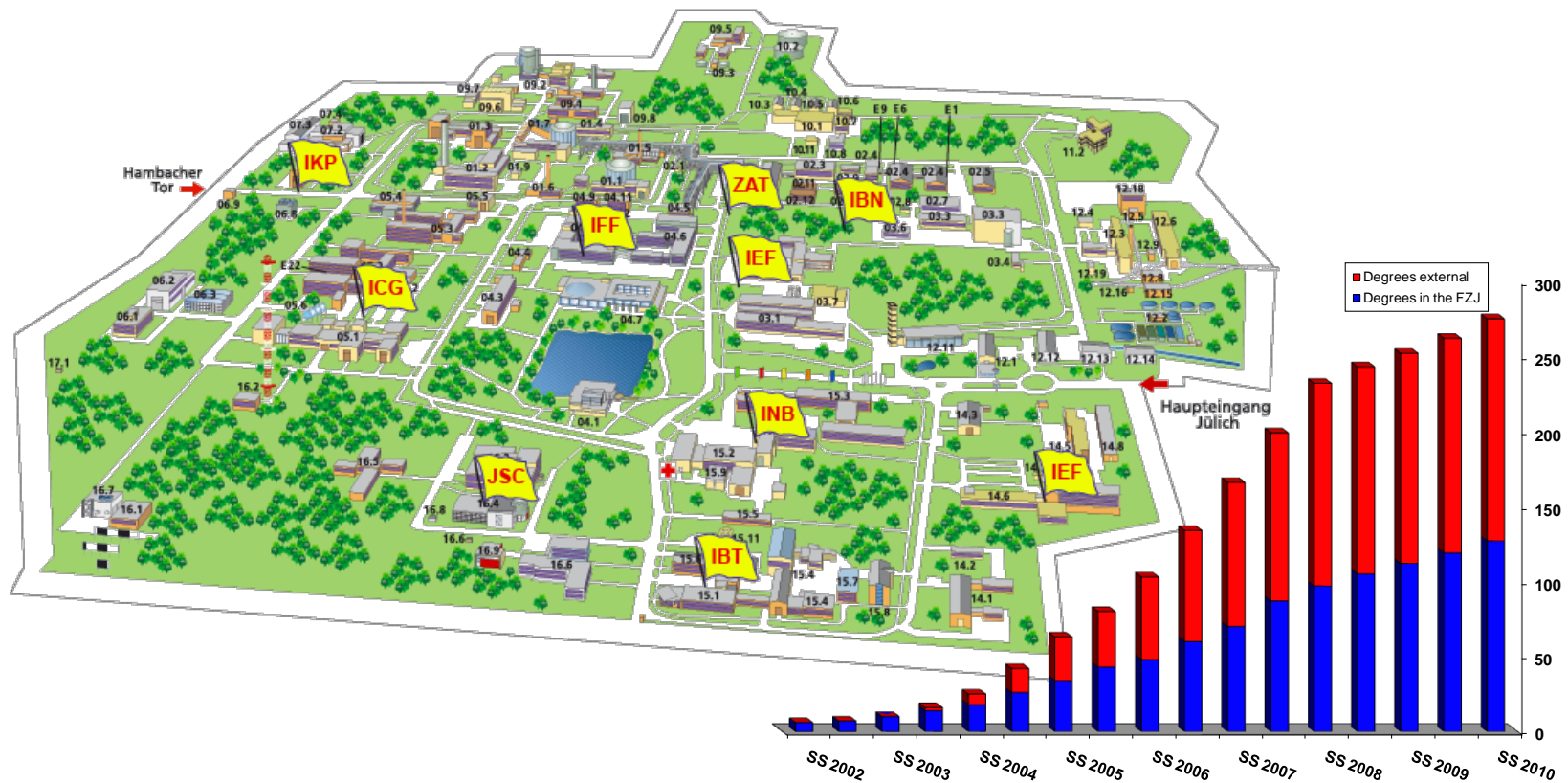


# Master Technomathematics

Specialization Applied Mathematics	Specialization Scientific Computing	Specialization Engineering
Master Colloquium - 5 CP	Master Colloquium - 5 CP	Master Colloquium - 5 CP
Master Thesis 25 CP	Master Thesis 25 CP	Master Thesis 25 CP
Elective Courses 15 CP	Elective Courses 15 CP	Elective Courses 15 CP
Seminar - 5 CP	Seminar - 5 CP	Seminar - 5 CP
Engineering 10 CP	Engineering 10 CP	Engineering 30 CP
Scientific Computing 10 CP	Scientific Computing 30 CP	
Applied Mathematics 30 CP		Applied Mathematics 20 CP
	Pure Mathematics 20 CP	Pure Mathematics 10 CP
		Pure Mathematics 10 CP

# Technomathematics at FZ Jülich

## Diploma/Master degrees



# German Research School for Simulation Sciences (GRS)

- Joint foundation of Research Centre Jülich and RWTH Aachen
- Part of the Jülich Aachen Research Alliance (JARA)
- 4 new full professorships
- New master course and doctoral programme
- Access to state-of-the-art HPC computing resources at JSC and RWTH Aachen
- New buildings in Jülich and Aachen



# Master Simulation Sciences

- New **non-consecutive two-year master** course started in 2008
- Entry profile: BSc in physics, chemistry, engineering, mathematics or computer science
- Large mandatory course block as harmonization area
- Electives from 6 participating faculties of RWTH Aachen
  - Engineering: mechanical, CES
  - Natural sciences: physics, chemistry, geoscience, life science
  - Methodology: mathematics, computer science
- Bridging the gap between **Quantum and Continuum Physics**
- First graduates in 2010
- Some of the students in fast track: MSc + doctoral programme

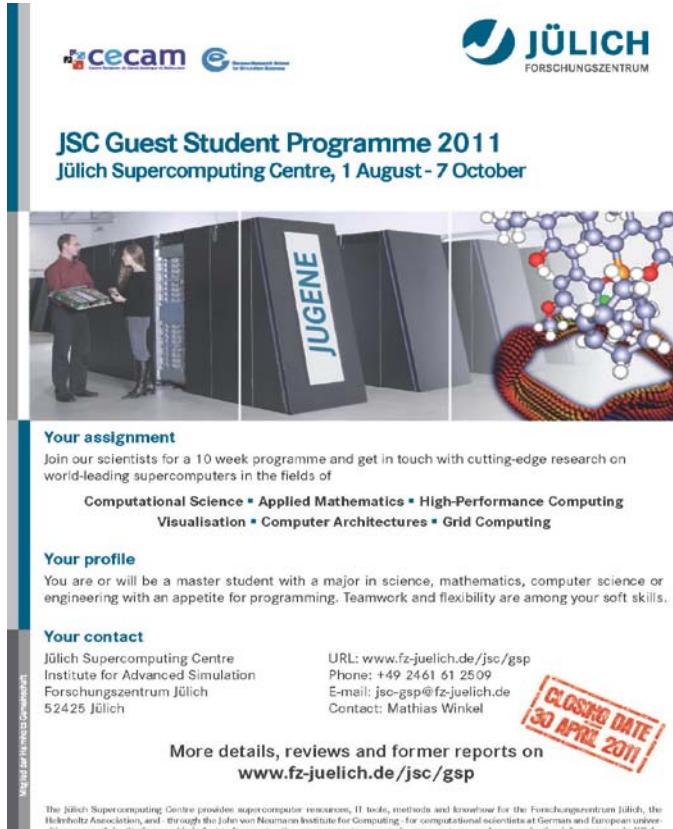
# Master Simulation Sciences Curriculum


1st Semester Winter – 30 CP	2nd Semester Summer – 30 CP	3rd Semester Winter – 30 CP	4th Semester Summer – 30 CP
Numerical Methods for Partial Differential Equations 8 CP	Fast Iterative Solvers 4 CP	Simulation Science Laboratory 6 CP	Master Thesis 27 CP
	Parallel Computing in Simulation Sciences 6 CP		
From Quantum to Continuum Physics I 6 CP	From Quantum to Continuum Physics II 5 CP	Elective Courses 24 CP	
Simulation Methods 6 CP	Model Based Estimation Methods 5 CP		
Data Analysis and Visualization 4 CP	Elective Courses 10 CP		
Simulation Software Engineering 6 CP			



# JSC Guest Student Programme

- Organized every year since 2000
- Programme runs for 10 weeks
- Course participants: Master students of CSE, mathematics or computer science
- Introduction to parallel computing
- Each student will be assigned to a staff member who will allocate a task from his current field of research
- Final report, colloquium with presentations
- Guest student programme will be a CECAM activity in 2011
- Partner: GRS






**JSC Guest Student Programme 2011**  
 Jülich Supercomputing Centre, 1 August - 7 October



**Your assignment**  
 Join our scientists for a 10 week programme and get in touch with cutting-edge research on world-leading supercomputers in the fields of


**Computational Science • Applied Mathematics • High-Performance Computing**  
**Visualisation • Computer Architectures • Grid Computing**

**Your profile**  
 You are or will be a master student with a major in science, mathematics, computer science or engineering with an appetite for programming. Teamwork and flexibility are among your soft skills.

**Your contact**  
 Jülich Supercomputing Centre  
 Institute for Advanced Simulation  
 Forschungszentrum Jülich  
 52425 Jülich

URL: [www.fz-juelich.de/jsc/gsp](http://www.fz-juelich.de/jsc/gsp)  
 Phone: +49 2461 61 2509  
 E-mail: [jsc-gsp@fz-juelich.de](mailto:jsc-gsp@fz-juelich.de)  
 Contact: Mathias Winkel

**More details, reviews and former reports on**  
[www.fz-juelich.de/jsc/gsp](http://www.fz-juelich.de/jsc/gsp)



The Jülich Supercomputing Centre provides supercomputer resources, IT tools, methods and knowhow for the Forschungszentrum Jülich, the Helmholtz Association, and through the Jülich von Neumann Institute for Computing, for computational scientists at German and European universities, research institutions and in industry. It operates the supercomputers, central server systems, and communication infrastructure in Jülich.

# JSC Summer/Winter Schools

- Organized every second year since 2000
- School's target audience: PhD students, postdocs
- Programme runs for 1-2 weeks
- Lectures in the morning, practical sessions in the afternoon
- Introduction to parallel computing
- Lecture notes are available before the schools starts
- All participants are kindly invited to submit posters on their own work
- Winter school 2012 is planned as CECAM activity



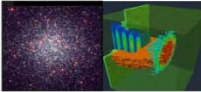





WE-Heraeus Summer School

## Fast Methods for Long-Range Interactions in Complex Systems

Summer School  
Forschungszentrum Jülich  
6 -10 September 2010

P. Gibbon  
Th. Lippert  
G. Sutmann

**Tutorials**  
 Particle Simulations  
 Fast Fourier Techniques  
 Tree-Methods  
 Multigrid Techniques  
 Fast Multipole Method

**Hands-on Training**  
 Application of Simulation Methods  
 Introduction to Parallel Computing



**Deadline for Applications: 31 July 2010**

Forschungszentrum Jülich  
 Institute for Advanced Simulation (IAS)  
 Jülich Supercomputing Centre (JSC)

URL: [www.fz-juelich.de/wehss](http://www.fz-juelich.de/wehss)  
 E-mail: [jsc-wehss@fz-juelich.de](mailto:jsc-wehss@fz-juelich.de)  
 Phone: (+49) 2461 61 - 6746  
 Contact: Godehard Sutmann

# Heraeus Summer School 2010

## Fast Methods for Long-Range Interactions in Complex Systems

	Monday 6 September	Tuesday 7 September	Wednesday 8 September	Thursday 9 September	Friday 10 September
9:00 – 9:30	Registration	<i>G. Sutmann</i> Parallel Algorithms for Particle Simulations	<i>M. Bolten</i> Multigrid Methods for Long-Range Interactions	<i>P. Gibbon</i> Parallel Tree Methods I	<i>F. Gähler</i> Local Cutoff-Methods for Long-Range Interactions I
09:30 – 10:15		<i>D. Potts</i> Non-Equidistant Fast-Fourier Transforms	<i>M. Bolten</i> Parallel Multigrid	<i>P. Gibbon</i> Parallel Tree Methods II	<i>F. Gähler</i> Local Cutoff-Methods for Long-Range Interactions II
10:15 – 10:45	Welcome <i>N. Attig</i> Challenges in High Performance Computing	Coffee Break			
10:45 – 11:30	Coffee Break	<i>D. Potts</i> NFFT and Fast Summation	<i>A. Arnold</i> Fourier Transform-Based Methods I	<i>I. Kabadshow</i> The Fast Multipole Method	<i>N. Eicker</i> The Future of Cluster Computing
11:30 – 12:15	<i>G. Sutmann</i> Particle Simulation Methods	<i>D. Potts / N. Pippig</i> Parallel NFFT and Fast Algorithms	<i>A. Arnold</i> Fourier Transform-Based Methods II	<i>I. Kabadshow</i> Periodic FMM & Parallel FMM	Final Remarks
12:15 – 13:30	Lunch Break				
13:30 – 14:15	<i>L. Arnold / A. Schiller</i> Introduction to MPI & Parallel Computing	<i>M. Bolten</i> The Multigrid Method	<i>A. Arnold</i> Optimal Methods: P <sup>3</sup> M	<i>R. Speck / M. Winkel</i> Introduction to PEPC	Departure
14:15 – 14:45	Practical Session Parallel Computing	<i>D. Potts / M. Pippig</i> Introduction to Practical NFFT	<i>O. Lenz / A. Arnold</i> Introduction to Espresso	Practical Session Experiences with PEPC	
14:45 – 15:45		Practical Session Experiences with NFFT	Practical Session Experiences with Espresso	<i>I. Kabadshow / H. Daxsel</i> Practical FMM	
15:45 – 16:15				Practical Session Experiences with FMM	
16:15 – 17:00					
17:00 – 17:30		Poster Presentations	Social Programme Excursion to Aachen		
17:30 – 19:00	Get-Together	Poster Session			

Thank you for your attention!