Programme:

09:00 **Welcome Address**
Prof. Dr. Roland Wiesendanger, University of Hamburg, Germany

09:15 **Keynote: What's new beyond CPU?**
Dr. Lothar Wenzel, National Instruments, Austin, USA

10:00 **Keynote: Computational Micromagnetics**
Prof. Dr. Yoshinobu Nakatani, University of Electro-communications, Chofu, Japan

10:45 **Coffee Break**

11:15 **Keynote: Transport Theory and Simulation of Hybrid Structures**
Prof. Dr. Jairo Sinova, Texas A&M University, College Station, USA

12:00 **What to learn from finite size systems**
Prof. Dr. Daniela Pfannkuche, University of Hamburg, Germany

12:25 **New Quantum Monte Carlo methods for fermions**
Prof. Dr. Alexander Lichtenstein, University of Hamburg, Germany

12:50 **Iterative real-time path-integral simulations of nonequilibrium quantum transport**
Prof. Dr. Michael Thorwart, University of Hamburg, Germany

13:15 **Lunch Break**

14:15 **Keynote: Fast micromagnetics by energy minimization**
Prof. Dr. Thomas Schrefl, St. Pölten University of Applied Science, Austria

15:00 **Micromagnetic Simulation Framework for variable Hardware Platforms**
Dr. André Drews, University of Hamburg, Germany

15:25 **MuMax: High Performance Micromagnetics on the GPU**
Dr. Arne Vansteenkiste, University of Ghent, Belgium

15:50 **Coffee Break**

16:10 **Multipolar Approach for Large-Scale Simulations of Magnetic Arrays**
Dr. Elena Vedmedenko, University of Hamburg, Germany

16:35 **Spin-dependent Transport in Semiconductor Nanostructures**
Prof. Dr. Ewelina Hankiewicz, University of Würzburg, Germany

17:00 **Coffee Break**

17:30 **Round-Table Discussion**

18:30 **Closing**

18:45 **Informal Get-Together**

International Symposium High Performance Computing in Nano-Spintronics

Hamburg
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University of Hamburg
Institute of Applied Physics
Jungiusstraße 11, 20355 Hamburg,
Germany

Organizers:

Prof. Dr. Dietmar P.F. Möller
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Functional Metal-Semiconductor Hybrid Systems

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LEXI LANDESEXZELLENZINITIATIVE HAMBURG

Dear Colleague,

Welcome to the 1st International Symposium „High-Performance Computing in Nano-Spintronics“ in Hamburg jointly organized by the Excellence Cluster „Nanospintronics“ of the Free and Hanseatic City of Hamburg and the DFG Research Training Center 1286 „Functional Metal-Semiconductor Hybrid Systems.

We are happy to present you an interesting selection of keynotes and talks on the prospering field of numerical simulations in nano-spintronics to model spin dynamics and transport in low-dimensional systems.

The organizers of the symposium wish everybody a pleasant and very informative stay in Hamburg!

Kind Regards,

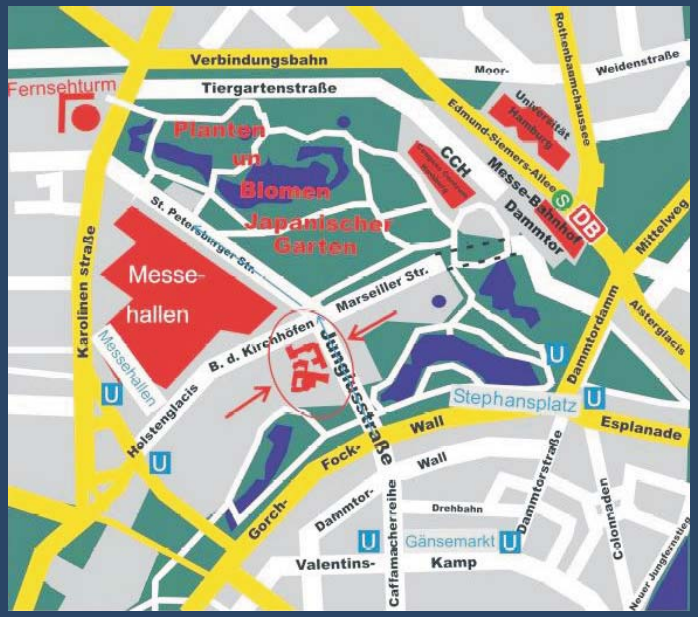
Prof. Dr. Dietmar Möller
Dept. of Informatics

Dr. André Drews
Dept. of. Informatics

Dr. Jan Jacob
Dept. of Physics

Scope of the Symposium:

The symposium focuses on recent developments in simulations of spin dynamics and spin-dependent transport in nanoscale devices. Latest results of spin-spin interaction and transport of charge and spin in low-dimensional systems will be covered to address computational aspects of numerical simulations. A focus is laid on the development of efficient algorithms and their optimization for modern hardware platforms like multicore processors, general purpose graphic processing units, and field-programmable gate arrays as well as distributed computing.



Directions:

By Plane:
From Hamburg-Fuhlsbüttel International Airport take Metro S1 to Central Station, then change to S11/21/31 and exit at Dammtor

By Train:
Please exit at Hamburg-Dammtor, one stop after Central Station. Most long distance trains will stop here, too.

By Car:
Follow the signs to Messe and CCH. Parking space is available at the Institute

Public Transport:
Metro S11/S21/S31 to Dammtor, Metro U1 to Stephansplatz, Metro U3 to Gänsemarkt as well as and Bus 4/5/109/112 to Stephansplatz or Bus 35 to Messe Eingang Ost

Keynotes:

What's new beyond CPU?
Lothar Wenzel, National Instruments, Austin, USA

Many physics applications require an enormous computational power to solve large mathematical problems with real-time constraints. Often several thousand channels, acquired in real-time feed mathematical routines to generate outputs in milliseconds. Parallel dataflow approaches are presented for real-time mathematics in many fields of physics. The required computational power is fueled by multi-core implementations in conjunction with FPGAs, and GPUs. Benchmarks illustrate what is achievable with such an approach.

Computational Micromagnetism
Yoshinobu Nakatani, University of Electro-communications, Chofu, Japan

Micromagnetic simulations have been used to calculate the spin structure and its dynamics in nanoscale magnetic materials. A method of reducing the calculation time is needed because it requries prolonged periods for calculation. Several methods proposed for the past years for several computers and simulation examples will be presented.

Transport Theory and Simulation of Hybrid Structures
Jairo Sinova, Texas A&M University, College Station, USA

Our understanding of spin and charge transport in multi-component nanostructures remains a terra incognita in many aspects. Analytically we are limited to a few linear response techniques which work well at different length scales. Coupling these from the nano- to the macro scale is of pivotal importance for reliabe design of spin-based logic devices. The latest developments to achieve this goal will be presented and what progress has been done up to this point in implementing real devices such as spin-field-effect transistors, spin-filters, etc.

Fast micromagnetics by energy minimization
Thomas Schrefl, St. Pölten University of Applied Science, Austria

The properties of hard and soft magnets for energy applications depend on their microstructure. A fine computational grid is required, in order to take into account grain morphology, intergranular phases, and surface defects. The hysteresis properties can be efficiently computed by minimizing the Gibbs Free Energy. Conjugate gradient based methods are well suited for multi-core hardware platforms.