

# Interaction between Research Mathematics, Mathematics Teacher Training, and Mathematics Education at Schools

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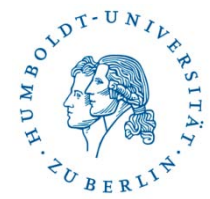
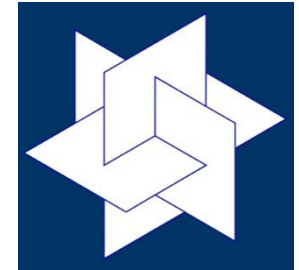
## Outline

1. DFG Research Center MATHEON – Mathematics for Key Technologies
2. MATHEON Application Area “Education”
3. Humboldt-ProMINT-Kolleg
4. Accompanying Activities
5. Vision

1. DFG Research Center MATHEON –  
Mathematics for Key Technologies

## About MATHEON

- MATHEON is one of currently six Research Centers funded by the German Science Foundation DFG
- Funding periods:  
2002 – 2006, 2006 – 2010, 2010 – 2014
- Cooperating institutions:
  - Free University Berlin (FU)
  - Humboldt University Berlin (HU)
  - Technical University Berlin (TU)
  - Weierstrass Institute for Applied Analysis and Stochastics (WIAS)
  - Zuse Institute Berlin (ZIB)



Weierstraß-Institut für Angewandte Analysis und Stochastik

## Application Areas

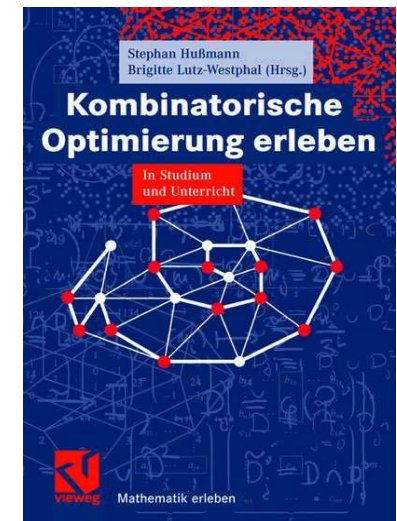
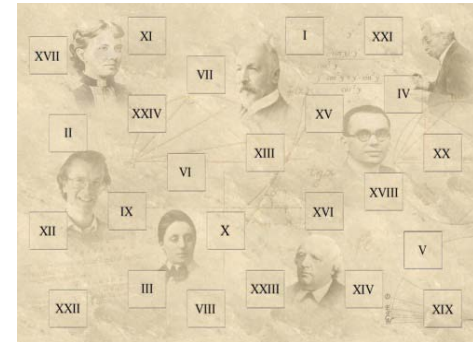
- Life Sciences
- Logistics, Traffic, and Telecommunication Networks
- Production
- Electronic and Photonic Devices
- Finance
- Visualization
- Education and Outreach



## 2. MATHEON Application Area "Education"

## Aims

- Practice-orientation of the mathematics' teacher education/training
- Close cooperation between schools and universities
- Specific emphasis on mathematically interested/talented high school students
- Design of application-oriented and innovative teaching and course materials
- Communicating MATHEON and its activities to the public at large



## Project: Teachers at university

- Integrating mathematical content knowledge and pedagogical content knowledge
- Practice-orientation by tandems of scientists and delegated teachers in courses, seminars, and practical studies

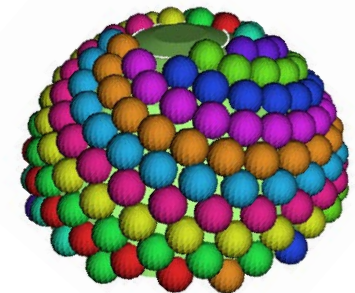


Cooperation with the Senate's Administration for Education and Research of Berlin



## Project: Current mathematics at schools

- Peggy Daume (2002 – 2006):  
Design of teaching units for the stochastics of finance in grades 9 to 13; development, evaluation, implementation, and teacher training; in cooperation with MATHEON scientists
- Heino Hellwig (2006 – 2010) :  
Design of mathematical modelling problems for high schools; implementation via seminar courses at schools; supervising the resulting scientific paper (“Facharbeit”) with teachers; in cooperation with MATHEON scientists



## Project: Mathematics teacher training initiative

- Overcome deficits in mathematics' teachers' lifelong learning
- Practice orientation:
  - tandem: scientist – teacher
  - teaching material available online
- In cooperation with German Mathematical Society (DMV) and Deutsche Telekom Foundation
- This project cooperates with ...



## Mathematics Done Differently

- German-wide teacher training project
- Initiated and sponsored by Deutsche Telekom Stiftung
- Started 2006 with a pilot phase
- Project heads: Günter Törner, Jürg Kramer
- Scientific mentor: Heinz-Elmar Tenorth (HU)



## Characteristics

- Courses “à la carte” and “on demand”
  - content oriented subjects
  - pedagogical content oriented subjects
  - methodological and general pedagogical contents
- 380 realized courses nationwide
- About 4 600 participants nationwide
  - teachers ideally come from one or several neighbouring schools
  - teachers act as multipliers in their respective schools

## Highlights

- Digital „Adventskalender“  
(> 15 000 participants in 2009)
- MathFilm-Festival 2008  
(> 20 000 DVD's to schools in Germany)
- Year of Mathematics 2008
- First annual meeting of DMV/GDM 2007  
(> 1 000 participants)
- „Math sounds great“ 2009
- Rent-the-Center platform
- ...



Foto: Kay Herschelmann



### 3. Humboldt-ProMINT-Kolleg

## One of the four winners in the German wide competition asking for improvements of the STEM teacher education (“MINT-Lehrerbildung”) by Deutsche Telekom Foundation

### Aim

Improvement of the teacher education in the STEM-fields



### Methodology

- Identify deficits in present educational concepts
- Identification of possible improvements based on scientific findings
- Redesign present educational concepts
- Implementation of the newly developed concepts
- Various levels of evaluation





## Components

- Horizontal integration of the various STEM-fields
  - in the teacher education
  - in the teaching at schools
- Vertical integration through all school levels (“smooth” transitions)
  - primary school -> secondary school I
  - secondary school I -> secondary school II
  - secondary school II -> university
- Interaction of the science and technology campus Adlershof with the teacher education
  - with high-tech companies
  - with extra-university research institutes





- Started in August 2010, funding guaranteed for 3 years
- 7 teams, one for each of the STEM-fields mentioned below, consisting of
  - 1 scientist
  - 1 delegated teacher
  - 1 PhD student
  - 1 tutor
- Represented STEM-fields
  - biology, chemistry, computer science, mathematics, physics
  - education of mathematics and the sciences in primary schools



## 4. Accompanying Activities

## Secondary School Sector

- Establishment of the Berlin Network Schools in 2001
- Mathematics courses based on specialized curricula
- Excellent grades in math accounted for by the universities
- Yearly delegation of three teachers supporting the teacher education



Andreas-OS



Immanuel-Kant-OS



Herder-OS



Heinrich-Hertz-OS

## Primary School Sector

- Pilot project for the advancement of mathematically talented pupils in grades 5 and 6
- Design of special curricula in mathematics and the sciences
- Up to five times as many applicants as places available



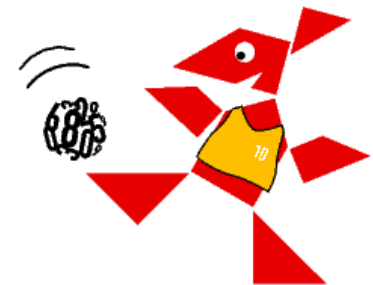
## Mathematische Schülersgesellschaft „Leonhard Euler“

- Weekly courses in mathematics at the university for high school students of grades 7 to 13 supervised by scientists of the university
- Since 2005 also for pupils of grades 5 and 6



## „Känguru Competition“

- Supported by the Department of Mathematics of Humboldt University
- Participants from grades 3 to 13
- Increase from 184 participants in 1995 to more than 824 000 in 2010



## Summer Schools „Fun with Mathematics“



- Started in 2001
- 36 – 38 students from Berlin Network Schools
- 4 – 6 teachers from Berlin Network Schools
- 6 – 7 scientists from universities



## Graduate Education

- Cooperation with the Berlin Mathematical School, a Graduate School in the framework of the Initiative of Excellence in Germany
- BMS was founded in 2006 as a joint project of FU, HU, TU, catalyzed by MATHEON
- Phase I studies from a Bachelor's degree to a Qualifying Exam
- Phase II studies ending with a PhD thesis
- Source for recruiting graduate students supporting educational and training activities



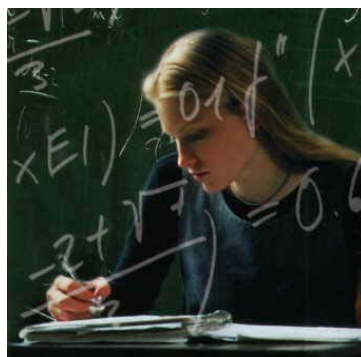
## 5. Vision



## Furtherance in mathematics education from Kindergarten to Graduate School, and beyond ...



Foto: Heike Zappe, Humboldt-Universität zu Berlin



Thank you for your attention!