



Bayerischer Forschungsverbund für Nanoelektronik

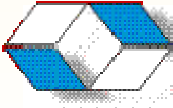
# Bavarian Research Cooperation for Nanoelectronics

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Chair of Electron Devices, University of Erlangen-Nuremberg  
Fraunhofer Institute of Integrated Systems and Device Technology (IISB), Erlangen

**3<sup>rd</sup> FORNEL Workshop on Nanoelectronics**

Erlangen, March 27, 2007

supported by  **Bayerische  
Forschungsfond**

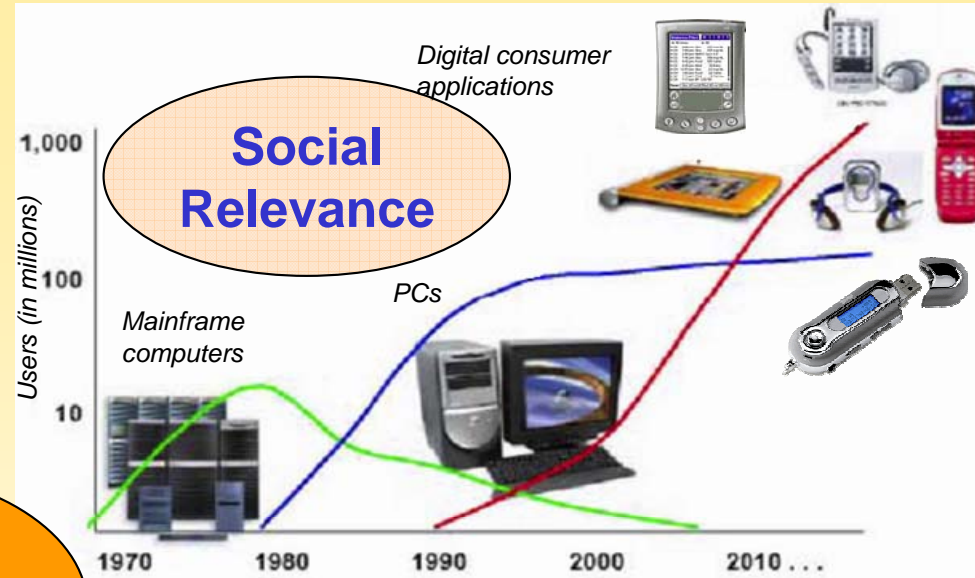
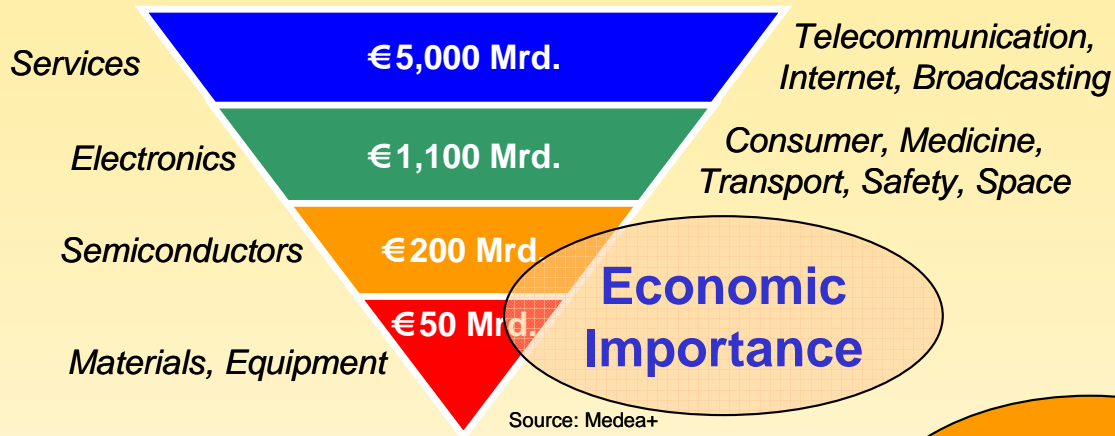


3<sup>rd</sup> FORNEL Workshop on Nanoelectronics, March 27, 2007

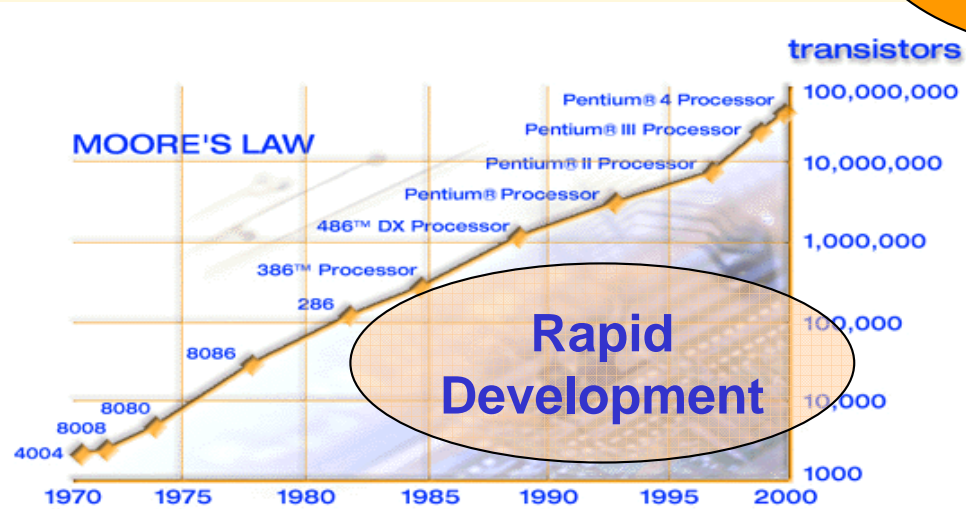
H. Ryssel, Introduction to FORNEL

# Motivation

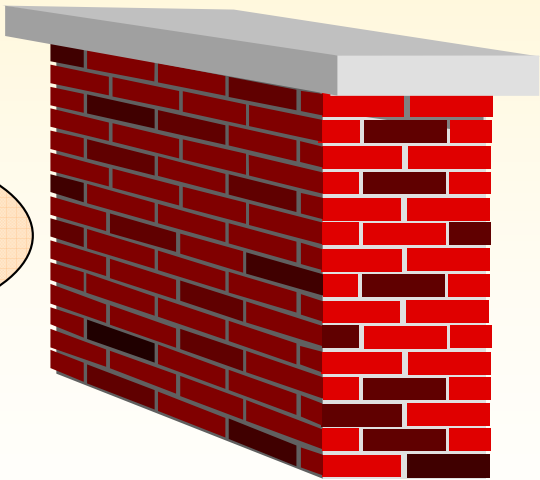
Worldwide Values for 2004



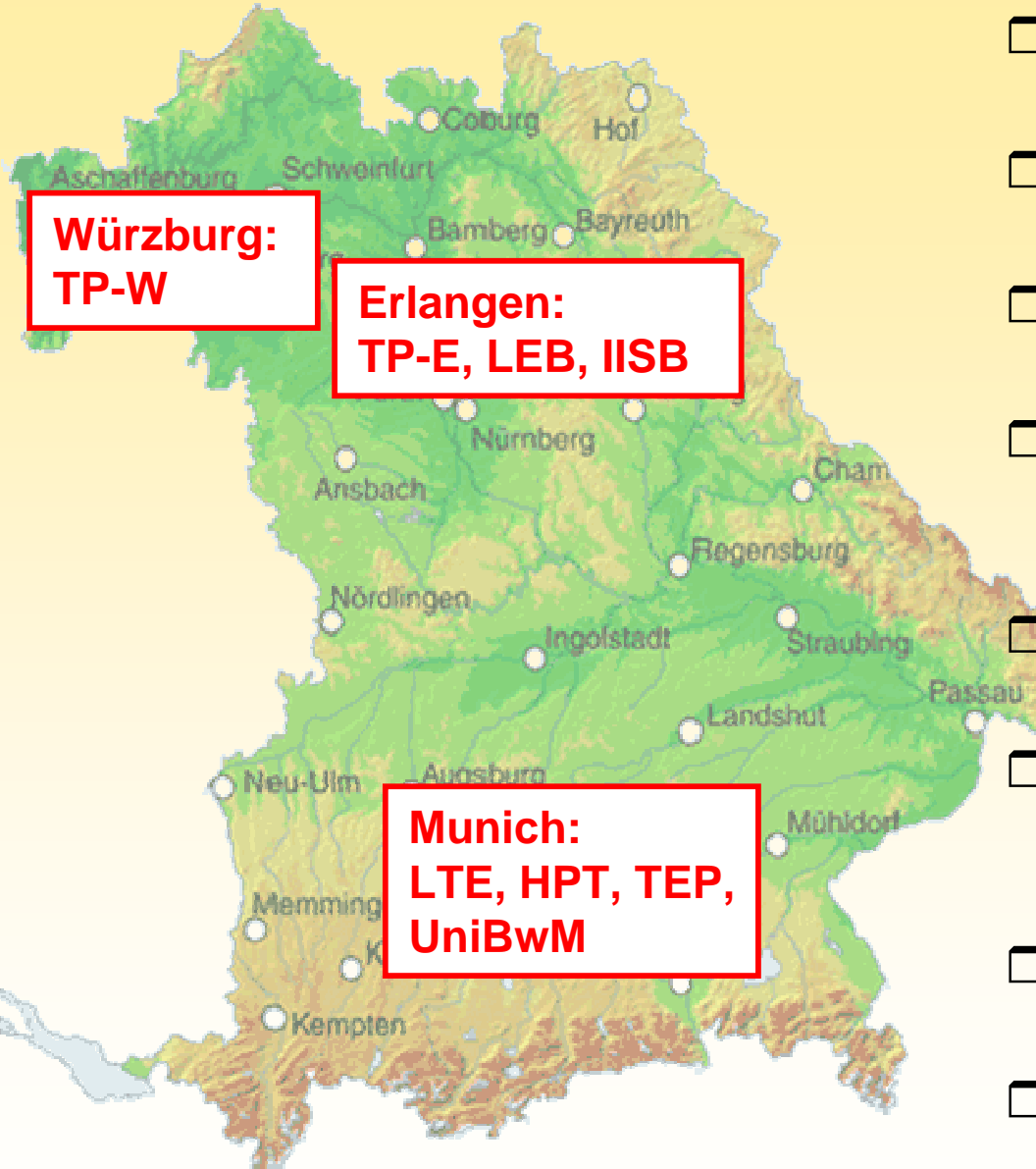
**Why Nano-electronics?**



**The Red Brick Wall !?**



# Academic Partners



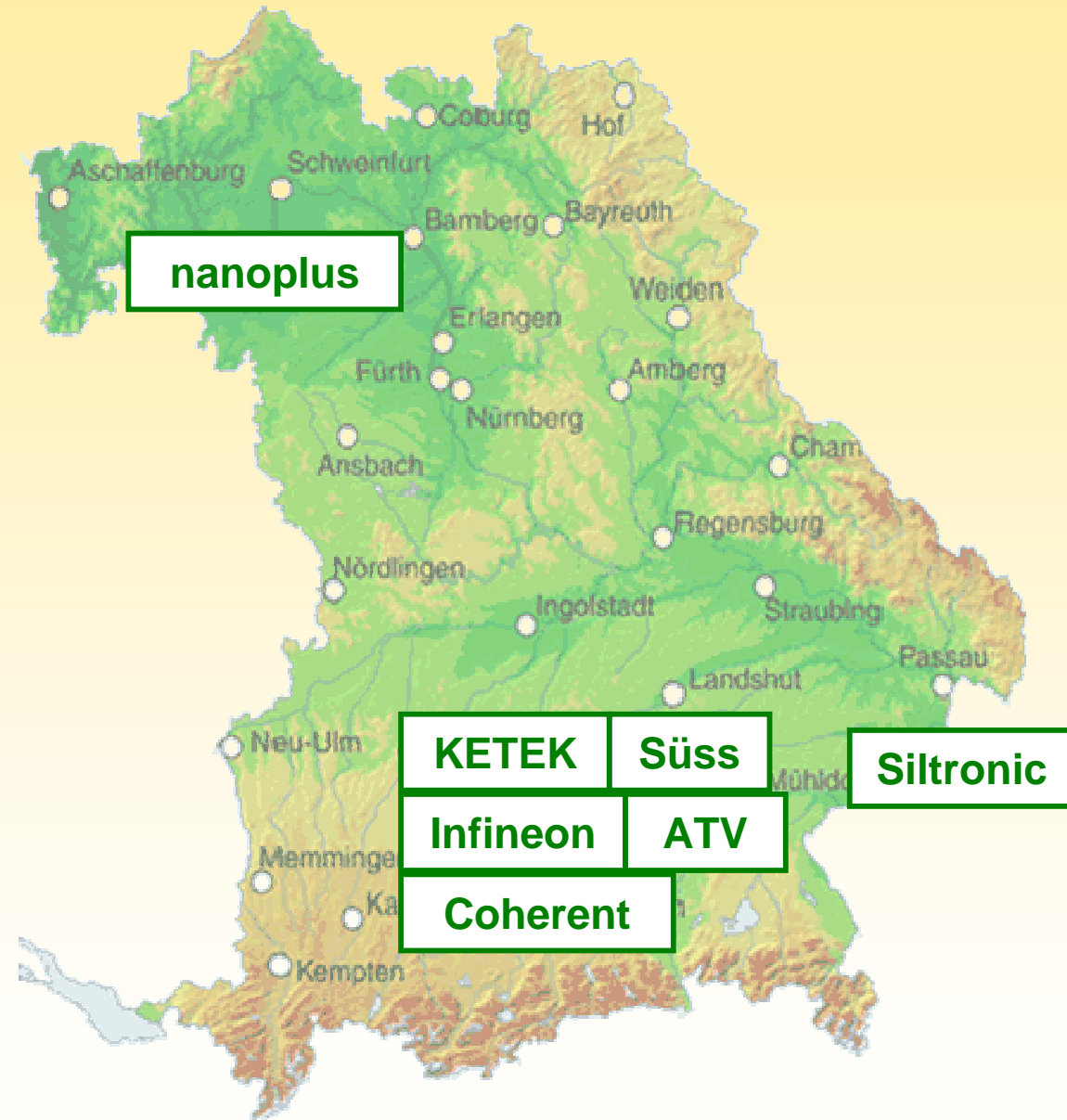
**Würzburg:**  
**TP-W**

**Erlangen:**  
**TP-E, LEB, IISB**

**Munich:**  
**LTE, HPT, TEP,  
UniBwM**

- Chair of Technical Physics (TP-W),  
University of Würzburg, Prof. Forchel
- Chair of Technical Physics (TP-E),  
University of Erlangen-Nuremberg, Prof. Ley
- Chair of Electron Devices (LEB),  
University of Erlangen-Nuremberg, Prof. Ryszel
- Fraunhofer Institute of Integrated Systems and  
Device Technology (IISB),  
Erlangen, Prof. Ryszel
- Chair of Technical Electronics (LTE),  
TU Munich, Prof. Schmitt-Landsiedel
- Semiconductor Manufacturing Technology  
(HPT), Chair of Technical Electronics,  
TU Munich, Prof. Hansch
- Chair of Physics of Electrotechnology (TEP),  
TU Munich, Prof. Wachutka
- Institute of Physics, Bundeswehr University,  
Munich, Prof. Eisele

# Industrial Partners



- ❑ ATV Technologie GmbH, Vaterstetten
- ❑ Coherent GmbH, Munich
- ❑ Infineon Technologies AG, Munich
- ❑ KETEK GmbH, Munich
- ❑ nanoplus GmbH, Gerbrunn
- ❑ Siltronic AG, Burghausen
- ❑ Süss MicroTec AG, Garching

# Facts on FORNEL

- ❑ Funding: Bayerische Forschungsstiftung/Bavarian Research Foundation (BFS)

Total budget	4,375.4 k€	
Industry	2,295.4 k€	(52.5%)
BFS	2,080.0 k€	(47.5%)
- ❑ Funding period: July 1, 2004 – December 31, 2007 (3.5 years)
- ❑ 8 projects
- ❑ Speaker: Prof. Dr. Heiner Ryssel  
Deputy Speaker: Prof. Dr. Doris Schmitt-Landsiedel  
Managing Director: Dr. Bernd Fischer
- ❑ More information on FORNEL:  
Flyers, [www.abayfor.de/fornel](http://www.abayfor.de/fornel) and [www.fornel.de](http://www.fornel.de)



# Goals of FORNEL

- Investigation of key aspects of nanoelectronics
  - Research Area I: Nanostructures
  - Research Area II: Nanodevices and Nanocircuits
  - Research Area III: Modeling and Simulation
  
- Synergy effects
  - Bundling of competencies in Bavaria
  - Mutual use of technologies and infrastructure
  - Intensified dialog between research and industry
  
- Transfer into industrial products and applications
  - Use of completely new technologies and concepts
  - Quick and application-oriented realization
  - Added value for Bavarian companies
  - Viability by reduced scientific and economic risk for the companies

## Research Area I: Nanostructures

- I.1 Atomically self-controlled deposition of silicon nitride layers
- I.2 Atomically controlled synthesis of alternative gate dielectrics
- I.3 Photon-activated cleaning and deposition processes
- I.4 Nanoimprint lithography

## Research Area II: Nanodevices and Nanocircuits

- II.1 Quantum mechanical and ballistic nanodevices based on silicon
- II.2 Analog circuits with tunneling transistors
- II.3 Nanotransistors based on ballistic Y switches

## Research Area III: Modeling and Simulation

- III Physical modeling and numerical simulation of nanostructures

# Public Presentation of FORNEL



*Science Summer 2006,  
Munich*



*SEMICON Europa  
2005/6, Munich*



*Long Night of Science,  
2005, Erlangen*



*Deutsches Museum  
Traffic Center  
2006/7, Munich*

# FORNEL Workshops

- ❑ Annual scientific workshops, at sites of FORNEL partners
- ❑ Goals:
  - Presentation of FORNEL results to the public by internal speakers
  - Embedding of FORNEL activities into international R&D: invitation of international external speakers
  - Exchange on latest developments in nanoelectronics
  
- ❑ 1<sup>st</sup> FORNEL Workshop: April 12, 2005, in Munich (parallel to SEMICON Europa)
- ❑ 2<sup>nd</sup> FORNEL Workshop: March 15, 2006, in Würzburg
- ❑ 3<sup>rd</sup> FORNEL Workshop: today
- ❑ Presentations of this workshop will be published at [www.fornel.de](http://www.fornel.de)



*Munich, 2005*



*Würzburg, 2006*

# Thank you!

# Acknowledgements

## The speakers and management of FORNEL thank...

- ❑ ...the academic partners for their participation in FORNEL and this workshop
- ❑ ...the industrial partners for their contributions to FORNEL and this workshop
- ❑ ...the speakers of this workshop from academia and industry
- ❑ ...the Association of Bavarian Research Cooperations, abayfor, for supporting the PR work of FORNEL
- ❑ ...the Bavarian Research Foundation for their extensive support in all organization issues and for funding FORNEL
- ❑ **...YOU for your interest in this workshop**