ENERGY 2021, Valencia 31.5. - 2.6.2021

Special Track: Modelling Dynamics of Power Grids (MoDyPoG)

Chair: Eckehard Schöll
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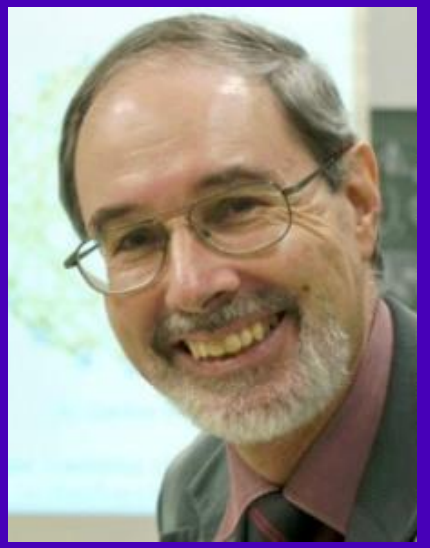
DFG Deutsche Forschungsgemeinschaft German Research Foundation



Eckehard Schöll

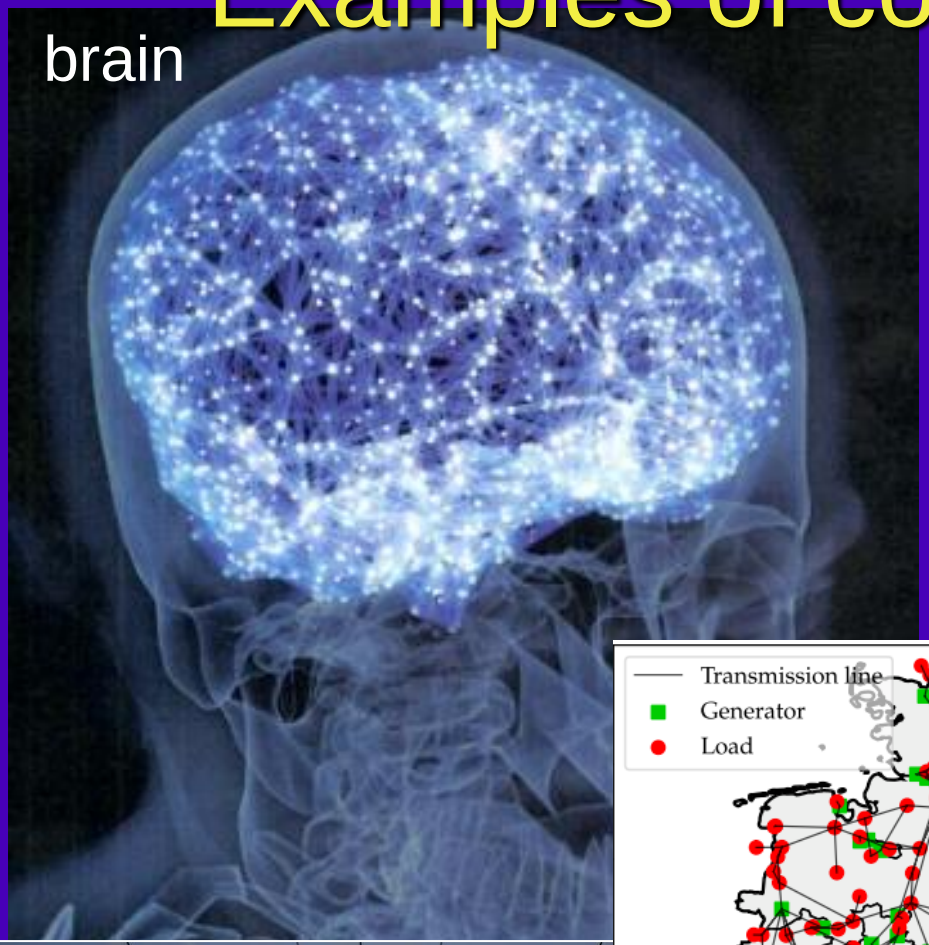
1970 studied Physics in Stuttgart + Tübingen
1978 PhD (Maths) Southampton/UK
1981 PhD (Physics) RWTH Aachen/Germany
1983-84 Visiting Ass. Professor (El. Engg) Detroit/USA
1989-2019 Professor of Theoretical Physics TU Berlin

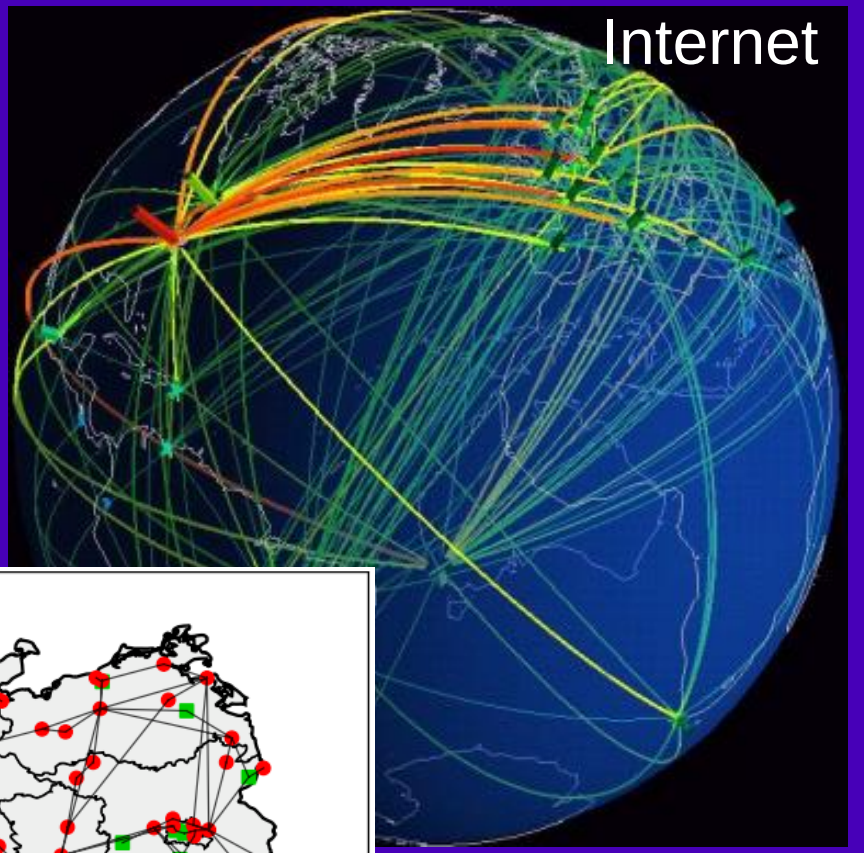
2000 Visiting Professor Duke University/NC, USA
2004 Visiting Professor London Mathematical Society
2017 Honorary Doctorate Saratov State University/Russia
2019- President of International Physics and Control Society (IPACS)
promotes interaction between researchers in Physics and Control Sciences
organizes PhysCon (Int. Conference on Physics and Control)

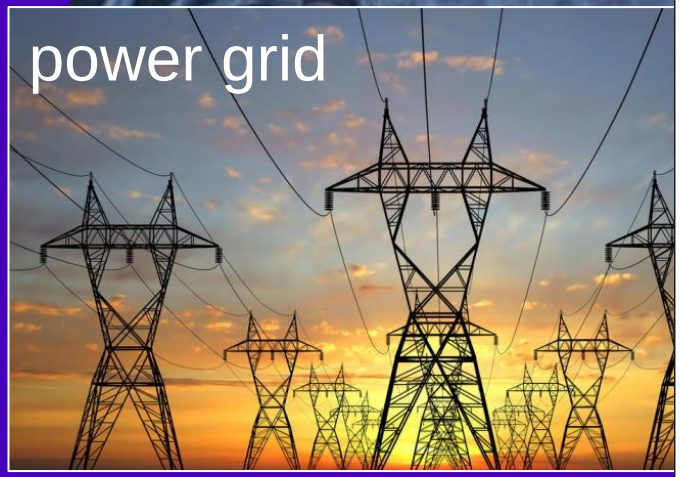
2020- Guest Scientist Potsdam Institute for Climate Impact Research
Department of Complexity Science

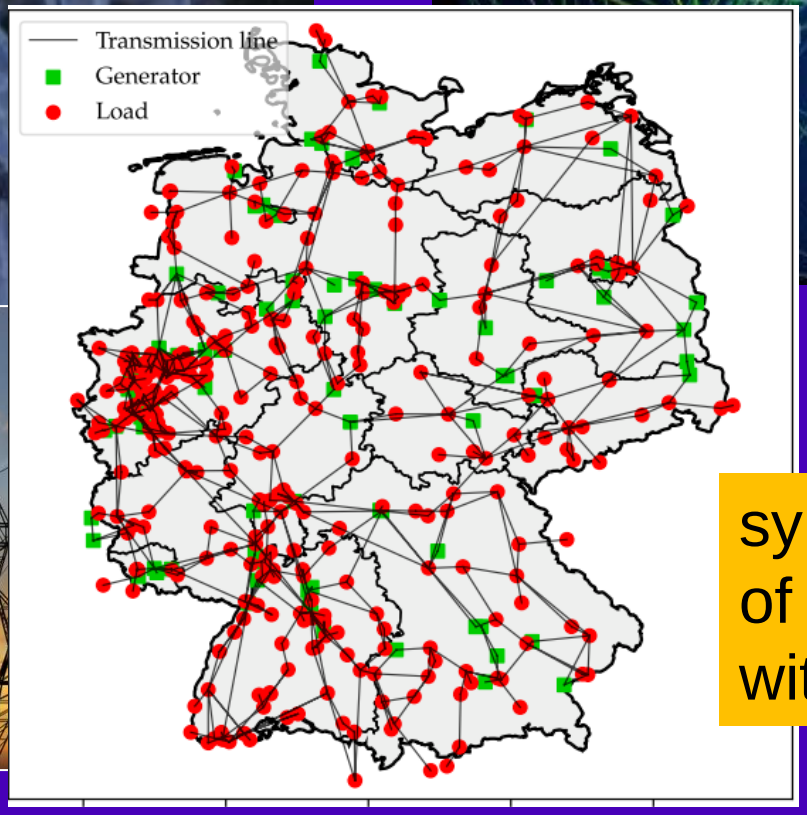
2011-2018 Founder and Chair of Center of Excellence SFB 910
“Control of Self-Organizing Nonlinear Systems”

Examples of complex networks



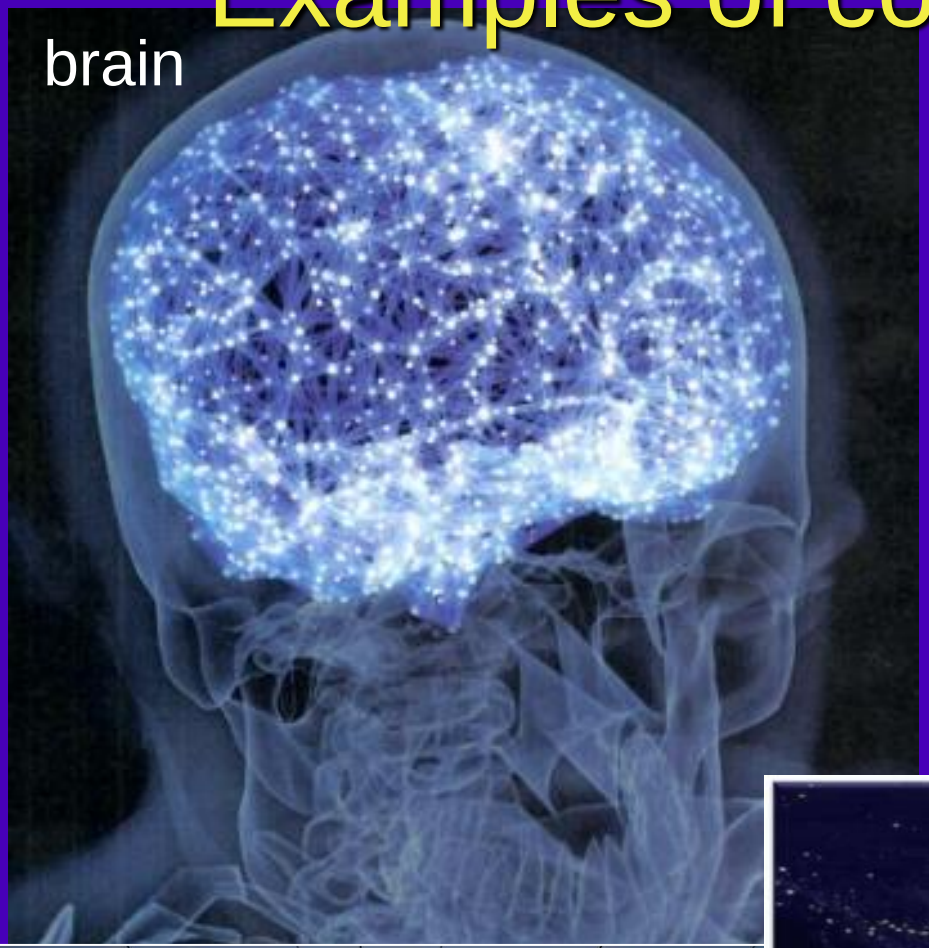


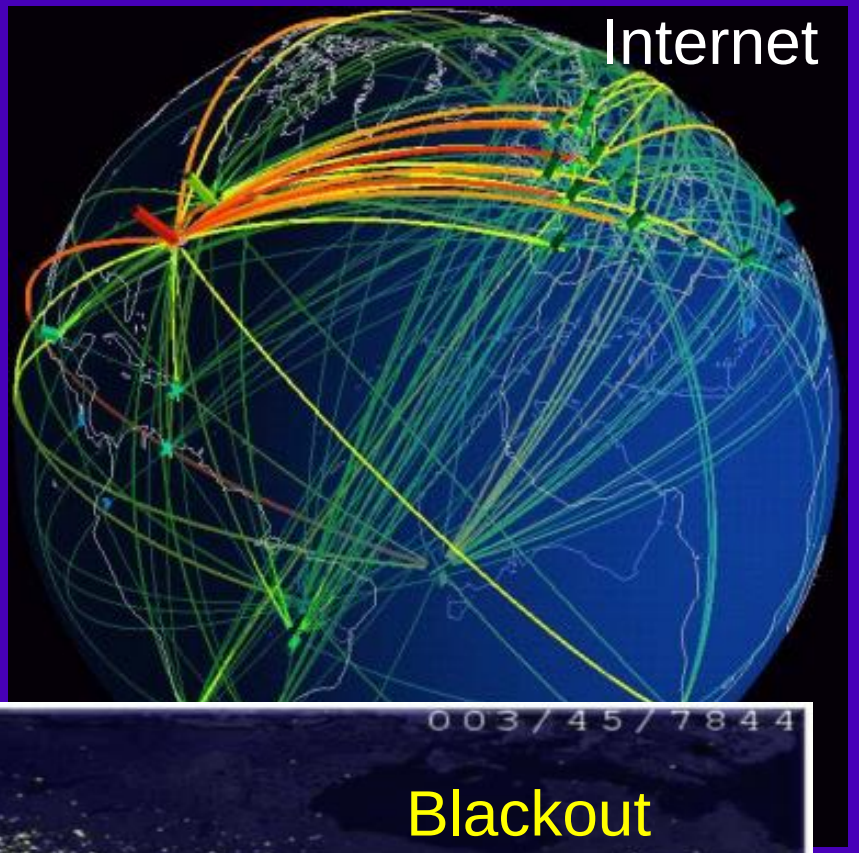


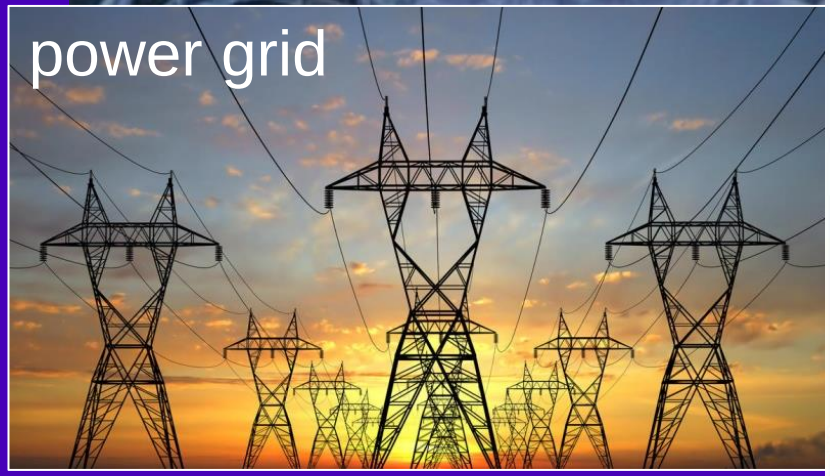


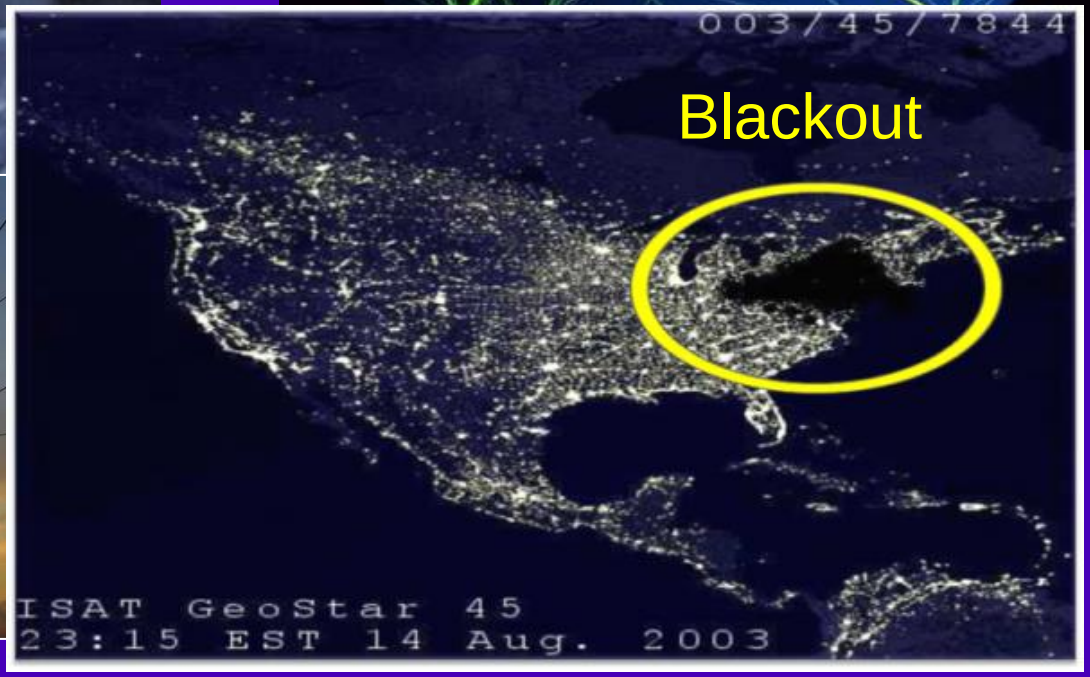
synchronization
of ac voltage
with 50 Hz necessary

Examples of complex networks









Outline

- Transition to renewable and sustainable energies
  - stable and efficient operation of the power grid
  - fluctuating power input (wind, solar)

- Complex networks perspective
  - modelling approaches based on simple swing equation
  - interplay of complex topologies and phase oscillator dynamics
  - control of synchronization and stability
  - analysis of cascading failures
  - influence of stochastic fluctuations of generators and loads

MoDyPoG Session I: Monday, 31 May 2021

- 15:00 Simona Olmi (Istituto dei Sistemi Complessi, CNR Sesto Fiorentino, Italy): Control of Synchronization in two-layer power grids

- 15:30 Mattia Frasca (University of Catania, Italy): Analysis of cascading failures in power grids via network based structure preserving models

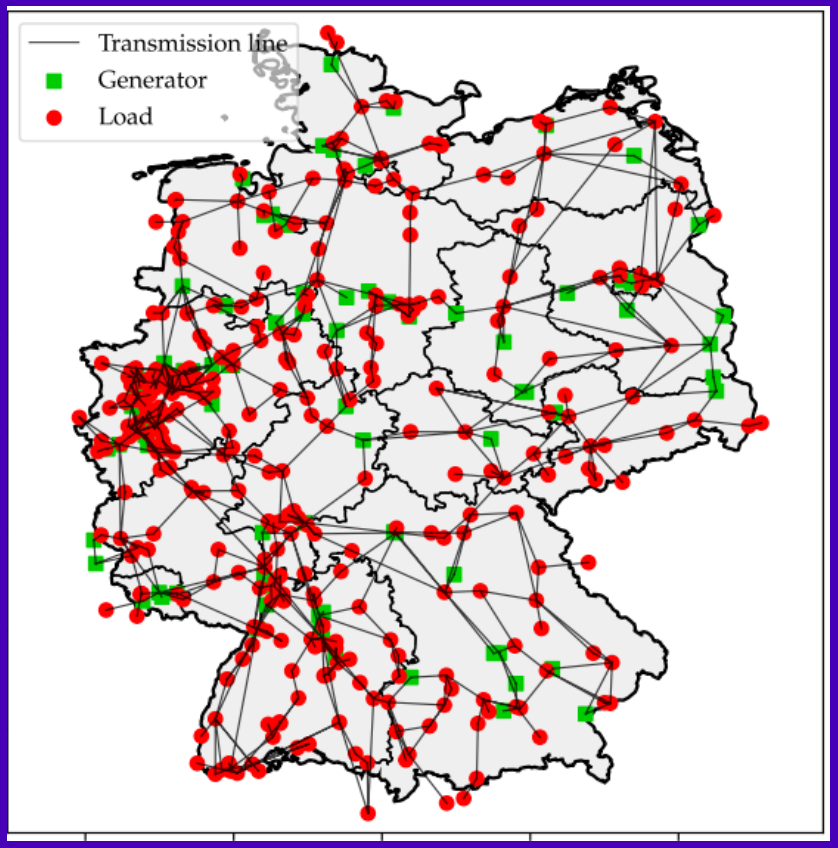
- 16:00 Liudmila Tumash (CNRS Grenoble, France): Stability and control of power grids with diluted network topology

- 16:30 Kosisochukwu Nnoli (Jacobs University Bremen, Germany): Dynamics of Momentary Reserves under Contingency: Observations from Numerical Experiments

- 17:00 Melvyn Tyloo (Université de Genève, Switzerland): Power grids: Small Signal Stability vs. Dynamical Parameters

Keynote Lecture: Tuesday, 1 June 2021

- 15:00 Eckehard Schöll (TU Berlin and Potsdam Institute for Climate Impact Research, Germany): Control of synchronization patterns in complex dynamical networks



MoDyPoG Session II: Wednesday, 2 June 2021

- 15:00 Pere Colet (IFISC Palma de Mallorca, Spain):
  Data analysis of frequency fluctuations in the Balearic grid before and after coal closure

- 15:30 Mehrnaz Anvari (Potsdam Institute for Climate Impact Research, Germany):
  The risk of cascading failures in electrical grids triggered by extreme weather events

- 16:00 Hildegard Meyer-Ortmanns (Jacobs University Bremen, Germany):
  Arbitrage on the energy market and its impact on the physical grid stability

- 16:30 Leonardo Rydin Gorjao (FZ Jülich, Germany): Scaling and spatio-temporal properties of power grid frequencies: An open database

- 17:00 Rico Berner (TU Berlin, Germany):
  Modelling power grids as pseudoadaptive networks

Future challenges

- Complex networks perspective:
  interplay of dynamics and network topology

  - Complex real-world network topologies from open-source data
    dynamics beyond phase oscillators, including voltage dynamics

  - Novel control concepts:
    dynamic 2-layer networks, delayed feedback control

  - Stochastic fluctuations of generation, consumption, markets
    renewable energies: non-Gaussian intermittent fluctuations

  - Bifurcation analysis elucidates instabilities, desynchronization,
    e.g., solitary states, multifrequency cluster states