

# Eugene Wigner Colloquium

*joint event of GRK 1558 and SFB 910*



## Marc Timme

MPI for Dynamics and Self-Organization, Göttingen

### “Inverse Problems of Network Dynamics From Control to Reconstruction and Design”

Collective dynamical phenomena on and of networks are traditionally studied in a forward manner by measuring system dynamics and analyzing them or setting up mathematical models and running computer simulations at given (well-motivated) parameters. Control of networks, where external signals are applied to achieve a certain dynamics, constitutes the first step towards an inverse perspective. Design and reconstruction of network structure for or from given dynamics constitute genuine mathematical inverse problems and are intrinsically hard to solve mathematically due to the many variables and parameters involved. Here we introduce recently developed concepts for inverse problems for network dynamical systems and illustrate applications in biological and engineering settings. Examples include how to set up a structure or local dynamic rules to achieve specific network-wide coordination or information routing and ways to find physical interaction networks from observed dynamical trajectories even if signals are asynchronously measured, partially hidden or sampled only at few discrete events, as present in gene regulatory networks, neural circuits and power grids among others.

Fakhteh Ghanbarnejad

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**Thursday, 29.06.17 · 16:15h · EW 202**

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