SOE 21: Traffic Dynamics, Urban and Regional Systems I

Time: Friday 9:30–10:00 Location: GÖR 226

SOE 21.1 Fri 9:30 GÖR 226

Phases of scaling and cross-correlation behavior in traffic — •Jan W. Kantelhardt[1], Matthew Fullerton[2], Mirko Kämpf[1], Cristina Beltran-Ruiz[3], and Fritz Busch[2] — [1]Institut für Physik, Martin-Luther-Universität Halle-Wittenberg — [2]Department of Traffic Engineering, Technische Universität München — [3]Sociedad Iberica de Construcciones Electricas, Madrid, Spain

While many microscopic models of traffic flow describe transitions between different traffic phases, such transitions are difficult to quantify in measured traffic data. Here we study long-term traffic recordings consisting of $\approx$ 2900 days of flow, density, and velocity time series with minute resolution from a Spanish motorway. We calculate fluctuations, cross-correlations, and long-term persistence properties of these quantities. This leads to a data-driven definition of three (local) traffic states based on the dynamical properties of the data. The states can be identified with free flow, viscous traffic, and traffic jam. The dynamic classification is related with a static classification into three regions in the flow-density diagram.

SOE 21.2 Fri 9:45 GÖR 226

Air Traffic, Boarding and Scaling Exponents — •Reinhard Mahnke — Rostock University, Institute of Physics, D-18051 Rostock, Germany

The air traffic is a very important part of the global transportation network. In distinction from vehicular traffic, the boarding of an airplane is a significant part of the whole transportation process.

Here we study an airplane boarding model, introduced in 2012 by Frette and Hemmer, with the aim to determine precisely the asymptotic power–law scaling behavior of the mean boarding time $\langle t_b \rangle$ and other related quantities for large number of passengers N. Our analysis is based on an exact enumeration for small system sizes $N \leq 14$ and Monte Carlo simulation data for very large system sizes up to $N = 2^{16} = 65\,536$. It shows that the asymptotic power–law scaling $\langle t_b \rangle \propto N^{\alpha}$ holds with the exponent $\alpha = 1/2$ ($\alpha = 0.5001 \pm 0.0001$). We have estimated also other exponents: $\nu = 1/2$ for the mean number of passengers taking seats simultaneously in one time step, $\beta = 1$ for the second moment of $\langle t_b \rangle$ and $\gamma \approx 1/3$ for its variance. We have found also the correction–to–scaling exponent $\theta \approx 1/3$ and have verified that a scaling relation $\gamma = 1 - 2\theta$, following from some analytical arguments, holds with a high numerical accuracy.