Working Group on Physics of socio-economic Systems
Arbeitskreis Physik sozio-ökonomischer Systeme (AKSOE)

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Overview of Invited Talks and Sessions
(lecture rooms EW 203 and EW 201; Poster G)

Invited Talks

AKSOE 2.1	Mon	9:30–10:15	EW 203	**Network organizations** — •Fernando Vega-Redondo
AKSOE 7.1	Tue	9:30–10:15	EW 203	**Sexual networks** — •Fredrik Liljeros
AKSOE 10.1	Tue	16:00–16:45	EW 201	**Fat-tails and the physics of finance** — •Lisa Borland
AKSOE 14.1	Thu	9:30–10:15	EW 203	**Risk, Expectations and Bidding in First Price Auctions** — •Oliver Kirchkamp

Sessions

AKSOE 1.1–1.1	Sun	14:00–17:00	EW 203	**Tutorial: Introduction to the Physics of Complex Networks**
AKSOE 2.1–2.1	Mon	9:30–10:15	EW 203	**Dynamics of Groups and Organizations I**
AKSOE 3.1–3.5	Mon	10:15–12:45	EW 203	**Financial Markets and Risk Management I**
AKSOE 4.1–4.4	Mon	14:00–16:00	EW 203	**Dynamics of Groups and Organizations II**
AKSOE 5.1–5.4	Mon	16:00–18:00	EW 203	**Social-, Information-, and Production Networks I**
AKSOE 6	Mon	18:00–19:00	EW 203	**Mitgliederversammlung**
AKSOE 7.1–7.1	Tue	9:30–10:15	EW 203	**Dynamics of Groups and Organizations III**
AKSOE 8.1–8.4	Tue	10:15–12:15	EW 203	**Economic Models and Evolutionary Game Theory**
AKSOE 9.1–9.3	Tue	14:00–15:30	EW 203	**Social, information-, and production networks I**
AKSOE 10.1–10.1	Tue	16:00–18:00	EW 201	**Award Ceremony: Young Scientist Award for Socio- and Econophysics**
AKSOE 11.1–11.3	Wed	13:00–14:30	EW 203	**Social-, Information-, and Production Networks I**
AKSOE 12.1–12.5	Wed	14:45–17:15	EW 203	**Dynamics of groups and organizations IV**
AKSOE 13.1–13.17	Wed	17:30–19:00	Poster G	**Poster Session (posters on display 10:00-19:00)**
AKSOE 14.1–14.1	Thu	9:30–10:15	EW 203	**Financial Markets and Risk Management II**
AKSOE 15.1–15.4	Thu	10:15–12:15	EW 203	**Social-, Information-, and Production Networks II**
AKSOE 16.1–16.5	Thu	13:30–16:00	EW 203	**Financial Markets and Risk Management III**
AKSOE 17.1–17.4	Thu	16:15–18:15	EW 203	**Traffic Dynamics, Urban, and Regional Systems**

Symposium: Game Theory in Dynamical Systems SYDN

Friday 9:40 - 13:00, room H0105, see separate program section SYDN

Special Event: Award Ceremony of the Young Scientist Award for Socio- and Econophysics

Tuesday　　16:00–18:00　　EW201

Annual member's assembly of the Working Group on Physics of socio-economic Systems (AKSOE)

Monday   18:00–19:00   EW 203

- Bericht des Vorsitzenden des AKSOE
- Wahl des Vorsitzenden
- Diskussion über geplante Aktivitäten
- Verschiedenes

AKSOE 1: Tutorial: Introduction to the Physics of Complex Networks

Time: Sunday 14:00–17:00 — Location: EW 203

Tutorial — AKSOE 1.1 — Sun 14:00 — EW 203

Introduction to the Physics of Complex Networks — •JÖRG REICHARDT — Institute for Theoretical Physics and Astronomy, University of Würzburg

The tutorial will give an introduction to the field of complex networks. It will show how multi-agent or many-particle systems coming from a variety of fields spanning the social and life sciences can be modeled as networks. Driven by an ever growing amount of empirical data, a number of surprising and interesting results have been obtained by physicists in recent years in this truly interdisciplinary field between discrete mathematics and statistical physics on the one hand, and sociology or biology on the other. They shall be reviewed in this tutorial.

Statistical mechanics traditionally studies many particle systems in which the specificities of the interactions between individual particles are unknown and – worse – unaccessible. For systems such as gases or solids, these details are even unimportant as many system level properties can still be obtained without their knowledge. In contrast, the real world is full of many-particle systems for which the interactions between individual particles *are* known and accessible. However, being markets, traffic and social networks or gene regulatory networks, such systems have not been traditionally studied by physicists. What makes them interesting is that for such systems the details of the network of interactions *does* matter for the determination of system level properties. Hence, there are a lot of fascinating phenomena to be explored and the talk will show how this can be done – even with the toolbox of statistical mechanics.

The tutorial will be divided into three parts. Part 1 will focus on the structure and topology of networks and introduce basic concepts of network and graph theory. Key results in the study of empirical networks will be reviewed and a number of important network models such as small world and scale free networks will be discussed. In particular, it will be shown that real world networks are wired far from randomly and how insights into the network generation process may be obtained by studying exactly these deviations from random behavior.

The second part will focus on dynamics *on* networks. In particular, it will address the intimate relation between the topology of a network and dynamical processes running on a network. Such processes include transport and regulation as well as spreading phenomena. For instance, it will be shown that the scale free topology of many real world networks has important implications for the spreading of diseases across these networks, such as the absence of an epidemic threshold. However, knowledge of these features also allows for the design of efficient immunization strategies and a few of these will be discussed.

The last part of the talk will be devoted to the large scale analysis of networks. While the first two parts have presented a treatment on the level of individual nodes, this last part will show that there exists a hierarchy of coarse structures in many real world networks. Nodes may be grouped into classes based on patterns in the connectivity of the network, and statistical mechanics provides the tools to detect such patterns. Such classes of similar connectivity often correspond to classes of similar function, and analyzing topology may hence provide insights into function. Market and protein interaction networks will give examples, and an excursion into the theory of optimization problems will provide an insight into possibilities and an outlook to the limitations of data driven research on networks.

References:

M. E. J. Newman, The structure and function of complex networks, SIAM Review 45, 167-256 (2003)

S. Bornholdt, H.G. Schuster (Hrsg.): Handbook of Graphs and Networks. Wiley, 2003.

AKSOE 2: Dynamics of Groups and Organizations I

Time: Monday 9:30–10:15 — Location: EW 203

Invited Talk — AKSOE 2.1 — Mon 9:30 — EW 203

Network organizations — •FERNANDO VEGA-REDONDO — European University Institute, Florence, Italy

It is common to define a network organization as one that is fast and flexible in adapting to changes in the underlying environment. But besides the short-run advantages of adaptability, fast changes in the structure of the organization can also be detrimental in the longer run. This happens because a widespread knowledge of the organization's structure is important in channelling (and thus speeding up) search.

I discuss the trade-off between adaptability and structural stability in a changing environment where, if the structure of the organization adjusts, information on the exact nature of the change becomes known only with some lag. The main conclusion is that, as environment becomes more volatile, the optimal operational mode of the organization essentially passes from being totally flexible to being completely rigid, i.e. no intermediate options are ever optimal. Intuitively, this is a reflection of what could be heuristically understood as increasing returns to structural stability. Thus, when the preservation of some structure is beneficial, the optimal arrangement involves the preservation of all structure. An analogous conclusion applies in the opposite direction: when it is beneficial to have a partially adaptive structure, full adaptation is optimal.

AKSOE 3: Financial Markets and Risk Management I

Time: Monday 10:15–12:45 — Location: EW 203

AKSOE 3.1 — Mon 10:15 — EW 203

Modeling and predicting financial data — •JOACHIM PEINKE and ANDREAS P. NAWROTH — Institute of Physics, Carl von Ossietzky University of Oldenburg, D 26111 Oldenburg, Germany

It is shown how based on given financial data stochastic equations can be extracted. Based on these equation a new method is proposed which allows a reconstruction of time series based on higher order multiscale statistics given by the hierarchical process. This method is able to model the time series not only on a specific scale but for a range of scales. It is possible to generate complete new time series, or to model the next steps for a given sequence of data. The method itself is based on the joint probability density which can be extracted directly from given data, thus no estimation of parameters is necessary. The results of this approach are shown for financial data. The unconditional and conditional probability densities of the original and reconstructed time series are compared and the ability to reproduce both is demonstrated.

Therefore in the case of Markov properties the method proposed here is able to generate artificial time series with correct n-point statistics.

AKSOE 3.2 — Mon 10:45 — EW 203

Studies of the limit order book around large price changes — •BENCE TOTH[1,2], JANOS KERTESZ[2], and J. DOYNE FARMER[3] — [1]Complex Systems Lagrange Lab, ISI Foundation, Torino, Italy — [2]Department of Theoretical Physics, Budapest University of Technology and Economics, Budapest, Hungary — [3]Santa Fe Institute, Santa Fe, USA

Most of the financial markets today are governed by a continuous double auction mechanism, with a limit order book containing the orders placed to buy or sell a stock. We study the dynamics of this limit order book of liquid stocks on the London Stock Exchange (LSE) after experiencing a large intra-day price change. Previous studies of Trade and Quote data[1] revealed interesting results about the volume, volatility

and bid-ask spread for these periods. The analysis of the order book at the level of single orders gives insight to the the "microscopic" dynamics of price formation, especially to the role of liquidity thus it enhances our understanding of market risk.

[1] A.G. Zawadowski, G. Andor and J. Kertész, Quantitative Finance 6, 283-295 (2006)

AKSOE 3.3   Mon 11:15   EW 203

The hidden volatility process in financial time series — •Josep Perelló[1], Jaume Masoliver[1], and Zoltán Eisler[2] — [1]Departament de Física Fonamental, Universitat de Barcelona, Diagonal, 647, E-08028 Barcelona, Spain — [2]Department of Theoretical Physics, Budapest University of Technology and Economics, Budafoki út 8., H-1111, Budapest, Hungary

Volatility characterizes the amplitude of log-price fluctuations. Despite its popularity on trading floors, volatility is unobservable and only the price is known. Diffusion theory has many common points with the research on volatility, the key of the analogy being that volatility is a time-dependent diffusion coefficient of a random walk. We present a formal procedure to extract volatility from price data by assuming that it is described by a hidden Markov process which together with the price forms a two-dimensional diffusion process [1]. We derive an alternative maximum-likelihood estimate valid for a wide class of processes. We apply it to the exponential Ornstein-Uhlenbeck stochastic volatility model [2] since studies have shown its good performance in several aspects [3-5] and observe that it is able infer the hidden state of volatility [1]. The formalism is applied to the Dow Jones daily index.

[1] Z. Eisler, J. Perelló, J. Masoliver, Phys. Rev. E 76, 056105 (2007)
[2] J. Masoliver, J. Perelló, Quant. Finance 6, 423 (2006)
[3] J. Perelló, J.Masoliver, Phys. Rev. E 67, 037102 (2003)
[4] J. Perelló, J. Masoliver, Phys. Rev. E 75, 046110 (2007)
[5] T. Qiu, B. Zheng, F. Ren, S. Trimper, Phys. Rev. E 73, 065103 (2006)

AKSOE 3.4   Mon 11:45   EW 203

Characteristic times in limit order executions — •Zoltan Eisler[1,2], Janos Kertesz[1,3], Fabrizio Lillo[4,5], and Rosario N. Mantegna[4] — [1]Science & Finance, Capital Fund Management, Paris, France — [2]Department of Theoretical Physics, Budapest University

of Technology and Economics, Budapest, Hungary — [3]Laboratory of Computational Engineering, Helsinki University of Technology, Espoo, Finland — [4]Dipartimento di Fisica e Tecnologie Relative, Universit'a di Palermo, Palermo, Italy — [5]Santa Fe Institute, Santa Fe, NM, USA

We present a study of the order book data of the London Stock Exchange. We study the first passage time of order book prices (i.e., the time needed to observe a prescribed price change), the time to fill (TTF) for executed limit orders and the time to cancel (TTC) for canceled ones. We find that the distribution of the first passage time decays asymptotically in time as a power law with an exponent $\lambda_{\text{FPT}} = 1.5$. The quantities TTF, and TTC are also asymptotically power law distributed with exponents $\lambda_{\text{TTF}} = 1.8 - 2.2$ and $\lambda_{\text{FPT}} = 1.9 - 2.4$, respectively. We outline a simple model, which assumes that prices are characterized by the empirically observed distribution of the first passage time and orders are canceled randomly. The model correctly predicts that $\lambda_{\text{TTF}} \approx \lambda_{\text{TTC}}$, and one can estimate from empirical data that the directly unobservable lifetimes are also power law distributed with an exponent $\lambda_{\text{LT}} \approx 1.6$.

AKSOE 3.5   Mon 12:15   EW 203

Predicting employment and pension levels for the G7 and China — •Hans Danielmeyer and Thomas Martinetz — Institute of Neuro- and Bioinformatics, Universität Bremen, Germany

The fundamental uncertainty of employment and pension policy was so far the lack of long term theories for the demand of the home floor, the productivity of the factory floor, and the return on investment. Our analytically closed solutions for both floors and available data from the life insurance business allow designing sustainable pension systems. For G7 level nations (1.3 bn people) in 2100 the mean life expectancy will be 105 years, and we predict a working time of 24 hours per week (60 years/48 hours before WWII, 45 years/96 hours at the start of the industrial society). A new method distributing paid work for sustainable pension systems must be found immediately. An exclusive (no intergeneration transfer) and collective pension fund controlling directly 33 per cent of the capital market will require an increase of the retirement age to 80 by 2100. The corresponding trade off depends only on the pension level as percentage of average income (40 per cent in the above example). China (1.4 bn people) will be in a comparable position in 2040-50.

AKSOE 4: Dynamics of Groups and Organizations II

Time: Monday 14:00–16:00

Location: EW 203

AKSOE 4.1   Mon 14:00   EW 203

Two case studies of the Hirsch index and some of its variants — •Michael Schreiber — Institut für Physik, Technische Universität Chemnitz

The h-index was introduced by Hirsch to quantify the impact of the publications of a scientist by measuring the number of citations. I present an analysis of two data sets, one for 8 famous physicists and another [1,2] for 26 not-so-prominent colleagues. Difficulties with the determination of the index and its interpretation are discussed. In addition the influence of self-citations is analyzed. Some variants of the index are investigated. A new modification is suggested in order to take the number of co-authors appropriately into account. By means of this new m-index it is possible to attribute the fame for multi-authored manuscripts in a fair way.

[1] M. Schreiber, EPL 78 (2007) 30002
[2] M. Schreiber, Ann. Phys. (Leipzig) 16 (2007) 640

AKSOE 4.2   Mon 14:30   EW 203

Slower-is-faster: Enforcing consensus formation by heterogeneous inertia to change opinion — Hans-Ulrich Stark, Claudio Juan Tessone, and •Frank Schweitzer — Chair of Systems Design,ETH Zurich, Switzerland

In this paper, we investigate the role of a certain heterogeneity in an extension of the voter model. In our model, voters are equipped with an individual inertia to change opinion which depends on the persistence time of a voter's current opinion. We focus on the simplest scenario, where there are only two different inertia values present in the system: zero if a voter just adopted its current opinion and ν otherwise. In this way, voters change their individual behavior over time and the system builds up heterogeneity. The unexpected outcome of this dynamics is

a non-monotonous development of average consensus times T_κ on the value ν. Up to a value ν_c, T_κ decreases systematically with increasing ν, i.e. systems with higher average inertia reach the final attractor state faster. For inertia values larger than ν_c, consensus times increase and can exceed the reference time of the voter model. These results are obtained only by considering a heterogeneity of voters that evolves through the described ageing of the voters, as we find monotonously increasing consensus times in a control setting of homogeneous inertia values. In the paper, we present the dynamical equations for the mean-field case, that give insight into the complex dynamics leading to the observed slower-is-faster effect.

AKSOE 4.3   Mon 15:00   EW 203

Surrounding of clusters in a one-dimensional system — •Julian Sienkiewicz and Janusz Holyst — Faculty of Physics, Warsaw University of Technology, Poland

We investigate evolution of a system consisting of randomly added two-state objects e.g. spins or group members having one of the two opinions. Our numerical and analytical calculations show that even a simple one-dimensional model (a chain of N nodes) provides interesting results. The system's dynamics is described as follows: in each time step we add a spin with opposite value at a random, not occupied node in the chain until there is no space left in the chain. If after the addition of a new spin, there is a cluster (n consecutive spins with the same sign) surrounded by two spins of the opposite sign - the spins in the cluster are turned inactive. Those nodes no longer interact with the rest of the chain. In the investigated system the critical density - the moment at which the first blocked spin appears vanishes in the termodynamical limit (N goes to infinity). The rescaled number of the blocked nodes Z/N increases with the rescaled time t/N as

$(Z/N) \sim (t/N)^\gamma$ with γ exponent close to 3. We believe that the future generalization on other structures (2D, 3D and arbitrary complex network) can be used to model the process of one community being surrounded by another one.

AKSOE 4.4   Mon 15:30   EW 203
Parameter Estimation for Stochastic Models of Interacting Agents: An Approximate ML Approach — •Thomas Lux — University of Kiel

Simple models of interacting agents can be formulated as jump Markov processes via suitably specified transition probabilities. Their aggregate dynamics might then be analyzed by the Master equation for the change of the probability distribution over time, or the Fokker-Planck equation that is obtained by a power series expansion and governs the probability distribution for fluctuations around an equilibrium. With such information on the transient density of the process, maximum likelihood estimation of its parameters becomes feasible. Even if the Fokker-Planck equation can not be solved explicitly, one can resort to numerical approximations like the Crank-Nicolson method for approximate ML estimation. We explain this algorithm with a simple model of interacting agents and show that the approximate ML procedure works well and has desirable accuracy even in the case of bimodal limiting distributions. We illustrate possible applications by estimating the parameters of this model for a popular business climate index for the German economy showing that the pronounced ups and downs of the survey expectations can be explained to a large extent by social interactions.

AKSOE 5: Social-, Information-, and Production Networks I

Time: Monday 16:00–18:00   Location: EW 203

AKSOE 5.1   Mon 16:00   EW 203
Efficiency and Stability of Dynamic Innovation Networks — Michael D. König, Stefano Battiston, Mauro Napoletano, and •Frank Schweitzer — Chair of Systems Design, ETH Zurich, Kreuzplatz 5, 8032 Zurich, Switzerland

We investigate some of the properties and extensions of a dynamic innovation network model. In the model, the set of efficient graphs ranges, depending on the cost for maintaining a link, from the complete graph to the (quasi-) star, varying within a well defined class of graphs. However, the interplay between dynamics on the nodes and topology of the network leads to equilibrium networks which are typically not efficient and are characterized, as observed in empirical studies of R&D networks, by sparseness, presence of clusters and heterogeneity of degree. In this paper, we analyze the relation between the growth rate of the knowledge stock of the agents from R&D collaborations and the properties of the adjacency matrix associated with the network of collaborations. By means of computer simulations we further investigate how the equilibrium network is affected by increasing the evaluation time over which agents evaluate whether to maintain a link or not. We show that only if the evaluation time is long enough, efficient networks can be obtained by the selfish link formation process of agents, otherwise the equilibrium network is inefficient. This work should assist in building a theoretical framework of R&D networks from which policies can be derived that aim at fostering efficient innovation networks.

AKSOE 5.2   Mon 16:30   EW 203
Transient innovations - the case of blog hypes — Werner Ebeling[1], •Andrea Scharnhorst[2], and Mike Thelwall[3] — [1]Humboldt University Berlin, Germany — [2]VKS-KNAW, Amsterdam, The Netherlands — [3]University of Wolverhampton, UK

What triggers sudden bursts in public debates on specific topics, such as the recent hype on bird flu, blog discussions about bomb attacks, or the on-going debate on climate changes? How do mathematical approaches from physics contribute to a better understanding of complex communication pattern? In this paper, we look into 'hype phenomena' in on-line communication. We investigate to what extent increasing activity (visible in rapid growth) is related to structural changes in a system. We take as an example hype phenomena in blogs. We present a model based on different types of bloggers to explain hypes as a result of their non-linear interaction. In particular, we introduce the notion of 'transient innovations'. We place 'transient innovations' in a taxonomy of 'innovations' using concepts of complex dynamic systems as trajectories, attractor space. We discuss 'transient innovations' as temporary, but instable changes. The paper is part of the EU-funded research project Critical Events in Evolving Networks, CREEN (www.creen.org) that brings together theoretical physicists, information scientists, and social scientists in their shared effort to study the complex dynamics of the public communication of science and technology, as well as sudden developments within the sciences.

AKSOE 5.3   Mon 17:00   EW 203
Local and Global Dynamics of Production and Supply Networks under Mixed Production Strategies — •Reik Donner[1], Johannes Höfener[1,2], Kathrin Padberg[1], Stefan Lämmer[1], and Dirk Helbing[3] — [1]TU Dresden, Andreas-Schubert-Str. 23, 01062 Dresden, Germany — [2]MPI for Dynamics of Complex Systems, Nötznitzer Str. 38, 01187 Dresden, Germany — [3]ETH Zürich, Universitätstr. 41, 8092 Zürich, Switzerland

The analysis and control of dynamic material flows in traffic, production, and logistics is a subject of contemporary interest. In this contribution, we introduce a generalised input-output model of commodity flows that allows to study the dynamics of production and supply networks under different production strategies. It is demonstrated that production units subjected to a temporally varying demand and/or supply show an amplification of these variations for both push and pull strategies. Using an extended linear stability analysis, we identify under which conditions a consideration of mixed push-pull strategies leads to a suppression of these effects. Our corresponding results have important implications for the strategic planning and control of manufacturing networks.

AKSOE 5.4   Mon 17:30   EW 203
Using MAS to study the propagation of failures in dynamical supply-chains — •Samir Hamichi[1,2], Diana Mangalagiu[1,3], and Zahia Guessoum[2] — [1]Institute for Scientific Interchange Foundation, Turin, Italy — [2]LIP6, University Paris 6, France — [3]Reims Management School, France

Weisbuch and Battiston [1] introduced a simple model of failure propagation on a production network of firms linked by supply-customer relationships. They studied the evolution of these networks under very simple assumptions, identified the conditions under which local failures can result in avalanches of shortage and bankruptcies across the network and characterized the scale free properties of the model.

   We pursue the investigation of this model using a MAS approach and introducing features leading to a more realistic behavior of the production networks: 1) the price is linked to the market demand; 2) the behavior of the firms is adaptive i.e. the orders are linked to the price and reliability of the suppliers; 3) the structure of the network is allowed to evolve over time. Our preliminary results show that the adaptive behavior of the firms reinforces the local structure of the economy, the supply-chains changing from large spatial structures towards tree-like structures. We investigate the stability of the production and wealth patterns, the magnitude of the scale-free distribution of firm wealth as well as the influence of the propagation of failures on the global production of the economy.

[1]. Weisbuch, G. and Battiston, S. Production Networks and Failure Avalanches, JEBO (2007, forthcoming).

AKSOE 6: Mitgliederversammlung

Time: Monday 18:00–19:00   Location: EW 203

Mitgliederversammlung

AKSOE 7: Dynamics of Groups and Organizations III

Time: Tuesday 9:30–10:15   Location: EW 203

Invited Talk   AKSOE 7.1   Tue 9:30   EW 203
Sexual networks — ●FREDRIK LILJEROS — Dep. of sociology, Stockholm University, Stockholm, Sweden

Sexually transmitted infections continue to be a severe health problem in contemporary Western societies, despite the considerable funds allocated for control programs. In this seminar I will present and discuss a variety of explanations that have been advanced on why this type of disease is so hard to eradicate, despite the fact that the contact by which it is spread is far less frequent than is the case with most other infectious diseases. We conclude that several processes and mechanisms facilitate the spread of sexually infected diseases, and that both broad and targeted intervention is therefore needed to eradicate such diseases

AKSOE 8: Economic Models and Evolutionary Game Theory

Time: Tuesday 10:15–12:15   Location: EW 203

AKSOE 8.1   Tue 10:15   EW 203
Socioeconomic Networks with Long-Range Interactions — RUI CARVALHO[1] and ●GIULIA IORI[2] — [1]Centre for Advanced Spatial Analysis, 1-19 Torrington Place, University College London, WC1E 6BT United Kingdom — [2]Department of Economics, School of Social Science City University, Northampton Square, London EC1V 0HB United Kingdom

In well networked communities, information is often shared informally among an individual's direct and indirect acquaintances. Here we study a modified version of a model previously proposed by Jackson and Wolinsky to account for communicating information and allocating goods in socioeconomic networks. The model defines a utility function of node i which is a weighted sum of contributions from all nodes accessible from i. First, we show that scale-free networks are more efficient than Poisson networks for the range of average degree typically found in real world networks. We then study an evolving network mechanism where new nodes attach to existing ones preferentially by utility. We find the presence of three regimes: scale-free (rich-get-richer), fit-get-rich, and Poisson degree distribution. The fit-get-rich regime is characterized by a decrease in average path length.

AKSOE 8.2   Tue 10:45   EW 203
Cooperation in Prisoner's Dilemma with Dynamical Connection Weights — ●PLATKOWSKI TADEUSZ and MOGIELSKI KRZYSZTOF — Department of Mathematics, Informatics and Mechanics, University of Warsaw

We propose a model of continuous population of agents which, at any instant of time, are randomly matched to play the 2-person Prisoner's Dilemma game. The payoff from each encounter depends on the payoff matrix and on the weights of connections between different types of players. In our model the weights are dynamical variables. Their evolution depends on the difference of the agent's payoff from the considered type of encounters and his average payoff. Time evolution of the frequency of cooperators in the population is governed by the replicator equation. Both symmetric and asymmetric weights between cooperators and defectors are considered. Solutions of the resulting systems of differential equations are discussed. Structure of equilibrium states of the systems is investigated. In particular we prove existence of equilibrium states with partial cooperation.

AKSOE 8.3   Tue 11:15   EW 203

Impact of Topology on the Dynamical Organization of Cooperation — ANDREAS PUSCH, ●SEBASTIAN WEBER, and MARKUS PORTO — Institut für Festkörrperphysik, Technische Universität Darmstadt, Germany

The way cooperation organizes dynamically strongly depends on the topology of the underlying interaction network. We study this dependence using heterogeneous scale-free networks with different levels of (a) degree-degree correlations and (b) enhanced clustering [1], where the number of neighbors of connected nodes are correlated and the number of closed triangles are enhanced, respectively. Using these networks, we analyze the evolutionary replicator dynamics of the prisoner's dilemma, a two-player game with two strategies, defection and cooperation, whose payoff matrix favors defection. Both topological features significantly change the dynamics with respect to the one observed for fully randomized scale-free networks and can strongly facilitate cooperation even for a large benefit in defection and should hence be considered as important factors in the evolution of cooperation.
[1] A. Pusch, S. Weber, and M. Porto, submitted

AKSOE 8.4   Tue 11:45   EW 203
Differentialformen der Ökonophysik — ●JÜRGEN MIMKES — Department Physik, Uni Paderborn

Ökonomisches Wachstum führt auf nicht totale Differential- formen, deren Integral vom Weg abhängt. Diese Differentiale beschreiben Einkommen und Gewinne, die sich nur "ex post", nach Kenntnis des Integral- oder Produktionsweges berechnen lassen. Neoklassiche Theorien lassen sich nur auf Null- Wachtum anwenden. Nicht totale Differentiale lassen sich durch einen integrierenden Faktor Lambda in ein totales Differential dF umwandeln. F heisst in der Ökonomie Produktionsfunktion und in der Physik Entropie. Der Wirtschaftskreislauf läßt sich als Carnot Prozess auffassen, der immer auf zwei Niveaus Lambda führt, warm und kalt, Kapital und Arbeit, Investor und Sparer, reich und arm. Der Carnot Prozess führt in der Produktion zur Reduktion der Entropie (Ordnen der Bauelemte des Produktes) und auf dem Rückweg zur Entropieproduktion (Umwelt- und Klimaschäden). Im Handel führt er zum Kaufen (sammeln) bei niedrigem Preis und zum verkaufen (verteilen) bei hohem Preis. Im Bankwesen führt er zur Risiko Verringerung für Sparer und zu erhöhtem Risiko bei Investoren. Im Finanzwesen ist die Entropie die Produktionsfunktion jedes Portfolios. Ökonophysik umfasst Produktion, Handel, Banken und Finanzwesen.

AKSOE 9: Social, information-, and production networks I

Time: Tuesday 14:00–15:30   Location: EW 203

AKSOE 9.1   Tue 14:00   EW 203
Zipf law in the popularity distribution of chess openings — BERND BLASIUS[1] and ●TÖNJES RALF[2] — [1]ICBM, University of Oldenburg — [2]Institute of Physics, University of Potsdam

Human fascination with the game of chess is long-standing and pervasive. However, despite a large body of theoretical investigations, a quantitative understanding of playing behavior remains elusive. Here we demonstrate, based on an analysis of extensive chess databases, that there are simple statistical laws underlying the choice of opening moves in games of chess grandmasters and amateur players. We find that the frequencies of chess openings are distributed according to a power-law with an exponent that increases linearly with the game depth. Thus, in their initial phase the majority of chess games are concentrated among a small number of fashionable openings, whereas with increasing game depth rarely used move sequences are dominating. We present a simple stochastic process that is able to capture the observed playing statistics, providing a universal mechanism for the generation of Zipf's law. Our findings are of relevance in general composite decision processes and long tail economics.

AKSOE 9.2   Tue 14:30   EW 203
On recent trends to model and study social networks —
●Pedro Lind[1] and Hans Herrmann[2] — [1]Institute for Computational
Physics, Universität Stuttgart, Pfaffenwaldring 27, D-70569 Stuttgart,
Germany — [2]Computational Physics, IfB, HIF E12, ETH Hönggerberg, CH-8093 Zürich, Switzerland

We describe and develop three recent novelties in network research
which are particularly useful for studying social systems. First, we
describe a simple model of mobile colliding agents, whose collisions
define the connections between the agents which are the nodes in the
underlying network, and develop some analytical considerations. In
particular, we show that such an approach allows to reproduce all
the fundamental features of social networks. Second, we address the
particular feature of clustering and its relationship with global network measures, namely with the distribution of the size of cycles in
the network. Since in social bipartite networks it is not possible to
measure the clustering from standard procedures, we propose an alternative clustering coefficient that can be used to extract an improved
normalized cycle distribution in any network. Third, we describe two
properties to characterize the propagation of information in networks.
We focus on gossip propagation which impose some restrictions in the
propagation rules and find that there is an optimal non-trivial number
of friends for which the spread factor is minimized.

AKSOE 9.3   Tue 15:00   EW 203

**A Model to Test How Diversity Affects Resilience in Regional
Innovation Networks** — ●Sergi Lozano[1] and Alex Arenas[2] —
[1]ETH Zurich, Swiss Federal Institute of Technology, Zurich, Switzerland. — [2]Universitat Rovira i Virgili, Tarragona, Spain.

Research about resilience on complex systems has been commonly addressed from a structural point of view, relating this concept to the
preservation of the connectivity against the suppression of individual
nodes or links. This perspective coherently encompasses the analysis
of resistance of networked infrastructures to structural damage (e.g.
power grids, transportation and communication networks), but not
necessarily other sort of socio-economical systems. Here we associate
the resilience concept to the capability of a social organization to keep
acceptable levels of functionality against external socio-economic disrupting factors that do not imply necessarily destruction of existing
links.

As a particular case of study, we show how diversity of the organizational characteristics (both structural and related to individual*s behavior) improves resilience of regional innovation systems to uncertain
socio-economic scenarios. We reanalyze the conclusions of a classical
text about regional development (Saxenian 1994), comparing the evolution of two industrial districts, by first making a qualitative analogy
in terms of resilience and, second, building up a simplified model of
innovation systems that support quantitatively our argumentation.
(Recently published in Journal of Artificial Societies and Social Simulation)

AKSOE 10: Award Ceremony: Young Scientist Award for Socio- and Econophysics

Time: Tuesday 16:00–18:00   Location: EW 201

Invited Talk   AKSOE 10.1   Tue 16:00   EW 201
Fat-tails and the physics of finance — ●Lisa Borland — Evnine
and Associates, Inc., 456 Montgomery Street #800, San Francisco, CA
94104, USA

The dynamics of financial markets and the price formation process is
an example of a high dimensional complex system at work. There
is a need to understand and model the fluctuations that drive these
processes, for purposes such as correctly pricing complicated traded
instruments such as options, or for hedging financial risk. At the same
time one would like a model that is somewhat intuitive and analytically
tractable.

The most popular model, made famous by Black, Scholes and Merton in their Nobel-prize winning work, is essentially a simple Brownian
motion, resulting in Gaussian statistics for the price changes. However,
real financial time series exhibit a slew of anomalous statistics - or styl-

ized facts - such as persistent fat tails, long-range memory and time
reversal asymmetry. We discuss some feasible models, in particular a
non-Gaussian model that generalizes the standard one in a way that reproduces many of the stylized facts while still allowing for closed-form
solutions which allow efficient pricing of options and other important
derivatives such as credit default swaps.

In addition we show that not only the distributions of stock returns
and stock indices are fat-tailed, but so are also the distributions of
hedge fund strategy returns. This indicates the need - in general - for
more efficient control of extreme risks.

**— Presentation of the Young Scientist Award for Socio-
and Econophysics 2008 —**

— Awardees Talk —

AKSOE 11: Social-, Information-, and Production Networks I

Time: Wednesday 13:00–14:30   Location: EW 203

AKSOE 11.1   Wed 13:00   EW 203
The Backbone of Control in G8 Countries — ●James Glattfelder, Stefano Battiston, and Frank Schweitzer — Chair of
Systems Design, ETH Zurich, Switzerland

Starting from a network of shareholding relationships of quoted companies in G8 countries, the question of the distribution of control is
addressed. The special nature of such complex networks — the orientation and weights of links — is taken into account by introducing
new statistical measures which allow the identification of shareholders cumulatively controlling a substantial fraction of the market. The
backbone of control, this clique of powerholders and their portfolios,
is further analyzed using appropriate metrics unveiling distinct characteristics of the nature of the core of the G8 markets.

AKSOE 11.2   Wed 13:30   EW 203
**Networks of tag co-occurrence and measures of relatedness
in social tagging systems** — ●Ciro Cattuto[1,2], Dominik Benz[3],
Andreas Hotho[3], Gerd Stumme[3], and Andrea Baldassarri[4] —
[1]Centro Studi e Ricerche "Enrico Fermi", Compendio Viminale, 00184
Roma, Italy — [2]Complex Networks Lagrange Laboratory (CNLL), ISI
Foundation, 10133 Torino, Italy — [3]Knowledge & Data Engineering

Group, University of Kassel, 34121 Kassel, Germany — [4]Phys. Dept.,
Università di Roma "La Sapienza", P.le A. Moro 2, 00185 Roma, Italy
Social tagging systems allow web users to organize and share resources
by associating them with free-form keywords (*tags*). The popularity of
these systems has surged to a point where their study is important both
for scientific and technological reasons. Their underlying data structures are hypergraphs (known as *folksonomies*) collaboratively built
by the unsupervised activity of users: understanding their structure
and evolution poses promising challenges in different fields of research.
Crucial concepts are those of tag (node) similarity and tag (node) relatedness. We show that a bridge can be developed between statistical
measures of tag relatedness in the folksonomy and standard notions
of taxonomic distance in formal representations of knowledge. We use
data from the social bookmarking system *del.icio.us* to analyze three
distributional measures of tag relatedness (tag co-occurrence, cosine
similarity and FolkRank, an adaptation of PageRank to folksonomies)
and provide a solid semantic grounding of our findings by mapping the
nodes of the folksonomy hypergraph into a large taxonomic database of
English, and applying there standard measures of semantic similarity.

AKSOE 11.3   Wed 14:00   EW 203

K-core structure of folksonomies — •Andrea Baldassarri[1], Ciro Cattuto[2], and Vittorio Loreto[1,3] — [1]Sapienza Università di Roma, Rome, Italy — [2]Centro Studi e Ricerche "Enrico Fermi", Rome, Italy — [3]ISI Foundation, Turin, Italy

Collaborative tagging systems have become very popular on the web. In these systems, users collect and share information annotating resources with freely chosen keywords ("tags"), that can be used to browse the annotated information. The emergent data-structure ("folksonomy") can be described as a tri-partite network of users, tags and resources. Each time a user annotates a resource with a tag, a hyper-link is added to the network, which then undergoes a decentralized, unsupervised growth. Previous investigations focused on the structure of the network, revealing its small-world nature and spotting specific correlations encoding semantics. Here we explore the topological structure of the network and we investigate the existence of cores of highly connected nodes. We characterize such cores and interpret their member nodes in terms of measures of semantic relatedness. The study requires the introduction of some methodological novelty in order to define tools and measures suitable for the specific nature of folksonomies.

AKSOE 12: Dynamics of groups and organizations IV

Time: Wednesday 14:45–17:15 Location: EW 203

AKSOE 12.1 Wed 14:45 EW 203

Community dynamics in social networks — •Gergely Palla[1], Albert-Làszlò Barabàsi[2], and Tamàs Vicsek[1] — [1]Statistical and Biological Physics Research Group of HAS, Budapest, Hungary — [2]Department of Physics, University of Notre Dame, USA

We study the statistical properties of community dynamics in large social networks, where the evolving communities are obtained from subsequent snapshots of the modular structure. Such cohesive groups of people can grow by recruiting new members, or contract by loosing members; two (or more) groups may merge into a single community, while a large enough social group can split into several smaller ones; new communities are born and old ones may disappear. We find significant difference between the behaviour of smaller collaborative or friendship circles and larger communities, eg. institutions. Social groups containing only a few members persist longer on average when the fluctuations of the members is small. It appears to be almost impossible to maintain this strategy for large communities, however. Thus we find that the condition for stability for large communities is continuous changes in their membership, allowing for the possibility that after some time practically all members are exchanged.

AKSOE 12.2 Wed 15:15 EW 203

Cultural route to the emergence of linguistic categories — Andrea Baronchelli[1], •Vittorio Loreto[2,3], and Andrea Puglisi[2] — [1]Departament de Fisica i Enginyeria Nuclear, Universitat Politecnica de Catalunya, Campus Nord, Modul B4, 08034 Barcelona, Spain — [2]Dipartimento di Fisica, "Sapienza" Universita' di Roma, Piazzale Aldo Moro 2, 00185 Rome, Italy — [3]Complex Networks Lagrange Laboratory, ISI Foundation, Turin, Italy

Categories provide a coarse grained description of the world. A fundamental question is whether categories simply mirror an underlying structure of nature, or instead come from the complex interactions of human beings among themselves and with the environment. Here we address this question by modeling a population of individuals who co-evolve their own system of symbols and meanings by playing elementary language games. The central result is the emergence of a hierarchical category structure made of two distinct levels: a basic layer, responsible for fine discrimination of the environment, and a shared linguistic layer that groups together perceptions to guarantee communicative success. Remarkably, the number of linguistic categories turns out to be finite and small, as observed in natural languages.

AKSOE 12.3 Wed 15:45 EW 203

Collective Phenomena in Complex Social Systems — •González-avella Juan Carlos, Vazquez Federico, Eguíluz Victor, and San Miguel Maxi — Instituto de Física Interdisciplinar y Sistemas Complejos (IFISC-CSIC), Palma de Mallorca, Spain

The problem of social consensus is approached from the perspective of nonlinear dynamics of interacting agents in a complex network. Some basic concepts, such as dynamical metastability, are discussed in the framework of the prototype voter model. In the context of Axelrod's model for the dissemination of culture we describe a coevolutionary dynamics formulation with recent results on group formation and nonequilibrium network fragmentation and recombination transitions.

AKSOE 12.4 Wed 16:15 EW 203

Investigation of opinion poll data and election results in Germany and Great Britain — •Johannes Josef Schneider[1] and Christian Hirtreiter[2] — [1]Institute of Physics, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55099 Mainz, Germany — [2]Faculty of Chemistry, University of Regensburg, 93040 Regensburg, Germany

Since many years, the Allensbach institute in Germany and a related institute in Great Britain performs an opinion poll each week, asking at least 1000 people the question "Which party would you vote for if there was an election next Sunday?"

We investigate these opinion poll data by means of time series analysis. The most prominent results for the German data are fat tails in the return distributions of the time series. Furthermore, we find that the election results for the Green party cannot be predicted at all by opinion polls, for the conservative and the social democratic party, we find that the opinion poll data agree the more with the election results, the closer the date of the opinion poll is to the election date [1]. Thus, the question arises whether an opinion poll long before an election provides any useful information at all.

In this talk, we compare the results we found in Germany with corresponding data from Great Britain.

[1] J.J. Schneider and Ch. Hirtreiter, preprint, accepted for publication in Int. J. Mod. Phys. C, 2007.

AKSOE 12.5 Wed 16:45 EW 203

Some key properties of the German soccer league: a model-free time series analysis — •Andreas Heuer and Oliver Rubner — Inst. f. Phys. Chemie, Corrensstr. 30, 48149 Münster

In recent years several complex models have been devoloped to characterize the outcome of sports leagues in the course of a season. The final interpretation usually depends strongly on model assumptions. In this work we analyse a large database of 40 years of results in the German soccer league (1. Bundesliga). Therefrom interesting questions can be answered without resorting to any models: (1) How do the team fitnesses change during a season and from season to season? Many models assume a random walk-type behavior of a team fitness during one season. (2) Are offensive or defensive abilities more relevant for a successful outcome? (3) Do series of wins or losses exist beyond statistical fluctuations? Answering the last question involves ideas, originating from multidimensional NMR experiments and gives rise to interesting psychological insight into professional soccer.

AKSOE 13: Poster Session (posters on display 10:00-19:00)

Time: Wednesday 17:30–19:00   Location: Poster G

AKSOE 13.1   Wed 17:30   Poster G
Phase transitions in operational risk — •KARTIK ANAND — Department of Mathematics, King's College London, London, UK

In this paper we explore the functional correlation approach to operational risk. We consider networks with heterogeneous a priori conditional and unconditional failure probability. In the limit of sparse connectivity, self-consistent expressions for the dynamical evolution of order parameters are obtained. Under equilibrium conditions, expressions for the stationary states are also obtained. Consequences of the analytical theory developed are analyzed using phase diagrams. We find coexistence of operational and nonoperational phases, much as in liquid-gas systems. Such systems are susceptible to discontinuous phase transitions from the operational to nonoperational phase via catastrophic breakdown. We find this feature to be robust against variation of the microscopic modeling assumptions.

AKSOE 13.2   Wed 17:30   Poster G
Learning, evolution and population dynamics — JUERGEN JOST and •WEI LI — MPIMIS, Inselstr. 22, 04103 Leipzig

We study a complementarity game as a systematic tool for the investigation of the interplay between individual optimization and population effects and for the comparison of different strategy and learning schemes. The game randomly pairs players from opposite populations (buyers and sellers), with each independently making an offer between 0 and K. When the buyer's offer k(b) is no less than the seller's offer k(s), a deal is done and the buyer wins K-k(b) and the seller k(s); otherwise the interaction fails and both gain nothing. The game is symmetric at the individual level, but has many equilibria that are more or less favorable to the members of the two populations. Which of these equilibria then is attained is decided by the dynamics at the population level. Players play repeatedly, but in each round with a new opponent. They can learn from their previous encounters and translate this into their actions in the present round on the basis of strategic schemes. The schemes can be quite simple, or very elaborate. We can then break the symmetry in the game and give the members of the two populations access to different strategy spaces. Typically, simpler strategy types have an advantage because they tend to go more quickly towards a favorable equilibrium which, once reached, the other population is forced to accept. Also, populations with bolder individuals that may not fare so well at the level of individual performance may obtain an advantage towards ones with more timid players.

AKSOE 13.3   Wed 17:30   Poster G
Complex Correlations in High Frequency Asset Returns — •TOBIAS PREIS, WOLFGANG PAUL, and JOHANNES J. SCHNEIDER — Institute of Physics, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55099 Mainz, Germany

We analyze the conditional probability distribution functions of high frequent financial market data returns in order to test the randomness of financial markets. An observable for pattern conformity is introduced, which is able to measure complex correlations in a time series on short time scales. When we apply this method to high-frequency time series of the German DAX future contract, we find significant correlations on short time scales. We find strong correlations if one takes additionally into account transaction volumes and inter-trade waiting times.

AKSOE 13.4   Wed 17:30   Poster G
Parameter Estimation for a stochastic claim reserving model — •MAGDA SCHIEGL — Haydnstr. 6, D - 84088 Neufahrn

Claim reserving is a very important topic in property and casualty (P&C) insurance companies. The reserves represent the value of all liabilities arising from the insured portfolio. Therefore they have a huge influx on accounting and they are essential for the insurance company*s risk management. This is especially important in a time where the EU wide regulatory framework *Solvency II* is built up. A stochastic model for claim reserving has been introduced [1]. It consists of two parts: One model for the number of active claims and one for the claim payments. This model needs to be calibrated to the real world via appropriate data analysis and parameter estimation. We formulate the conditions on the claim data sets that can be used for calibration. Furthermore we apply methods of Bayes data analysis

to estimate the model parameters. This allows us to implement our prior knowledge on the run off behaviour of the claims. We discuss the results of applying the calibration methods.

[1] M. Schiegl, A stochastic model for claim reserves in P&C insurance companies, AKSOE, DPG Conference, March 2007, Regensburg

AKSOE 13.5   Wed 17:30   Poster G
Socio-Economic Influences of Population Density — •YURI YEGOROV — Institute for Advanced Studies, Vienna, Austria

While population density represents an important socio-economic parameter, its role is rarely studied in the literature. This paper represents a survey of mostly author*s results on important socio-economic influences of population density. It plays an important role in societies that depend on agriculture and natural resources, but the economic influence is not straight forward. Too high population density decreases the natural endowment per capita, but eases the development of infrastructure, leading to existence of an optimal population density for economic growth. Population density also influences an optimal country size, where the cost balance is now between border protection and communication costs. Ethnic communities based on more cooperative behavior emerge in the case of low cultural and physical distances. Higher probability of large projects (like infrastructure) leads to development of cooperative behavior in the society. Elaboration along these lines leads to the conclusion that population density positively correlates with individualistic (non-cooperative) behavior, through less time spent in cooperative infrastructure projects and higher frequency of meetings between individuals that with some probability lead to non-cooperative games. Population density also influences the demand for a monopolistic product, where too little density can lead to non-survival of a monopoly.

AKSOE 13.6   Wed 17:30   Poster G
Long-term memory effects in volatility first-passage time — •JOSEP PERELLÓ and JAUME MASOLIVER — Departament de Física Fonamental, Universitat de Barcelona, Diagonal, 647, E-08028 Barcelona, Spain

Extreme times techniques, generally applied to nonequilibrium statistical mechanical processes, are also useful for a better understanding of financial markets. We present a detailed study on the mean first-passage time for the volatility of return time series [1]. The empirical results extracted from daily data of major indices seem to follow the same law regardless of the kind of index thus suggesting an universal pattern. The empirical mean first-passage time to a certain level L is fairly different from that of the Wiener process showing a dissimilar behavior depending on whether L is higher or lower than the average volatility. All of this indicates a more complex dynamics in which a reverting force drives volatility toward its mean value. We thus present the mean first-passage time expressions of the most common stochastic volatility models whose approach is comparable to the random diffusion description. We discuss asymptotic approximations of these models and confront them to empirical results with a good agreement with the exponential Ornstein-Uhlenbeck model.

[1] J.P and J.M., Phys. Rev. E 75, 046110 (2007)

AKSOE 13.7   Wed 17:30   Poster G
Some remarks on suitable risk measures for Basel II and Solvency II — •ULI SPREITZER[2] and VLADIMIR REZNIK[1] — [1]WatsonWyattHeissmann Deutschland GmbH, Wiesbaden — [2]Beltios GmbH, Munich * 'on leave from institute'

Concerning rsik capital within banks - Basel II - and insurance companies - Solvency II - there has been a broad discussion on how to measure the risk as measured by capital required. Beside the discussions what measure of risk is suitable: quantil, standard deviation etc. here is also some discussions on measures of risk of single or multiple businesses units. Multiple businesses are discussed using correlations matrices. We show, that there are limitations within this concept and suggest applying a measure of risk applied on the complete company after having simulated the whole company.

AKSOE 13.8   Wed 17:30   Poster G
Seeking for criteria to define optimality in economic and social systems — ELENA RAMÍREZ BARRIOS[1] and •JUAN G. DÍAZ

OCHOA[2] — [1]Fachbereich 7, Bremen University, Hochschulring 4, D28359 Bremen — [2]Fachbereich 1, Bremen University, Otto Hahn Allee, D-28359 Bremen

Modeling social phenomena as, for example, voters models or consumers trends formation, is strength elated with collective processes, where the whole population are seeking for an optimum. This social optimum is, for instance, the increase of the total populations welfare within an economic system, or increasing the trust degree inside a given society. However, the criteria to achieve these social optima is difficult to define, because social consensus is underlying these processes and complete coordination is very hard to achieve (Arrow, 1951, 1963). Furthermore, this coordination process has different dynamics between small and large population groups, making more difficult to find appropriate unique criteria.

Using techniques from systems with self organized criticality, we define a system with non-fixed links between individuals, originating continuous fluctuations in the definition of the criteria for an optimum. This model is pillared in system of agents with changing preferences, altering the connectivity with their neighbors. With our simulations we found out that optimization criteria are non static, but exhibit a kind of punctuated equilibrium. This result is analyzed when the system lies in a critical state.

AKSOE 13.9 Wed 17:30 Poster G

Renewal equations for option pricing — ●MIQUEL MONTERO — Departament de Física Fonamental, Universitat de Barcelona, Diagonal 647, E-08028 Barcelona, Spain.

We will present an original approach, based in the use of renewal equations, for obtaining pricing expressions for financial instruments whose underlying asset can be solely described through a simple continuous-time random walk (CTRW). This setup enhances the potential use of CTRW techniques and results in finance.

We solve the equations for several contract specifications (European binary calls, European vanilla calls, American binary puts, perpetual American vanilla puts), by obtaining explicit expressions for a particular but exemplifying jump probability density function: an asymmetric exponential.

We present plots that depict the properties of the option prices for different values of the free parameters, and show how one can recover the celebrated results for the Wiener process under certain limits.

AKSOE 13.10 Wed 17:30 Poster G

Kauffman Boolean model in undirected scale free networks — PIOTR FRONCZAK, AGATA FRONCZAK, and ●JANUSZ HOLYST — Faculty of Physics, Warsaw University of Technology, Koszykowa 75, 00-662 Warsaw, Poland

We investigate analytically and numerically the critical line in undirected random Boolean networks with arbitrary degree distributions, including scale-free topology of connections $P(k) \sim k^{-\gamma}$. We explain that the unattainability of the critical line in numerical simulations of classical random graphs is due to percolation phenomena. We suggest that recent findings of discrepancy between simulations and theory in directed random Boolean networks can have the same reason. We also show that in infinite scale-free networks the transition between frozen and chaotic phase occurs for $3 < \gamma < 3.5$. Since most of critical phenomena in scale-free networks reveal their non-trivial character for $\gamma < 3$, the position of the critical line in Kauffman model seems to be an important exception from the rule.

AKSOE 13.11 Wed 17:30 Poster G

Modeling of financial markets by the Poissonian-like multifractal point processes — ●BRONISLOVAS KAULAKYS, VYGINTAS GONTIS, MIGLIUS ALABURDA, and JULIUS RUSECKAS — Institute of Theoretical Physics and Astronomy of Vilnius University, A. Gostauto 12, LT-01108 Vilnius, Lithuania

Recently we proposed and investigated Poissonian-like point processes with slowly fluctuating mean interevent time, driven by the multiplicative autoregressive stochastic equation [1]. The proposed model relates the power-law spectral density with the power-law distribution of the signal intensity into the consistent theoretical approach. The generated time series of the model are multifractal [2]. Here we present the comparison of the model with the empirical data of the trading activity for stocks traded on NYSE. This enables us to present a model, based on the scaled equation, universal for all stocks. The proposed model reproduces the main statistical properties, including the spectrum of the trading activity with two different scaling exponents and

the waiting time distribution.

[1] V. Gontis and B. Kaulakys, Physica A **343**, 505 (2004); **382**, 114 (2007).
[2] B. Kaulakys, M. Alaburda, V. Gontis and T. Meskauskas, In *Complexus Mundi: Emergent Patterns in Nature*, Ed. M. M. Novak, World Scientific, Singapore, p. 277 (2006).

AKSOE 13.12 Wed 17:30 Poster G

Realized Volatility and Realized Covariance in Heavy-Tailed Financial Data — ●OLIVER GROTHE and CHRISTOPH MÜLLER — University of Cologne, Research Training Group Risk Management

Realized volatility and realized covariance have recently been used intensively for measuring and forecasting volatility and dependency of intraday financial data. For these estimators, nice convergence properties may be derived under standard assumptions. However, they face two important problems when actually working with high frequency financial data: market microstructure effects and heavy tails in return data. The former introduces a bias to the estimators, the latter may lead to infinite variances of the estimators. While recent research suggested several solutions to overcome the bias, the influence of heavy tails on the estimators remains mainly unexplored.

We analyze this influence and show that the standard estimators tend to get useless if the tail indices of return distributions approach values as commonly observed in financial data. However, we proof that other estimators such as the bipower variation remain accurate.

AKSOE 13.13 Wed 17:30 Poster G

A Chaotic-Dynamic View of Investment Risk in Emerging Economies — ●EDGARDO JOVERO — University of Kent

A Chaotic-Dynamic View of Investment Risk in Emerging Economies by Edgardo Jovero (University of Kent, Canterbury, UK, email: ej34@kent.ac.uk) Dr. Hans Martin Krolzig (Thesis supervisor) An open-economy neo-Keynesian model is developed which highlights market power and price-setting behavior as a source of the indeterminacy and structural instability characterizing the risk environment in emerging markets. This should explain why countries, which constitute the whole of the emerging economies as a group, provide different country investment risks individually.

MSC (2000) : 91B62 (mathematical economics), 37N40 (complex dynamical systems in optimization problems) PACS code: 89.67.Gh (economics, econophysics) JEL classification: F43 (economic growth of open economies) Keywords: risk, foreign capital, emerging markets, neo-Keynesian economics, Hopf bifurcation

AKSOE 13.14 Wed 17:30 Poster G

Optimization of portfolios with longer investment period — ●ULI SPREITZER[2] and VLADIMIR REZNIK[1] — [1]WatsonWyattHeissmann Deutschland GmbH, Wiesbaden — [2]Beltios GmbH, Munich; 'on leave from institute'

We investigate the optimization of portfolios with the investment I done periodically (n-times) with a period Δt_1, and the investment is been hold after the last investment for a time Δt_2 much larger than $n\Delta t_1$. We show that, when using the μ - $k\sigma$ optimization for the portfolio one has to consider, that σ is time dependent. Considering different assets (shares) with the same $\sigma(\Delta t_2)$ the investment in the asset is preferable with the highest $\sigma(\Delta t_1)$. That means, that portfolio optimization with the measure of risk as μ - $k\sigma$ and the cost average effect holds best for assets with $\sigma(\Delta t_1)$ large and $s(\Delta t_2)$ small. Also this shows, that one should add a measure of risk for the investment process. With respect to Solvency II, this means, that different measures of risk for different business processes should be applied.

AKSOE 13.15 Wed 17:30 Poster G

On the problem of a suitable distribution of students to universities — ●CHRISTIAN HIRTREITER[1], JOHANNES JOSEF SCHNEIDER[2], and INGO MORGENSTERN[3] — [1]Faculty of Chemistry, University of Regensburg, 93040 Regensburg, Germany — [2]Institute of Physics, Johannes Gutenberg University of Mainz, Staudinger Weg 7, 55099 Mainz, Germany — [3]Faculty of Physics, University of Regensburg, 93040 Regensburg, Germany

Since many years, the problem of how to distribute students to the various universities in Germany according to the preferences of the students remains unsolved. In a nowadays widely used approach, students apply for a place at various universities. The best students get then several acceptances, whereas some worse students fail everywhere. In the next step, the best students choose a place at their preferred

university, such that places suddenly become free for students, who received a rejection in the first step and who now get an acceptance. This scheme is iterated several times, each time takes some weeks. Then the semester has already started before some students get the acceptance letter. But for some subjects, like medical science, students can lose a whole year by this way. The former way of distributing students was to apply for a place at some preferred universities at a central agency called ZVS (Zentralstelle für die Vergabe von Studienplätzen). However, due to a strange rule set, many students ended up at universities which were not in their preference list. In this talk, we show how the rules for distributing students could be changed easily in order to increase the fraction of satisfied students.

AKSOE 13.16   Wed 17:30   Poster G
Correlation problem in economic capital issues of operatioal risk — •CHITRO MAJUMDAR — i-flex Inc.

In Operational Risk we need to estimate loss distributions for 56 Business-Event type combinations (7*8 matrix). Loss Distribution is a combination of frequency dist and severity dist. Each of the 56 cells will have their own frequency and severity dist. Now the problem is to aggregate the Loss Dist across different cells. Currently Basel II recommends simple addition but this is too conservative. So the problem is to determine correlation across Frequency and Severity dist. Currently in the industry there are no standard methods for severity dist aggregation. The practice is to use frequency dist aggregation. Aggregation of frequency is done using copulas. Gaussian/Frank/Gumbel and Clayton are some of the possibilities. But all of these would require estimation of some form of correlation. So the problem is how to find

out this frequency correlation? volatility measures the uncertainty of returns, beta measures how much an individual asset is likely to move with the general market and Value at Risk, which is a recent innovation, measures the maximum loss (in the probabilistic sense) that is likely to be occurred in the immediate future. Given the distribution of the risk factors, their Tail Correlations and the Functional Relationship between Loss Metric for the Cluster and underlying factors, we perform a Monte Carlo simulation using Cholesky Factorization, to include correlation effects, to generate the Loss Distribution of the cluster.

AKSOE 13.17   Wed 17:30   Poster G
Mutations in the Three-Species Cyclic Lotka-Volterra Model on a Lattice — •ANTON WINKLER, TOBIAS REICHENBACH, and ERWIN FREY — Arnold Sommerfeld Center for Theoretical Physics and Center for NanoScience, Department of Physics, Ludwig-Maximilians-Universität München, Theresienstraße 37, D-80333 München, Germany

We study the effect of mutations on the dynamics of the three-species cyclic Lotka-Volterra Model, also known as the Rock-Scissors-Paper game, on a regular one-dimensional lattice. It is demonstrated that a simple real-space renormalization group approach is capable of capturing many of the features of the process in the vicinity of the unstable critical point, located at zero mutation rate. Care is taken in discriminating between mutations to the respective "predator" and "prey", giving rise to two different renormalization group eigenvalues. The approach enables us to work out reliable scaling relations which are robust to a broad range of variations in the model.

AKSOE 14: Financial Markets and Risk Management II

Time: Thursday 9:30–10:15   Location: EW 203

Invited Talk   AKSOE 14.1   Thu 9:30   EW 203
Risk, Expectations and Bidding in First Price Auctions — •OLIVER KIRCHKAMP — Universität Jena; 07743 Jena

Bids in private value first-price auctions consistently deviate from risk neutral symmetric equilibrium bids. We first present results of a new experiment that measures the impact of risk aversion on actual bid-

ding behaviour. We then present a procedure which allows to study the formation of expectations separately from the determination of a best reply against these expectations. We find that deviations from Bayesian Nash equilibrium are not due to wrong expectations but due to deviations from a best replies. We finally discuss how boundedly rational functions can provide a better explanation for actual bidding behaviour.

AKSOE 15: Social-, Information-, and Production Networks II

Time: Thursday 10:15–12:15   Location: EW 203

AKSOE 15.1   Thu 10:15   EW 203
Impact of human behavior on information spreading: Viral marketing and social networks — JOSE LUIS IRIBARREN[1] and •ESTEBAN MORO[2] — [1]IBM corporation, ibm.com e-Relationship Marketing Europe, 28002 Madrid (Spain) — [2]Departamento de Matematicas, Universidad Carlos III de Madrid, 28911 Leganes (Spain)

The dynamics of information dissemination in social networks is of paramount importance in processes such as rumors or fads propagation , spread of product innovation, word-of-mouth communications or viral marketing. Due to the difficulty in tracking information when transmitted by people, most understanding of information spreading in social networks comes from models or indirect measurements. Using data collected in Viral Marketing campaigns that reached over 31,000 individuals in eleven European markets, we find that information travels mostly by super-spreading events and at an unexpected low pace (logarithmic in time) due to the large variability both in the frequency and intensity of participants' actions. Remarkable accurate description of the results is given by stochastic branching process which corroborates the importance of heterogeneity and shows how traditional population-average descriptions fail to describe information diffusion in social networks. The fact that humans show similar degrees of heterogeneity in many other activities suggests that our findings are pertinent to other human driven diffusion processes like rumors, innovations or news which has important consequences for business management, communications, marketing and online communities.

AKSOE 15.2   Thu 10:45   EW 203

Opinion Formation in Laggard Societies — •PETER KLIMEK[1], RENAUD LAMBIOTTE[2], and STEFAN THURNER[1,3] — [1]Complex Systems Research Group; HNO; Medical University of Vienna; Währinger Gürtel 18-20; A-1090; Austria — [2]GRAPES; Universite de Liege; Sart-Tilman; B-4000 Liege; Belgium — [3]Santa Fe Institute; 1399 Hyde Park Road; Santa Fe; NM 87501; USA

We introduce a statistical physics model for opinion dynamics on random networks where agents adopt the opinion held by the majority of their direct neighbors only if the fraction of these neighbors exceeds a certain threshold, pu. We find a transition from total final consensus to a mixed phase where opinions coexist amongst the agents. The relevant parameters are the relative sizes in the initial opinion distribution within the population and the connectivity of the underlying network. As the order parameter we define the asymptotic state of opinions. In the phase diagram we find regions of total consensus and a mixed phase. As the 'laggard parameter' p_u increases the regions of consensus shrink. In addition we introduce rewiring of the underlying network during the opinion formation process and discuss the resulting consequences in the phase diagram.

AKSOE 15.3   Thu 11:15   EW 203
Effects of noise and confidence thresholds in metric Axelrod dynamics of social influence — •TOBIAS GALLA[1,2] and LUCA DE SANCTIS[2] — [1]The University of Manchester, School of Physics and Astronomy, Schuster Building, Manchester M13 9PL, UK — [2]The Abdus Salam International Centre for Theoretical Physics, Strada Costiera 11, 34014 Trieste, Italy

We study the effects of bounded confidence thresholds and of interaction and external noise on Axelrod's model of social influence. Our study is based on a combination of numerical simulations and an integration of the mean-field Master equation describing the system in the thermodynamic limit. We find that interaction thresholds affect the system only quantitatively, but that they do not alter the basic phase structure. The known crossover between an ordered and a disordered state in finite systems subject to external noise persists in models with general confidence threshold. Interaction noise here facilitates the dynamics and reduces relaxation times. We also study Axelrod systems with metric features, and point out similarities and differences compared to models with nominal features. Metric features are used to demonstrate that a small group of extremists can have a significant impact on the opinion dynamics of a population of Axelrod agents.

AKSOE 15.4 Thu 11:45 EW 203

Limits of Unsupervised Learning in Networks — •Jörg Reichardt[1] and Michele Leone[2] — [1]Institute f. Theoretical

Physics, University of Würzburg — [2]ISI Foundation, Torino, Italy

Many systems in socio- and econophysics are abstracted as networks. Before we can build models for such systems, a careful data analysis is needed in order to select relevant features. The goal is to differentiate between those effects that arise from inherent randomness in the system and those that truly reflect structure in the data. Unsupervised learning algorithms can perform this task in an automated manner and the general experience from multi-variate data is that if the data set is only large enough, even the slightest deviation from randomness may be detected. The talk will show that this is not necessarily true for sparse networks. Even in the limit of infinite system size, sparse networks may not be differentiated from random networks despite them being generated by a non-random process. Equivalently, the fact that one cannot find deviations from randomness may not allow to rule out non-random data generating processes. The talk will discuss possible implications for the analysis of network data and limitations in our ability to forecast the evolution of the system.

AKSOE 16: Financial Markets and Risk Management III

Time: Thursday 13:30–16:00   Location: EW 203

AKSOE 16.1 Thu 13:30 EW 203

When are Extreme Events the easier to predict, the larger they are? — •S. Hallerberg and H. Kantz — Max-Planck-Institut für Physik komplexer Systeme, Dresden

We investigate the predictability of extreme events in time series. The focus of this work is to understand, under which circumstances large events are easier to predict than smaller events. Therefore we use a simple prediction algorithm based on precursory structures which are identified via conditional probabilities. Using the receiver operator characteristic curve as a measure for the quality of predictions we find that the dependence on the event size is closely linked to the probability distribution function of the underlying stochastic process. We evaluate this dependence on the probability distribution function analytically and numerically.

If we assume that the optimal precursory structures are used to make the predictions, we find that large increments are better predictable if the underlying stochastic process has a Gaussian probability distribution function, whereas larger increments are harder to predict, if the underlying probability distribution function has a power law tail. In the case of an exponential distribution function we find no significant dependence on the event size.

Furthermore we compare these results with predictions of increments in correlated data, i.e. , velocity increments of a free jet flow and wind speed measurements. The numerical results for predictions within free jet data comply well to the previous considerations for stochastical processes.

AKSOE 16.2 Thu 14:00 EW 203

Credit risk — a structural model with jumps and correlations — •Rudi Schäfer[1,2], Markus Sjölin[1], Andreas Sundin[1], Michal Wolanski[1], and Thomas Guhr[2] — [1]Mathematical physics, LTH, Lund university, Sweden — [2]Fachbereich Physik, Universität Duisburg-Essen, Germany

We set up a structural model to study credit risk for a portfolio containing several or many credit contracts. The model is based on a jump–diffusion process for the risk factors, i.e. for the company assets. We also include correlations between the companies. We study a simplified version of our model analytically. Furthermore, we perform extensive numerical simulations for the full model. The observables are the loss distribution of the credit portfolio, its moments and other quantities derived thereof. We compile detailed information about the parameter dependence of these observables. In the course of setting up and analyzing our model, we also give a review of credit risk modeling for a physics audience.

AKSOE 16.3 Thu 14:30 EW 203

Time scales and asynchronism in a simple model of financial markets — •Giancarlo Mosetti[1,2] and Damien Challet[1] — [1]ISI Foundation- Torino, Italy — [2]Fribourg University- Fribourg, Switzerland

Financial markets are very complex system. Time, in its broadest

sense, has probably the biggest impact in their complexity. For example, it has been claimed that lack of a clear time scale in market agent's behavior allows many heterogeneous beliefs to flourish and interact in a kind of symbiotic relationship.

In the first part of my talk I will analyse using a simple model of financial markets, the Minority Game [1], the interaction of agents with different time scales. The model displays interesting behavior, with phases in which faster agents (speculators) perform better than slower agents (producers), but also phases in which the opposite is true. Analytical as well as numerical results will be presented [2].

In the second part I will discuss another time related phenomenon in financial markets: the delay between submission and execution times of an order in a market, still in the framework of the Minority Game. We will see how a simple modification of the model gives rise to an interesting dynamics.

Bibliography

[1] D. Challet and Y.-C. Zhang, Emergence of Cooperation and Organization in an evolutionary Game, Physica A 246, (1997)

[2] G. Mosetti, D., Challet, Yi-cheng Zhang, Heterogeneous timescales in Minority Games, Physica A 365, (2005)

AKSOE 16.4 Thu 15:00 EW 203

Multifractality and phase transition within the structure defined by the intertransaction time-intervals — •Andrzej Kasprzak[1], Josep Perelló[2], Jaume Masoliver[2], and Ryszard Kutner[1] — [1]Warsaw University, Faculty of Physics, Hoza 69, Warsaw 00-681, Poland — [2]Universitat de Barcelona, Departament de Fisica Fonamental, Diagonal 647, Barcelona 08028, Spain

We considered the intertransaction time-intervals for some future contracts as a well-suited characteristics of investors activity. We observed that the moments of arbitrary order of the empirical intertransaction time-intervals possess negligible small statistical errors. Hence, we were able to find their multifractal behavior, which was well described within the continuous-time random walk formalism. We found that the spectrum of multifractality has untypical left-sided shape (where left side is closed and right one is open, slowly increasing). The multifractality can be considered here as an intermediate phenomenon between two unifractals observed for very small and asymptotically large orders of the moments. We came to the conclusion that transition between uni- and multifractal can be considered as the phase transition of the third order since discontinuity (of the analog) of the specific heat was observed.

AKSOE 16.5 Thu 15:30 EW 203

Exponential distributions with "fat tails" for sales of goods: correspondence to individual income distributions — •Romanovsky Michael — A.M.Prokhorov General Physics Institute of RAS. Russia, 119991 Moscow, Vavilov str. 38

Distribution of new car prices in the USA and UK in 2004 is investigated. In the USA, sales of cars lower than 100000 USD are distributed exponentially with the normalization ~ 21000 USD. The distribution of car sales with prices larger than 100000 USD is the Pareto distri-

bution. In the UK in 2004, sales of cars with prices lower than 50000 pounds are exponential also with the normalization ˜ 10000 pounds.

The distributions of individual incomes in the USA, UK, and Australia have the same form: an exponential "body" and Pareto "tail" [1]. The price distribution can be used for the independent evaluation of individual income distribution.

Distributions of new cars sales prices were determined for Russia in 2003-2006. They have the same form as in the USA: an exponential body (before 50000 USD) with the normalization 9000 USD in 2004,

and the Pareto tail with the exponent ˜ 2 after 50000 USD. The mean estimated individual income in Russia in 2004 was 12000 USD. This income is more than two times larger than the official salary in Russia during this period.

The method can be used for income determination (or reliable estimation) in economics with the partially transparent tax systems.

[1] V.M.Yakovenko et.al. Physica A. 2001. V.299. P.213; Physica A. 2006. V.370. P.54.

AKSOE 17: Traffic Dynamics, Urban, and Regional Systems

Time: Thursday 16:15–18:15   Location: EW 203

AKSOE 17.1   Thu 16:15   EW 203

Complex structure of steady state traffic flow diagram: Theory and data — •CHRISTOF LIEBE — Universität Rostock, Institut für Physik, 18051 Rostock, Deutschland

Within the american **N**ext **G**eneration **Sim**ulation Program (NGSIM) several vehicular datasets were recorded during the last years. These datasets contain a huge amount of data which leads to a good basis of traffic data analysis.

From the view of a physicist it is always positiv to map the reality to simple models. The optimal velocity model is such a simple one. Basically it is a relaxation to an optimal velocity, which is a sigmoidal function depending on the distance to the car in front.

Nevertheless this simple model leads to interesting phenomena well known from real traffic data like jams (cluster formation). Numerical analysis of a one-lane circular road shows a complex fundamental diagram with hysteresis effect. To compare this diagram with the datasets one has to take the length of a car into account which leads to limitation of the density.

Also comparisons concerning the energy and power of cars will be presented.

AKSOE 17.2   Thu 16:45   EW 203

Traffic Dynamics Prospectives: From Fundamental Diagram to Energy Balance — •REINHARD MAHNKE and CHRISTOF LIEBE — Universität Rostock, Institut für Physik, 18051 Rostock, Deutschland

Application of thermodynamics to driven systems is discussed. As particular examples, simple traffic flow models are considered. On a microscopic level, traffic flow is described by an optimal velocity model in terms of accelerating and decelerating forces. It allows to introduce kinetic, potential, as well as total energy, which is the internal energy of the car system in view of thermodynamics. The latter is not conserved, although it has certain value in any of two possible steady states corresponding either to fixed point or to limit cycle in the space of headways and velocities. The fundamental diagram as steady state flux over density shows hysteresis.

AKSOE 17.3   Thu 17:15   EW 203

Road traffic monitoring and management based on magnetic imaging of vehicles — •HAIBIN GAO[1], JOERG WOLFF[1], MICHAEL WEINMANN[2], STEFAN VOIT[2], and UWE HARTMANN[1] — [1]Physics Department, Saarland University, P.O.Box 151150, Saarbruecken,, 66041

Germany — [2]Votronic GmbH, Saarbruecker Str. 8, St. Ingbert, 66386 Germany

Increasing road traffic needs optimized traffic management. Magnetic field detectors can be employed for road traffic monitoring by means of vehicle magnetic imaging. Magnetoresistive sensors utilize the earth magnetic field as a bias field for detecting the presence of ferromagnetic objects i.e., components of a vehicle. The passive method of sensing requires no energy to be emitted, thus minimizing both energy consumption and risk of electromagnetic interference. The compact size of the magnetoresistive sensors allows for versatile placement options.

The detector has three identical channels for the three-dimensional detection with a sensitivity of 1nT/Hz. The influence of temperature is nearly completely cancelled in a range of -40 degree to +85 degree. The signal is sampled and mathematically filtered within the detector. The firmware uses changes of the sum of the (unsigned) magnitudes of the signals.

So far more than a thousand magnetic profiles of passing vehicles have been recorded. The speed is obtained by using two detectors at a lateral distance of one meter. Furthermore, magnetic profiles of different vehicles are investigated for vehicle classification.

AKSOE 17.4   Thu 17:45   EW 203

Local Control of Traffic Flows in Networks: Self-Organisation of Phase Synchronised Dynamics — STEFAN LÄMMER[1], •REIK DONNER[1], and DIRK HELBING[2] — [1]TU Dresden, Andreas-Schubert-Str. 23, 01062 Dresden, Germany — [2]ETH Zürich, Universitätstr. 41, 8092 Zürich, Switzerland

The effective control of flows in urban traffic networks is a subject of broad economic interest. During the last years, efforts have been made to develop decentralised control strategies that take only the actual state of present traffic conditions into account. In this contribution, we introduce a permeability model for the local control of conflicting material flows on networks, which incorporates a self-organisation of the flows. The dynamics of our model is studied under different situations, with a special emphasis on the development of a phase synchronised switching behaviour at the nodes of the traffic network. In order to improve the potential applicability of our concept, we discuss how a proper demand anticipation and the definition of a priority function can be used to further optimise the performance of the presented strategy.