SOE 15: Poster Session

Time: Wednesday 16:45–17:50 Location: Poster F

Please note: Posters can and should be on display all day.

SOE 15.1 Wed 16:50 Poster F

Evolvement of uniformity and volatility in the stressed global financial village — •Dror Y. Kenett[1], Matthias Raddant[2,3], Thomas Lux[2,3], and Eshel Ben-Jacob[1] — [1]School of Physics and Astronomy, Tel-Aviv University, Tel-Aviv, Israel — [2]Kiel Institute for the World Economy, Kiel, Germany — [3]Department of Economics, University of Kiel, Kiel, Germany

In the current era of strong worldwide market couplings, the global financial village has become highly prone to systemic collapses, events that can rapidly sweep through out the entire village. We present a new methodology to assess and quantify inter-market relations. The approach is based on the correlations between the market index, the index volatility, the market Index Cohesive Force and the meta-correlations (correlations between the intra-correlations). We investigated the relations between six important world markets - U.S., U.K., Germany, Japan, China and India from January 2000 until December 2010. We found that while the developed "western" markets (U.S., U.K., Germany), are highly correlated, the interdependencies between these markets and the developing "eastern" markets (India and China) are very volatile and with noticeable maxima at times of global world events (2001: 9/11-attacks, 2003: Iraq war, SARS, etc). The Japanese market switches "identity" - it switches between periods of high meta-correlations with the "western" markets and periods that it behaves more similar to the "eastern" markets. The methodological framework provides a way to quantify the evolvement of interdependencies in the global market, and to evaluate the world financial network.

SOE 15.2 Wed 16:50 Poster F

Bursting behavior of non-linear stochastic model and empirical high-frequency return — •Aleksejus Kononovicius, Vygintas Gontis, Julius Ruseckas, and Bronislovas Kaulakys — Institute of Theoretical Physics and Astronomy, Vilnius University, A. Gostauto 12, 01108 Vilnius, Lithuania

Recently we have proposed a nonlinear stochastic model reproducing power law probability density and power spectral density of absolute return in financial markets [1,2]. The proposed model and its generalizations also exhibit power law bursting behavior (see [3] for numerical evidence). We show that bursting behavior reproduced by the proposed model and observed in the financial markets are similar.

[1] V. Gontis, J. Ruseckas and A. Kononovicius (2010): A Nonlinear Stochastic Model of Return in Financial Markets, in: Stochastic Control, ed. C. Myers, Scyio.

[2] V. Gontis, J. Ruseckas and A. Kononovicius (2010): A long-range memory stochastic model of the return in financial markets, Physica A 389.

[3] B. Kaulakys, M. Alaburda and V. Gontis (2009): Modeling scaled processes and clustering of events by the nonlinear stochastic differential equations, AIP Conf. Proc. 1129.

SOE 15.3 Wed 16:50 Poster F

Agent-Based Models of Monetary Exchange to understand Income Distributions — •Jose M Miotto[1,3] and Martin G Zimmermann[2] — [1]Depto. de Fisica - UBA, Intendente Güiraldes 2160 - Ciudad Universitaria - CABA C1428EGA, Argentina — [2]UDeSA, Vito Dumas 284, San Isidro B1644BID, Buenos Aires, Argentina — [3]MPI for the Physics of Complex Systems, Nöthnitzer Strasse 50, Dresden 01187, Deutschland

Several problems arising in Economics are analyzed using concepts and quantitative methods from Physics. In this work in particular, different Multiple Agents-based Models are explored, applied to the study of Income and Wealth Distribution.

We present Computational Models that simulate a Market of Bilateral Exchanges with Conserved Wealth. Different types of Systems are studied based on the type of restrictions imposed to the Interactions: the first, with restrictions on the amount of Exchange; the second, allowing agents to interact just with some neighbors, in simple networks of agents (significant networks for Social Systems are chosen); and the third, on bipartite networks, where a second class of agents, the firms, are introduced. The defined environment is static, and the basis for a dynamical model is studied.

Different possible variations of these models are analyzed, with the aim of obtaining a realistic income or wealth distribution minimizing the assumptions.

SOE 15.4 Wed 16:50 Poster F

Spin models as microfoundation of macroscopic financial market models — •Sebastian M. Krause and Stefan Bornholdt — Institut für Theoretische Physik, Universität Bremen, Otto-Hahn-Allee, 28359 Bremen

The prices of financial assets show a typical behavior, known as stylized facts. The logarithmic absolute returns are power law distributed, which means that big changes are more common than in a Gaussian random walk, and they occur clustered.

There are two model types concerning stylized facts. Macroscopic models model the stochastic properties of prices and are broadly used to estimate future risks. Microscopic agent based models provide a better understanding of the emergence of stylized facts from local behavior. We here investigate a modified Ising model [1] which is an agent based model known to reproduce several stylized facts. We deduce a macroscopic Langevin equation for this model and use the comparison of micro- and macro-description to understand the mechanism behind fat-tailed logarithmic absolute returns. Additionally we find a crossover with consequences for the finite size scaling.

[1] S. Bornholdt, Expectation bubbles in a spin model of markets: Intermittency from frustration across scales; Int. J. Mod. Phys. C 12 (2001) 667-674.

[2] S. M. Krause and S. Bornholdt, Spin models as microfoundation of macroscopic financial market models (2011) arXiv:1103.5345v1.

SOE 15.5 Wed 16:50 Poster F

Stochastic analysis of coupling between stock prices — •Alex Neumüller, Matthias Wächter, and Joachim Peinke — ForWind - Center for Wind Energy Research, Institute of Physics, University of Oldenburg

Portfolio optimization is a large and important area of economic science. Commonly portfolios are selected by comparing and evaluating the correlations between different shares. This approach nevertheless neglects the time dependence and mutual influences of the shares. In extension to this, we aim at obtaining a functional relation between different share prices in terms of separate stochastic and deterministic contributions by reconstructing a multi-dimensional Langevin equation from non-equidistant time series of stock prices. In this way we aim to obtain a dynamical correlation of different shares.

SOE 15.6 Wed 16:50 Poster F

From probabilities of recurrence to stock index interrelations — •Bedartha Goswami[1], G. Ambika[2], Norbert Marwan[1], and Jürgen Kurths[1,3] — [1]Potsdam Institute for Climate Impact Research, P.O. Box 60 12 03, 14412 Potsdam, Germany — [2]Indian Institute of Science Education and Research, Pashan, Pune - 411021, India — [3]Department of Physics, Humboldt University Berlin, Newtonstr. 15, 12489 Berlin, Germany

Financial data is extensively studied for correlations using Pearson's cross-correlation coefficient ρ as the point of departure, such that ρ is now synonymous with the idea of 'connectivity'. We apply a recurrence-plot-based estimator—the Correlation of Probability of Recurrence (CPR)—to analyze 'connections' between nine stock indices spread worldwide; and suggest a modification of the CPR to get more robust results. We examine trends in CPR using an approximately 19-month window and compare them to ρ. Binning CPR into three levels of connectedness: strong, moderate and weak, we extract the trends in number of connections in each bin over time. CPR mainly uncovers that the markets move in and out of periods of strong connectivity erratically, instead of moving monotonously towards increasing global connectivity. This is in contrast to ρ, which gives a picture of ever increasing correlation. We use significance tests using Twin Surrogates to interpret all the measures estimated in the study.

SOE 15.7 Wed 16:50 Poster F

Coping with uncertainty in future market evolution of competing technologies — •Patrick Plötz — Fraunhofer-Institut für

System- und Innovationsforschung ISI, Breslauer Straße 48, 76139 Karlsruhe

The diffusion of innovations and prediction of future market evolution are important processes and the corresponding models have applications in many fields. The logistic equation is one of most important models in this context. Extensions of this approach as the Lotka-Volterra model have been developed to include the effect of mutual influences between innovations such as competition. However, many of the parameters entering this description are uncertain, difficult to estimate or simply unknown, particularly at early stages of the market diffusion. Here, a systematic way to study the effect of uncertain or unknown parameters on the future diffusion of interacting innovations is proposed. The input required is a general qualitative understanding of the system: is the mutual influence positive or negative and does it apply symmetrically to either technology? The methodology is developed in detail and applied the case of three types of upcoming electric vehicle propulsion technologies. The relation to Monte Carlo methods and the general use of random matrices in physics are discussed. The approach can easily be generalised to include other initial conditions, more technologies or other technological areas to find stable results for future market evolution independent of specific parameters.

SOE 15.8 Wed 16:50 Poster F

Link-based social dynamics in complex networks: time evolution and heterogeneous asymptotic states — •Juan Fernández-Gracia, Víctor M. Eguíluz, and Maxi San Miguel — IFISC, Instituto de Física interdisciplinar y Sistemas Complejos (CSIC-UIB), Campus Universitat Illes Balears, E-07122 Palma de Mallorca, Spain

Motivated by the idea that some characteristics are specific of the relations between individuals and not of the individuals themselves, we model them as states on the links in a network of interacting agents. Each link in the network can be in one of two equivalent states and, in each dynamical step a link is chosen, and this one takes the state of the majority of links surrounding it. We can characterize the nodes by the link heterogeneity index, which measures the tendency of a node to have links in one state or the other. On a fully connected network and a square lattice we fully characterize the non-trivial asymptotic configurations accessible from random initial conditions. For Erdös-Renyi random networks we also characterize the asymptotic configurations and the mechanisms leading to them. All these non-trivial asymptotic configurations are quite heterogeneous for a fully connected network and random networks. Furthermore those configurations are not stable for the node majority rule, which highlights the importance of modeling link-based dynamics. Once the asymptotic states are understood we can explain the evolution of the distributions of link heterogeneity indices on the different networks.

SOE 15.9 Wed 16:50 Poster F

The Interplay between Microscopic and Mesoscopic Structures in Complex Networks — •Jörg Reichardt[1], Roberto Alamino[2], and David Saad[2] — [1]Institute for Theoretical Physics, Würzburg University, Germany — [2]NCRG, Aston University, Birmingham, UK

Understanding a complex network's structure holds the key to understanding its function. The physics community has contributed a multitude of methods and analyses to this cross-disciplinary endeavor. Structural features exist on both the microscopic level, resulting from differences between single node properties, and the mesoscopic level resulting from properties shared by groups of nodes. Disentangling the determinants of network structure on these different scales has remained a major, and so far unsolved, challenge. Here we show how multiscale generative probabilistic exponential random graph models combined with efficient, distributive message-passing inference techniques can be used to achieve this separation of scales, leading to improved detection accuracy of latent classes as demonstrated on benchmark problems. It sheds new light on the statistical significance of motif-distributions in neural networks and improves the link-prediction accuracy as exemplified for gene-disease associations in the highly consequential Online Mendelian Inheritance in Man database.

SOE 15.10 Wed 16:50 Poster F

Node weighted measures for complex interacting networks — Marc Wiedermann[1,2], •Jonathan F. Donges[1,2], Jobst Heitzig[1], and Jürgen Kurths[1,2] — [1]Potsdam Institute for Climate Impact Research, Potsdam, Germany — [2]Department of Physics, Humboldt University, Berlin, Germany

When network theory is used in the study of complex systems, the typically finite set of nodes of the network of interest is frequently either explicitly or implicitly considered representative of a much larger finite or infinite set of objects of interest. The selection procedure, e.g., formation of a subset or some kind of discretization or aggregation, typically results in individual nodes of the studied network representing quite differently sized regions of the domain of interest. This heterogenous sampling may induce substantial biases in derived network statistics. Examples are among others frequently studied spatially embedded networks, where nodes may represent differently sized areas or volumes, or trade networks, where nodes stand for economies of widely varying gross domestic product (GDP). To avoid these problems, we propose an axiomatic scheme based on the idea of node splitting invariance to derive consistently weighted variants of various commonly used statistical network measures which approximate the corresponding properties of the underlying domain of interest. We show that these measures can be generalized to study the topology of complex interacting networks and demonstrate their applicability to several real world networks.

SOE 15.11 Wed 16:50 Poster F

Networks in a bucket, from dynamics to topology — •Nora Molkenthin[1,2], Norbert Marwan[1], and Jürgen Kurths[1,2] — [1]Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany — [2]Department of Physics, Humboldt University, Berlin, Germany

Recently the study of complex networks constructed from time series has attracted much attention for example in climate system science. A particular interest is in studying networks that represent the statistical interdependencies between observational or simulated time series at different locations, e.g., surface air temperature time series distributed over the Earth's surface. The theoretical background of this research, however, is still largely unclear. We have now attempted to compute networks in a bottom-up-approach directly from simple fluiddynamical advection-diffusion setups. A few examples are presented here both analytically and numerically.

SOE 15.12 Wed 16:50 Poster F

Investigation and modeling of human driver behavior based on Langevin analysis — •Michael Langner and Joachim Peinke — Istitute of Physics - Forwind, University of Oldenburg, Germany

Based on experimental data, taken from a driving simulator, we present different ways how a stochastic model of the driver behavior can be estimated directly from the given data. This method is called Langevin analysis and allows the separation of a given dataset into a stochastic diffusion- and a deterministic drift field equivalent to a stochastic potential. Usually this method is used to get a model for data that possess strong Markovian properties and a strong statistical component, but it also yields interesting results if it is used in a more general way. In this case it is used to model the variations in the car trajectories caused by the human behavior.

This work is part of the IMoST (Integrated Modeling for Safe Transportation) project. The data for the modeling purpose was collected with a driving simulator located at the DLR in Braunschweig.

SOE 15.13 Wed 16:50 Poster F

Quantitative analysis of Role behaviour and time evolution in usenet groups — •Eleni Hitchinson[1] and Christian von Ferber[1,2] — [1]Applied Mathematics Research Centre, Coventry University, UK — [2]Physikalisches Institut, University Freiburg

A number of `usenet` groups have a long history where individual users are found to participate over long time ranges. These groups therefore offer the possibility to test hypotheses like e.g. preferential attachment scenarios on such time scales. Our focus is in particular on developing quantitative indicators for the type of discussion (e.g. technical or philosophical) and the self-defined roles of the participants. Analysing technical discussion we identify time evolving network motives that describe 'expert' members who answer many questions while in 'philosophical' discussions some members occur who initiate a multitude of discussions. In this way we observe quantitatively how these roles evolve and may change with time.

SOE 15.14 Wed 16:50 Poster F

Fighting and writing, conflicts and editorial wars in Wikipedia — •Taha Yasseri, Róbert Sumi, András Rung, András Kornai, and János Kertész — Institute of Physics, Budapest University of Technology and Economics, Budapest, Hungary

Wikipedia is one of the few examples of large-scale collective cooperation of individuals with no external supervision or motivation, in which considerable amount of valuable information is generated and collected. Despite the recent efforts to characterize the rapid growth and development of Wikipedia, the underlying mechanisms that modulate this improvement are yet to be unravelled. This would yield a better understanding of the emergence of information through consensus of opinions on numerous article contents. In this work, we first develop a method to detect and rank the controversial issues [1] which are most disputed and debated by the Wikipedia editors. Based on this analysis, we characterize the temporal features of the editorial wars. On short-time scales, we observe an evident relation between the bursts of the editorial activities and the intensity of the conflicts. Peaceful situations on the other hand, result in more diverse and uncorrelated editorial contributions. On long-time scales, our phenomenological model can distinguish between the external factors which influence the behaviour of the editors and the internal causes of the conflicts related to the diversity of editors' opinions on the solid facts.

[1] R. Sumi, T. Yasseri, A. Rung, A. Kornai, and J. Kertész, Edit wars in Wikipedia, *IEEE SocialCom, 3rd Intl Conf on Social Computing*, Boston Oct. (2011).

SOE 15.15 Wed 16:50 Poster F

Dynamics of Hierarchical Coalition Formation — •Jobst Heitzig — Potsdam Institute for Climate Impact Research

In many situations of strategic interaction of many agents, complex coalition structures can form, and the question which coalitions will form can have considerable consequences, as is obvious from the ongoing international climate negotiations. Still, the dynamical process of coalition formation by boundedly rational agents is only understood quite rudimentary yet. We present first results of a new dynamical model of coalition formation that allows for hierarchical coalition structures (coalitions of coalitions). In particular, we argue that the possibility of first forming small regional coalitions and then forming an overarching global coalition later might increase the prospects of efficient climate mitigation.

SOE 15.16 Wed 16:50 Poster F

Ranking scientific publications by investigating the papers' wake — •David F. Klosik and Stefan Bornholdt — Institut für Theoretische Physik, Universität Bremen, Otto-Hahn-Allee, 28359 Bremen

Organisations providing scientific resources have one major question to answer: How to assess a scholar's or institution's scientific quality? Due to its availability citation information concerning the individual publications is widely used as a proxy for scientific impact. The use of raw direct citations, however, has been criticized against for a long time, and there have been several concepts trying to tackle the shortcomings of direct citation counting by considering the network-character of the aggregate citation information (e.g. centrality measures like PageRank or CiteRank as used by Maslov and collaborators [1]).

Emphasizing pioneering publications that prepared the ground for a new line of research, we investigate a ranking scheme for scientific publications which is based on the paper's 'wake' in the citation network.

[1] D. Walker, H. Xie, K.-K. Yan, S. Maslov, Ranking scientific publications using a model of network traffic; J. Stat. Mech. (2007) P06010.

SOE 15.17 Wed 16:50 Poster F

The role of noise and initial conditions in the asymptotic solution of the Deffuant *et al.* model — •Adrián Carro Patiño, Maxi San Miguel, and Raúl Toral — IFISC (CSIC - UIB), Palma de Mallorca, Spain

The Deffuant *et al.* model was introduced in 2000 to model the dynamics of continuous opinions under bounded confidence. In its original version, agents meet in random pairwise encounters and, if the difference between their continuous-value opinions is less than a certain confidence level, they interact, that is, they adjust their opinion towards the opinion of the other agent.

While most of the existing literature has focused on the important role played by the bound of confidence parameter, we have studied the strong importance of the initial distribution of opinions in determining the asymptotic configuration. Thus, we have sketched the structure of attractors of the dynamical system, by means of the numerical computation of the time evolution of the agents density. In particular, we have used a discrete density-based reformulation of the model as discussed by J. Lorenz.

Furthermore, the influence of noisy perturbations was studied. The role played by this noise is that of a free will, as individuals are given the opportunity to change their opinion, with a given probability, and return to a fundamental opinion taken from a given distribution. As a consequence, the importance of the initial condition is replaced by that of the basal distribution.

SOE 15.18 Wed 16:50 Poster F

Negative Stimmgewichte bei Bundestagswahlen — •Daniel Lübbert — Wissenschaftl. Dienst, Dt. Bundestag, Berlin

Wahlen sind ein Grundpfeiler der Demokratie. Wo Wahlabläufe insgesamt äußerst vielschichtig sind, da scheint zumindest ein Detail linearvorhersehbar: die Umrechnung von Stimmenzahlen in Parlamentssitze. Aber auch hier warten Überraschungen: Analysen der letzten Bundestagswahlen haben gezeigt, dass in nicht wenigen Einzelfällen eine Partei einen Sitz hinzugewonnen hätte, wenn weniger Wähler für diese Partei gestimmt hätten (und umgekehrt). Diese Diagnose eines "negativen Stimmgewichts" ist in jahrelanger Diskussion erhärtet worden und hat im September 2011 zu einer Änderung des Bundeswahlgesetzes geführt.

Der Vortrag skizziert, wie das Problem im alten Wahlsystem zustande kam und wie das neue Gesetz vom September 2011 es zu lösen versucht. Zuvor werden die inzwischen etablierten numerischen Diagnoseinstrumente eingeführt: Um den Einfluss zusätzlicher Wählerstimmen auf die Sitzverteilung zu detektieren, bedarf es einer differentiellen Analyse, für die Konzepte aus der mehrdimensionalen Analysis durchaus hilfreich sind. Wegen der ganzzahligen Sitzzahlen führen letztlich jedoch nur umfangreiche Computer-Simulationen zum vollständigen Verständnis. Ob das Wahlrecht damit "unter Computervorbehalt" steht? Vor dem genannten Hintergrund erstaunt es jedenfalls nicht, dass die Wahlrechtsdebatte der letzten Jahre von einigen Physikern mit geprägt wurde. Vieles bleibt noch zu erforschen, so dass sich hier auch für die Zukunft ein interessantes Betätigungsfeld für Physiker eröffnet.

SOE 15.19 Wed 16:50 Poster F

Fluctuation Analysis of Traffic Data: Comparison of Numerical Simulations, Driving-Simulator Experiments, and Real-World Data — •Mirko Kämpf[1], Jan W. Kantelhardt[1], Matthew Fullerton[2], and Fritz Busch[2] — [1]Institut f. Physik, Martin-Luther Universität Halle-Wittenberg, Halle (Saale), Germany — [2]Lehrstuhl für Verkehrstechnik, TU München, Munich, Germany

The understanding of dynamical properties of traffic flow is essential for distinguishing traffic states or patterns and designing optimization rules and control systems. Here, we employ Detrended Fluctuation Analysis (DFA) to check if time series of velocity and density generated by a common traffic simulation model show the same scaling behaviour as real world data. In particular, we analyse average-level and individual-level speeds and densities simulated by a (microscopic) Wiedemann traffic model combined with a VISSIM lane changing model on a straight road with one or two lanes and no exits. The same scaling analysis is applied to data obtained from driving simulator experiments with groups of four drivers and to measured data from a multi-lane highway near Madrid. Our results show that the model describes the long-range interactions (regarding large groups of cars) fairly well. For small groups of cars, however, we find strong long-term persistent anti-correlations in the simulated velocity data, which are not observed in experimental traffic simulator data and real world data. This way, DFA has reviled that short-range interactions between cars are probably too strong in the current model.

SOE 15.20 Wed 16:50 Poster F

Population numbers of trains - physical models — •Uli Spreitzer[1], Alexander Rabanser[1], and Robert Löw[2] — [1]Bonus Pensionskassen AG, Traungasse 14-16, 1030 Vienna, Austria — [2]

Population numbers of trains are being calculated with a model of finite number of train stations. In a first model we assume the random number of people who enter and leave the train as independent of the number of persons inside the train. In a second model we modify the model, so that, the number of people leaving the train is proportional to the number of people within the train. For both models we see convergence of the occupation number with increasing number of train stations. We will discuss this convergence of the occupation number and also similarity to boltzmann distribution

SOE 15.21 Wed 16:50 Poster F

Bicycle Helmets And Accident Risk Of Children Cyclists In

Germany — •Ingo R. Keck — University of Regensburg, Regensburg, Germany

Bicycle accidents and bicycle helmets are in the focus of the public attention since more than 20 years. In recent years the call for helmet laws is getting more insistend in Germany and countries in the European Union like Austria, the Czech Republic and Sweden have recently introduced helmet laws for children. At the same time information about the effects of helmet use in Germany and other European countries is spare.

In this submission it will be shown that the accident data of children cyclists in Germany in recent years can be described by a simple mathematical model. The most interesting finding is that the data of different age groups leads to very similar model parameters and that increasing helmet usage is connected to a clear increase in risk of severe injury or death.