BP 6: Networks: From Topology to Dynamics I (joint SOE/DY/BP)

Time: Monday 12:15–13:15 Location: MA 001

BP 6.1 Mon 12:15 MA 001

How mutational networks shape evolutionary processes — •Henning Siemen, Benjamin Maier, and Dirk Brockmann — Robert Koch-Institut, Berlin

Dynamic processes on complex networks have attracted a lot of attention in the past. The majority of the studies focus on understanding how topological network features shape dynamics. Several interesting results have been obtained in the context of epidemics and contagion phenomena recently, for instance the absence of epidemic thresholds in scale free networks, or the context of synchronization phenomena where certain network topologies can sustain chimera states. However, evolutionary processes on networks received comparatively little attention. It is largely unresolved how network topologies influence mutation and selection dynamics. Here, we investigate a network system of genetic strains in which each node represents a strain and links represent possible mutational pathways. We compare generic network topologies ranging from ordinary lattices and Erdos-Renyi networks to small world and scale free networks. We find that network topologies can have a substantial impact on equilibrium strain distributions. We show that locally clustered networks such as small world and lattice topologies tend to generate local maxima composed of communities with high fitness. Furthermore, we find that scale free topologies as opposed to ER networks are more likely to exhibit a lower error threshold.

BP 6.2 Mon 12:30 MA 001

Possible Origin of Stagnation and Variability of Earth's Biodiversity — •Jan Nagler[1], Theo Geisel[2], and Frank Stollmeier[2] — [1]ETH Zurich — [2]MPI DS, Göttingen

The magnitude and variability of Earth's biodiversity have puzzled scientists ever since paleontologic fossil databases became available. We identify and study a model of interdependent species where both endogenous and exogenous impacts determine the nonstationary extinction dynamics. The framework provides an explanation for the qualitative difference of marine and continental biodiversity growth. In particular, the stagnation of marine biodiversity may result from a global transition from an imbalanced to a balanced state of the species dependency network. The predictions of our framework are in agreement with paleontologic databases.

[1] Stollmeier, Geisel, Nagler, Phys. Rev. Lett. 112, 228101 (2014)

BP 6.3 Mon 12:45 MA 001

Excitable dynamics and cellular automata dynamics on loop-free networks — •Anne-Wiebke Harder[1,2] and Jens Christian Claussen[2,1] — [1]Institut für Neuro- und Bioinformatik, Universität zu Lübeck — [2]Computational Systems Biology Lab, Jacobs University Bremen

Spreading dynamics on graphs or networks have attracted considerable attention in the context of pattern formation and infection dynamics [1]. Here we investigate patterns generated by excitable dynamics [2] comprised by the states of susceptible - excitable - recovered, as well as cellular automata dynamics started from a localized seed on lattices and loop-free graphs [3]. The latter type of dynamics exhibits interesting characteristics as 1/f type spectra [4] and relates to new integer sequences [5]. Finally we investigate cellular-automata (CA) like limiting cases of the SER dynamics.

[1] C. Kamp PLoS Comput Biol 6 e1000984 (2010)
[2] M. Müller-Linow, C. Marr, M.-T. Hütt, Phys. Rev. E 74 026112 (2006)
[3] J.C. Claussen, J. Math. Phys. 49 062701 (2009)
[4] J. Nagler and J.C. Claussen Phys. Rev. E 71 067103 (2005)
[5] J.C. Claussen, in: Online Encyclopedia of Integer Sequences, entries http://oeis.org/A138276 and http://oeis.org/A138277 (2008)

BP 6.4 Mon 13:00 MA 001

Noise in Coevolving Networks — •Marina Diakonova, Victor Eguiluz, and Maxi San Miguel — Instituto de Física Interdisciplinar y Sistemas Complejos IFISC (CSIC-UIB), E07122 Palma de Mallorca, Spain

Coupling dynamics of the states of the nodes of a network to the dynamics of the network topology leads to generic absorbing and fragmentation transitions. The coevolving voter model is a typical system that exhibits such transitions at some critical rewiring. We study the robustness of these transitions under two distinct ways of introducing noise. Noise affecting all the nodes destroys the absorbing-fragmentation transition, giving rise in finite-size systems to two additional regimes: bimodal magnetisation and dynamic fragmentation. Noise Targeting a fraction of nodes preserves the transitions but introduces shattered fragmentation with its characteristic fraction of isolated nodes and one or two giant components. Both the lack of absorbing state for homogenous noise and the shift in the absorbing transition to higher rewiring for targeted noise are supported by analytical approximations.