Toward a statistic for complex systems

Stefan Thurner
Section for Science of Complex Systems
Medical University of Vienna
Spitalgasse 23
1090 Vienna, Austria

Email: stefan.thurner@meduniwien.ac.at

Abstract

We present a simple theory for driven out-of-equilibrium systems — which often are complex systems. Driven systems are composed of a driving- and a relaxation process, and generically produce power law distributions for low driving rates. The theory allows us to relate the driving rate with the distribution functions that typically occur in complex systems, including the power law, the Gamma, the Weibull, the Tsallis, the stretched exponential, the log-normal and many more. We present simple examples of the classes of processes that can be treated with the presented theory, such as search processes, language, fragmentation processes, self-organized critical systems, and the energy distribution of cosmic rays.

Biography

Stefan Thurner is full professor for Science of Complex Systems at the Medical University of Vienna, where he chairs Section for Science of Complex Systems. He is external professor at the Santa Fe Institute, senior researcher at IIASA, and president of the Complexity Science Hub Vienna. Stefan obtained a PhD in theoretical physics from the Technical University of Vienna and a PhD in economics from the University of Vienna. He held postdoc positions at Humboldt University of Berlin and Boston University before joining the faculty of the University of Vienna and later Medical University. His habilitation is in theoretical physics. Stefan started his career with contributions to theoretical particle physics and gradually shifted his research focus to the understanding of complex systems. Stefan has published more than 200 scientific articles in fundamental physics, applied mathematics, network theory, evolutionary systems, life sciences, economics and finance and lately in social sciences. He holds two patents. His work has been covered extensively by Austrian as well as international media such as the New York Times, BBC world, Nature, New Scientist, Physics World, and is featured in more than 400 newspapers, radio and television reports. Stefan was elected Austrian “scientist of the year” in 2018.