SOE 4: Social Systems, Opinion and Group Dynamics I

Time: Monday 15:00–16:15 Location: HSZ 03

SOE 4.1 Mon 15:00 HSZ 03

What Physics Can Contribute to the Science of Social Systems — •Dirk Helbing — ETH Zurich

Social systems may be viewed as complex multi-component systems. But given the cognitive features and the diversity of social agents, is it possible to develop explanatory theories of social phenomena, and if so, how? What are the potentials and limitations of a quantitative approach? And how to put social theories to the test, or apply them? What can physics contribute to the progress of this field? These questions will be addressed with examples from opinion formation, pedestrian, crowd, and traffic dynamics, as well as the emergence of social coordination, cooperation and norms. It will be shown that models of social phenomena can be used to create socio-inspired technologies, and to mitigate problems such as traffic jams, failures of financial systems, and conflicts. It will also be argued that many fields of physics, from mechanics, over kinetic gas theory and fluid dynamics, up to spin systems and renormalization theory could make fundamental contributions to revealing some of the most exciting (social) scientific puzzles of the 21st century.

SOE 4.2 Mon 15:30 HSZ 03

Origin of traveling waves in an emperor penguin huddle — •Richard Gerum[1], Ben Fabry[1], Claus Metzner[1], Michael Beaulieu[2], André Ancel[3,4], and Daniel P Zitterbart[1,5] — [1]Department of Physics, University of Erlangen-Nuremberg, Germany — [2]Faculty of Biology, University of Freiburg, Germany — [3]IPHC, 67087 Strasbourg, France — [4]CNRS, UMR 7178, 67037 Strasbourg, France — [5]AWI, Bremerhaven, Germany

Emperor penguins breed during the Antarctic winter and have to endure temperatures as low as -50°C and wind speeds of up to 200km/h. To conserve energy, they form densely packed huddles with a triangular lattice structure. Video recordings from previous studies revealed coordinated movements in regular wave-like patterns within these huddles. It is thought that these waves are triggered by individual penguins that locally disturb the huddle structure, and that the traveling wave serves to remove lattice defects and restore order. The mechanisms that govern wave propagation are currently unknown, however. Moreover, it is unknown if the waves are always triggered by the same penguin in a huddle. Here, we present a model in which the observed wave patterns emerge from simple rules involving only the interactions between directly neighboring individuals, similar to interaction rules found in other jammed systems, e.g. between cars in a traffic jam. Our model predicts that a traveling wave can be triggered by a forward step of any individual penguin located within a densely packed huddle. This prediction is confirmed by optical flow velocimetry of video recordings of emperor penguins in their natural habitat.

SOE 4.3 Mon 15:45 HSZ 03

On the time evolution of the Hirsch index: inertia versus predictabiliy — •Michael Schreiber — Institut für Physik, Technische Universität Chemnitz, 09107 Chemnitz, Germany

The h-index can be used as a predictor of itself. However, the evolution of the h-index with time is shown in the present investigation to be dominated for several years by citations to previous publications rather than by new scientific achievements. This inert behaviour of the h-index raises questions, whether the h-index can be used profitably in academic appointment processes or for the allocation of research resources.

- 15 min. break -