# DY 19: Extreme Events

Time: Monday 17:30–18:15 Location: BH-N 333

DY 19.1 Mon 17:30 BH-N 333

**Dragon-king-like extreme events in coupled bursting neurons** — •Syamal Dana — Department of Mathematics, Jadavpur University, Kolkata, India

We observe dragon-king-like extreme events in two slow-fast HR bursting oscillators that are mutually communicating via three different chemical synaptic interactions, excitatory, inhibitory and a mixed type. The extreme events follow a common mechanism for all three choices of synaptic coupling: two coupled bursters emerged into antiphase synchronization (APS), either with a burst synchrony or a spiking synchrony depending upon the nature of coupling (excitatory or inhibitory). They intermittently lost stability of APS when two arbitrary spikes within the two bursting oscillations evolve into in-phase synchony. As a result, the trajectory of the error dynamics of the coupled bursters moves out of the APS manifold, which is manifested as an extreme event. Such extreme events are recurrent and outliers to a power law that is obeyed by other small to medium size events present in the dynamics and, follow the drangon-king-like distribution. This is also observed for purely diffusive and repulsive coupling in two HR neurons. We present experimental evidence of the dragon-king-like extreme events using two analog circuits of the HR model under simple linear diffusive and repulsive coupling.

DY 19.2 Mon 17:45 BH-N 333

**Riddled Basins of Attraction in Systems exhibiting Extreme Events** — •Arindam Saha and Ulrike Feudel — ICBM, University of Oldenburg, Germany

Extreme events are rare, recurrent and irregular events which have a large impact on the system. Due to their occurrence in a variety of physical systems including oceans, atmosphere, lasers, ecological communities and financial markets, the existing literature studies their generation mechanisms, impact and possible precursors in detail. However, none of these studies discuss the implications of a system where extreme events are exhibited in a multistable system. In this talk, we investigate the basin structure of a system where extreme events co-exist with a few other possible stable dynamics. To this end, we study a system of two identical FitzHugh-Nagumo oscillators coupled to each other by multiple delay couplings. We show that if extreme events occur in a multistable regime, the phase space may be partitioned into 'pure' and 'mixed' regions, where trajectories starting from the pure regions are certain not to exhibit extreme events; the trajectories starting from the mixed regions may or may not exhibit extreme events. By computing the uncertainty exponent using final state sensitivity method, we verify that the uncertainty exponent tends to zero, which indicates that basin corresponding to extreme events is riddled. We therefore demonstrate the existence of riddled basins of attraction in delay-coupled systems for the first time.

DY 19.3 Mon 18:00 BH-N 333

**Extrem Velocity Fluctuations in Turbulence Characterised as Negative Entropy Events** — Andre Fuchs[1], Nico Reinke[1], Daniel Nickelsen[2], Matthias Wächter[1], and •Joachim Peinke[1] — [1]Institute of Physics, Carl von Ossietzky University of Oldenburg, Germany — [2]Institute of Theoretical Physics, University of Stellenbosch, South Africa

The turbulent cascade is analysed with respect to the evolution process of velocity increments towards smaller scales. A general n-point description is achieved by means of Markow process in the scale. Finally we set up Fokker-Planck equation for the cascade. Based in this description entropies values $S_i$ can be assigned to all velocity fluctuations. These fluctuating entropy values fulfil integral fluctuation theorem, claiming that $< exp(-S_i) >= 1$. As a main finding we see that negative entropies events are linked to localised extrem velocity fluctuations on small scales.