

Eugene Wigner Colloquium

joint event of GRK 1558 and SFB 910



James Gleeson

University of Limerick, Ireland

“Temporal profiles of avalanches on networks”

An avalanche or cascade occurs when one event causes one or more subsequent events, which in turn may cause further events in a chain reaction. Avalanching dynamics are studied in many disciplines, with a recent focus on average avalanche shapes, i.e., the temporal profiles that characterize the growth and decay of avalanches of fixed duration. At the critical point of the dynamics the average avalanche shapes for different durations can be rescaled so that they collapse onto a single universal curve. We apply Markov branching process theory to derive a simple equation governing the average avalanche shape for cascade dynamics on networks. Analysis of the equation at criticality demonstrates that nonsymmetric average avalanche shapes (as observed in some experiments) occur for certain combinations of dynamics and network topology; specifically, on networks with heavy-tailed degree distributions. We give examples using numerical simulations of models of information spreading, neural dynamics, and threshold models of behaviour adoption.

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