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## **ICTS Statistical Physics and Condensed Matter Seminar**

**Title** : A Benchmark for Self-Organized Criticality

**Speaker** : Alexander Shapoval (University of Lodz, Poland)

**Date** : Wednesday, 07 January 2026

**Time** : 11:30 AM (IST)

**Abstract** : Self-organized criticality (SOC) - the property of complex systems to evolve toward a critical state without parameter tuning - captures what has been described as “how nature works”. SOC emerges from the separation of timescales: slow stress accumulation and its rapid release. By revisiting the Bak-Tang-Wiesenfeld sandpile, the first model of SOC, we uncover that the perfect time separation produces a scale-invariance regime that is substantially shorter than previously reported. It then transitions into another regime of larger events, whose power-law behavior is questionable. However, if a power law does exist there, it corresponds to a distinct, though similar, exponent. When the time separation is relaxed by combining selected simultaneous events into “mega-events”, true scale invariance develops. This finding suggests new ways to interpret phenomena such as earthquake dynamics, where tectonic stress propagates along spatially distant faults, and bursts of collective social activity triggered by weakly connected individual events.

This is a joint work with B. Shapoval (Rice University) and M. Shnirman (Institute of Earthquake Prediction Theory and Mathematical Geophysics)

**Venue** : Online

Zoom Link: <https://icts-res-in.zoom.us/j/94893871752?pwd=9PEETbYbtNimamnOpdJp09jWOH16nL.1>

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