

SOE 4: Keynote Talk

Time: Monday 14:00–14:45

Location: H 0105

Keynote Talk

SOE 4.1 Mon 14:00 H 0105

The Fragility of Interdependency: Coupled Networks & Switching Phenomena — •H. EUGENE STANLEY — Departments of Physics, Chemistry, & Biomedical Engineering, Boston University, Boston, MA 02215 USA

Recent disasters ranging from financial "shocks" to large-scale power outages and terrorist attacks dramatically demonstrate what dangerous vulnerability hides in the many interdependencies which exist among different networks. In the past year, we have quantified failures in interconnected networks, and demonstrated the need to consider mutually dependent network properties in designing resilient systems. Specifically, we have uncovered new laws governing the nature of switching phenomena in coupled networks, and found that phenomena

that are smooth in isolated networks become abrupt in interdependent networks [S. V. Buldyrev, R. Parshani, G. Paul, H. E. Stanley, & S. Havlin, *Nature* **464**, 1025 (2010); J. Gao, S. V. Buldyrev, H. E. Stanley, & S. Havlin, *Nature Physics* **8** (1 Jan. 2012)]. We conclude by discussing the possibility that financial crashes are not unlike the catastrophic failures occurring in coupled networks. Specifically, we find that "trend switching phenomena" in complex financial systems are remarkably independent of the scale over which they are analyzed. For example, we find that the same laws governing the formation and bursting of the largest financial bubbles govern the tiniest bubbles too, over a factor of 10^9 in time scale [T. Preis, J. Schneider, & H. E. Stanley, *Proc. Natl. Acad. Sci. USA* **108**, 7674 (2011); T. Preis & H. E. Stanley, *Physics World* **24**, No. 5, 29 (May 2011)].