Quantifying hidden order out of equilibrium

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While the equilibrium properties, states, and phase transitions of interacting systems are well described by statistical mechanics, the lack of suitable state parameters has hindered the understanding of non-equilibrium phenomena in diverse settings, from glasses to driven systems to biology. Here we introduce a simple idea enabling the quantification of organization in non-equilibrium and equilibrium systems, even when the form of order is unknown. The length of a losslessly compressed data file is a direct measure of its information content. We use lossless data compression to study several out-of-equilibrium systems, and show that it both identifies ordering and reveals critical behavior and even some critical exponents in dynamical phase transitions. Our technique should provide a quantitative measure of organization in systems ranging from condensed matter systems in and out of equilibrium, to cosmology, biology and possibly economic and social systems.

Bio: After graduating from Stuyvesant High School in New York City, ***Paul Chaikin*** *earned his B.S. in physics from California Institute of Technology and his Ph.D. in physics from the University of Pennsylvania. He was physics faculty at UCLA, University of Pennsylvania and Princeton University, before joining New York University. He joined as staff at Exxon in 1983 and has remained with Exxon/Mobil since. He co-authored the text Principles of Condensed Matter Physics. He is the recipient of the 2018 Oliver E. Buckley Condensed Matter Physics Prize "for pioneering contributions that opened new directions in the field of soft condensed matter physics through innovative studies of colloids, polymers, and packing."* ***Dr. Chaikin*** *is the Silver professor of physics at NYU, a member of the National Academy of Science and a fellow of the American Academy of Arts and Sciences, the American Physical Society and the Institute of Physics (UK). He was an A. P. Sloan Foundation Fellow and a John Simon Guggenheim Fellow.*

Physics Colloquium

Thursday, April 4, 2019

Lewis Lab. 316 at 4:10PM

Refreshment at 3:45PM