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A simplified Markov model for 1/f noise ANDREW SHEVCHUK, RALPH CHAMBERLIN, BRYCE DAVIS, Department of Physics, Arizona State University, PRISCILLA GREENWOOD, Department of Mathematics, University of British Columbia — If a system is weakly coupled to an effectively infinite heat bath, standard fluctuation theory predicts that the power spectral density will exhibit frequency-independent (or "white") noise. However, at low frequencies most materials exhibit 1/f (or "pink") noise, which still has no widely accepted general explanation. A recent mechanism is that 1/f noise arises from direct coupling between the system and its bath. We investigate a Markov model containing (Ising-like) binary degrees of freedom that define a system, and unary degrees of freedom that reside in a bath. The model takes the form of a rectangular matrix for which the rows represent the thermodynamic macrostates and the columns represent the thermodynamic microstates. The macrostates are a function of the systems binary degrees of freedom alone, so that the bath states cause the dynamics of the system to pause. Although these pause states simply delay the dynamics of the system, they must be included in the total number of microstates to maintain maximum entropy. The partitioning of microstates between the system and the bath affects the transition probabilities between macrostates. Including these pause states in a Markov process yields 1/f noise, qualitatively agreeing with the behavior observed in materials.

Andrew Shevchuk
Department of Physics, Arizona State University

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