

RIDDLING: A PHENOMENON IN DYNAMICAL SYSTEMS

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Riddled and intermingled basins of attraction are a relatively recently noticed phenomenon in dynamical systems and differential equations. Although not necessary for its occurrence, riddling seems to occur most naturally in systems with some kind of (discrete) symmetry. A chaotic system exhibits sensitive dependence to initial conditions; however, usually the long-term average behavior is robust, except for initial conditions near basin boundaries. In a riddled system, the long-term average behavior is also infinitely sensitive to initial conditions. The name comes from the fact that the basin of an attractor is infinitely riddled with points which do not tend to the attractor. Riddled basins have no open sets—every point is a basin boundary. Intermingled basins are basins for different attractors which are dense in each other. Over the past several years, riddling has been observed in several scientific contexts: visually (originally), mathematically (rigorously), numerically (simulations), and experimentally (bench experiments). There are philosophical implications for replication of phenomena, which have been discussed in the popular scientific press under titles such as "Beyond Chaos." This talk is a survey of these developments.