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Pattern Control and State Estimation in Rayleigh-Bénard Convection[1] ADAM PERKINS, MICHAEL SCHATZ, Georgia Institute of Technology — We report on a new experimental approach to study instability in Rayleigh- Bénard convection. The convective fluid absorbs incident infrared laser light, thereby altering the fluid flow. Rapid scanning of the light allows nearly simultaneous actuation at many spatial locations of the pattern. This approach is used to impose reproducibly a given convection pattern. Control is demonstrated by preparing repeatedly a pattern near a straight roll instability. Selected perturbations are applied to this ensemble and decay lifetimes are measured as the system relaxes to the base state. We find that decay lifetimes increase near the instability and give a quantitative measure of distance from instability. We also create patterns that undergo the instability, giving a set of systems evolving from nearby initial conditions on both sides of the instability boundary. This set can be used to test systematically the sensitivity of state estimation, a crucial process in forecasting. Preliminary results of applying one state estimation algorithm to these diverging pattern trajectories will be discussed.

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