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**Bistability in off-resonantly driven ultracold Rydberg gases**
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— When exciting dense, ultracold gases to Rydberg states on resonance, the number of excitations within a finite volume is limited due to the long range van-der Waals interaction. Away from resonance initial excitation is suppressed, however an excited atom shifts surrounding atoms into resonance and facilitates further excitations. We discuss whether this mechanism launches an avalanche of excitations and what ultimately limits its growth in a many body system. A simplified mean field model for the driven, dissipative system shows in certain parameter regimes the emergence of bistability between a weakly and a strongly excited many body state. Within mean field theory we derive steady-state excitation rates and statistics as well as tunneling times between the two fixed points. Monte Carlo wavefunction simulations of the full dynamics in small systems and classical rate equation calculations show how this bistability is visible in stationary and dynamic observables in current experiments on small Rydberg ensembles.

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