Non-equilibrium phase-transitions in multi-component Rydberg gases

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Highly-excited Rydberg atoms have strong long-range interactions resulting in exotic optical properties such as large single photon non-linearities and intrinsic bistability. In this paper we study optical-driven non-equilibrium phase transitions in a thermal Rydberg gas with a sensitivity two order of magnitude higher than in previous work. In this regime we can elucidate the effect of interactions on the bistable optical response, and exploit different branches in the potential in order to study multi-component Rydberg gases with a rich of phase diagram including overlapping bistable regions. In addition, we study the effect of polarization on the width of the hysteresis loop. Finally, we observe that the medium exhibits a dynamical instability resulting from the competing dynamics of excitation and decay.

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