Radiation trapping in a dense cold Rydberg gas

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Cold atomic gases resonantly excited to Rydberg states can exhibit strong optical nonlinearity at the single photon level. We observe that in such samples radiation trapping leads to an additional mechanism for Rydberg excitation. Conversely we demonstrate that Rydberg excitation provides a novel in situ probe of the spectral, statistical, temporal and spatial properties of the trapped re-scattered light. We also show that absorption can lead to an excitation saturation that mimics the Rydberg blockade effect. Collective effects due to multiple scattering may co-exist with co-operative effects due to long-range interactions between the Rydberg atoms, adding a new dimension to quantum optics experiments with cold Rydberg gases.

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- RySQ [3]
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