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Emergent quantum optical phenomena in atomic arrays

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Atomic ensembles constitute a dominant platform for realizing quantum interfaces between light and matter. In dense and ordered arrays, interference in photon emission leads to the emergence of correlated states, with very different decay rates and lifetimes. This phenomenon has attracted a lot of interest recently, with work showing that collective emission can be used to realize improved quantum memories as well as atomic waveguides and mirrors. I will give a pedagogical overview of recent work on collective phenomena in light-matter interaction, discussing both experimental and theoretical advances as well as applications for quantum information and metrology.