

# Spatial Coherence of Light in Collective Spontaneous Emission

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Since the pioneering work of Dicke almost 70 years ago, collective (cooperative) spontaneous emission has remained an active research area, continually finding new applications, most recently in areas related to quantum information science. I will discuss our recent experimental and theoretical work where we study collective spontaneous emission from ultracold, laser-cooled ensembles, in a mesoscopic regime, with atom numbers ranging from about one hundred to about one million. A unique aspect of our work is that we study collective decay in dilute ensembles (very few atoms per wavelength of volume) that have a very low optical depth, and in the strong excitation regime (a large fraction of the atoms in the ensemble are excited). I will discuss several unique effects that can be observed in these systems such as superradiance-to-subradiance transition and the spatial coherence of the spontaneously emitted light. I will also discuss the connection of our results to various related research areas including fault-tolerant quantum computation.