Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Subradiance-protected excitation spreading in the generation of collimated photon emission from an atomic array KYLE BALLANTINE, JANNE RUOSTEKOSKI, Lancaster University — We show how an initial localized radiative excitation in a two-dimensional array of cold atoms can be converted into highly-directional coherent emission of light by protecting the spreading of the excitation across the array in a subradiant collective eigenmode with a lifetime orders of magnitude longer than that of an isolated atom. The excitation, which can consist of a single photon, is then released from the protected subradiant eigenmode by controlling the Zeeman level shifts of the atoms. Hence, an original localized excitation which emits in all directions is transferred to a delocalized subradiance-protected excitation, with a probabilistic emission of a photon only along the axis perpendicular to the plane of the atoms. This protected spreading and directional emission could potentially be used to link stages in a quantum information or quantum computing architecture.

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Date submitted: 31 Jan 2020 Electronic form version 1.4