

Abstract Submitted
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Coherent quantum optical control with sub-wavelength resolution

ALEXEY GORSHKOV, MIKHAIL LUKIN, Physics Department, Harvard University, Cambridge, MA — We propose a new method for coherent optical far-field manipulation of quantum systems with resolution that is not limited by the wavelength of radiation. Our method makes use of the manipulation of atomic response with a control beam under the conditions of Electromagnetically Induced Transparency. The idea is that within a small distance Δx around a zero of a strong control field (e.g. a standing wave or a beam with a doughnut-like cross section) an atom will not be saturated, but it will be saturated outside of Δx , where Δx can be made arbitrarily small by increasing the power of the control field. As a result, two atoms can respond very differently to the control field or other simultaneously applied fields despite being separated by much less than a wavelength. This approach can be used for selective coherent manipulation of proximally spaced ions, atoms, or solid-state defects. Practical performance of this technique and its potential applications to quantum information processing are discussed.

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