Analytical Instrumentation, Methods & Materials

COHERENT LIGHT SOURCE BASED ON COLLECTIVE SPONTANEOUS EMISSION

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Overview

Coherent light sources, in which the photons have highly matched frequencies and phases, are commonly produced by lasers. In a laser, the atoms of a laser medium are stimulated to excite the electrons to the larger orbits. When these electrons decay to a lower energy state, they stimulate the decay of other excited electrons which emit additional photons having the same wavelength, phase, and direction of the stimulating photons. Sustaining this stimulated emission requires optical feedback in the form of an optical cavity and a so-called "population inversion" where more atoms are in the excited state than in a lower energy state so that stimulated emission is more probable than photon absorption.

The Invention

UW-Madison researchers invented a coherent light source that does not use the techniques of population inversion and stimulated emission to produce coherent light but instead promotes a collective spontaneous emission of excited atoms through quantum coupling. The coherent light produced by spontaneous emission can have improved Poisson statistics such as lower shot noise that can be beneficial in some applications. Also, the quantum mechanism underlying the generation of the coherent light may allow the generation of multiple-photon Fock states, providing effectively shorter wavelengths than would be expected from the photon excitations. Significantly, the invention demonstrably provides high-quality coherent light from collective spontaneous emission obtained from a large number of disordered atoms distributed diffusely over a large area by maintaining an optically thin cloud.

Additional Information

For More Information About the Inventors

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Tech Fields

- Analytical Instrumentation, Methods & Materials : Optics

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842