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Quantum amplification by superradiant emission of radiation[1]
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A laser generates light through stimulated emission of radiation and requires population inversion. Quantum interference can yield lasing without inversion. However, such phase-sensitive quantum amplification still requires some atomic population in the excited state. We present a new kind of light amplifier (called the QASER) based on collective parametric resonance which, contrary to a laser, does not need any population in the excited state and generates high frequency coherent radiation by driving an atomic ensemble with a much smaller frequency. The amplification mechanism of the QASER is governed by the difference combination parametric resonance which occurs when the driving field frequency matches the frequency difference between two normal modes of the coupled light atom system. To achieve gain one must suppress AC Stark shift caused by the driving field. The resulting superradiant amplifier holds promise for a new kind of generator of high frequency (e.g. XUV or x-ray) coherent radiation utilizing a low frequency (e.g. infrared) drive. We present an experiment which demonstrates the QASER amplification mechanism in electronic circuit in the radio frequency range.

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