Light scattering and atom amplification in a Bose-Einstein condensate

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Abstract:

Since the first realization of Bose-Einstein condensation (BEC) in atomic gases in 1995, coherent matter waves, or *atom laser*, have been available to physicists, and the new field of *coherent atom optics* has been developed. To explore this new field, the atom-wave versions of basic optical elements, such as mirrors and beam splitters, are needed. I will first show how to realize those atom-optics elements with use of light [1]. Then, I will talk on how profoundly the nature of light scattering (Rayleigh/Raman) is altered in the BEC [2,3]; light scattering becomes highly directional and the scattering rate is dramatically enhanced. This phenomenon, referred to as superradiant light scattering, is a consequence of Bosonic stimulation in the BEC, and can be used to realize phase-coherent amplification of matter wave [4]. Now, we have mirrors, beam splitters, and amplifiers for matter waves. Finally, I will review the recent works for realizing true (continuous) atom lasers.

References:

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