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**Two-fluid model of a Bose-Einstein condensate in the cavity optomechanical regime**[1] DAN GOLDBAUM, The University of Arizona, KEYE ZHANG, East China Normal University, PIERRE MEYSTRE, The University of Arizona — We analyze an atomic Bose-Einstein condensate trapped in a high-$Q$ optical cavity driven by a feeble optical field. The dynamics of the resulting collective density excitation of the condensate are formally analogous to the central model system of cavity optomechanics: a radiation pressure driven mechanical oscillator [Brennecke *et al.*, Science **322**, 235 (2008)]. However, although BEC-based optomechanical systems have several desirable properties, one must also take into account the effect of atom-atom interactions. We treat these interactions via a two-fluid model that retains the intuitive appeal of the non-interacting two-mode description. We find that the Bogoliubov excitation spectrum of this system comprises a gapped upper branch and a lower branch that can include an unstable excitation mode.

D. S. Goldbaum, K. Zhang and P. Meystre, *Two-fluid model of a Bose-Einstein condensate in the cavity optomechanical regime*, arXiv:0911.3234.

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