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Faraday waves and granulation in a Bose-Einstein condensate[1]
JASON NGUYEN, DE LUO, PATRICK BAGGE, RANDALL HULET, Rice University — Faraday waves are surface waves of a non-linear medium generated by parametric modulation of the medium. Faraday waves in a Bose-Einstein condensate have been created by periodically modulating the transverse confinement of an optical trap, which indirectly modulates the interactions[2]. We have directly modulated the interactions via a Feshbach resonance in an elongated condensate of ^{7}Li atoms in the $|1,1\rangle$ state and identify two distinct regimes, differing in modulation frequency and strength. For frequencies near, or twice the radial trap frequency and for weak modulation strengths, we generate Faraday waves which are well described by a mean-field theory that accounts for the 3D nature of the elongated condensate. At lower frequencies no clear Faraday patterns occur, even with increasing modulation strength. Instead, the condensate forms an irregular granulated distribution that is outside the scope of a mean-field approach. In this regime, we find that the granulated condensate may be characterized by large quantum fluctuations and correlations, which are well-described using a beyond mean-field approach.

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[2]P. Engels, C. Atherton, & M. A. Hoefer, PRL 09, 095301 (2007)

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