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Sound-induced vortex interactions in a zero temperature two-dimensional superfluid PIOTR SUROWKA, ANDREW LUCAS, Harvard University — Recent experimental work[1][2] on two-dimensional turbulent superfluids have increased the importance of resolving fundamental theoretical questions about the nature of superfluid turbulence in two dimensions. Crucial to this task is a proper understanding of the effective dynamics of vortices in the superfluid. We present a systematic calculation of the effective action of $N > 1$ superfluid vortices, assuming that the underlying continuum action is the Gross-Pitaevskii action. Our calculation is valid at next-to-leading order in the ratio of the vortex core size to intervortex spacing, and so takes into account the leading-order dressing of superfluid vortices by sound. We are able to exactly determine the action for a pair of vortices and we find that it demonstrates no instability to annihilation. This is suggestive that the inverse cascade picture of classical turbulence is qualitatively correct for a turbulent zero temperature superfluid.

[1]T. W. Neely *et al.*, Physical Review Letters 111 235301 (2013).
[2]W. J. Kwon *et al.*, arXiv:1403.4658.

Piotr Surowka
Harvard University

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