Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Energetics of drop and bubble deformation with application to breakup in turbulent flows[1] ALBERTO VELA-MARTIN, Universidad Politecnica de Madrid, MARC AVILA, ZARM, University of Bremen — Drop breakup in fluid flows is investigated here as an exchange between the fluid's kinetic energy and the drop's surface energy. We show analytically that this energetic exchange is governed only by the action of the rate-of-strain tensor on the surface of the drop, more specifically, by a term analogous to vortex stretching. Our formulation allows to isolate the energetic exchange due to the relaxation of the drop, from the action of velocity fluctuations leading to breakup. We perform direct numerical simulations of single drops in isotropic homogeneous turbulence and show that an important contribution to breakup arises from the stretching of the fluid-fluid interface by velocity fluctuations away from the drop surface. This mechanism is approximately independent of the Weber number, whereas the dynamics inside (and close to) the drop only contribute to breakup for sufficiently large Weber numbers. We discuss the implication of these results for the simplification and improvement of breakup models.

[1]A.V-M acknowledges the support of the European Research Council COTURB project ERC-2014.AdG-669505.

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Date submitted: 03 Aug 2020 Electronic form version 1.4