Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Exploring Fluctuation-Induced Forces in Homogeneous Isotropic Turbulence DANIEL PUTT, University of Houston, VAMSI SPANDAN, Harvard University, ALPHA A. LEE, University of Cambridge, RODOLFO OSTILLA MONICO, University of Houston — Understanding force generation in nonequilibrium systems is a notable challenge in statistical physics. We uncover a fluctuation-induced force between two plates immersed in homogeneous isotropic turbulence using direct numerical simulations. The force is a nonmonotonic function of plate separation. The mechanism of force generation reveals an intriguing analogy with fluctuation-induced forces: In a fluid, energy and vorticity are localized in regions of defined length scales. When varying the distance between the plates, we exclude energy structures modifying the overall pressure on the plates. At intermediate plate distances, the intense vorticity structures (worms) are forced to interact in close vicinity between the plates. This interaction affects the pressure and forces between the plates. The combination of these two effects causes a nonmonotonic attractive force with a complex Reynolds number dependence. We show that this force remains present when using various plate shapes and sizes with slightly modified characteristics. Our study sheds light on how length scaledependent distributions of energy and high-intensity vortex structures determine Casimir forces.

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Date submitted: 31 Jul 2020 Electronic form version 1.4