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On Clarifying the Mechanisms for Persistent Asymmetries in Advecting Vortical Motions JOHN ELSNAB, HURMAT UI AIN, University of Melbourne, JOSEPH KLEWICKI, University of Melbourne and University of New Hampshire — A challenge associated with the study of turbulence relates to determining how and why ensembles of instantaneous motions underlie the observed behaviors of the time averaged flow. It is important to distinguish between events that make a lasting and unique signature to the time average representation of the flow, and events that simply make instantaneous contributions. The present experiments establish when laminar vortex rings interact with a time evolving shear-layer that persistent asymmetries are generated. These asymmetries are dynamically significant as they modify the gradient of the Reynolds stress (RS), which is the relevant quantity that appears in the mean equations. In turbulent wall flows, the gradient of the RS acts as a net source or sink of mean momentum depending upon the position where the RS is maximum. Vortex rings subjected to an induced advection velocity (an additive perturbation) do not exhibit persistent asymmetries; however, when rings with modified advection velocities interact with a shear-layer, the ring dynamics exhibit enhanced asymmetries when compared to shear-layer interactions alone. Connections are drawn between the velocity and vorticity field correlations that are attributed to the RS gradient and its modification.

John Elsnab
University of Melbourne

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