

Abstract Submitted  
for the DFD13 Meeting of  
The American Physical Society

**Homage to Bob Brodkey at 85: ejections, sweeps and the genesis and extensions of quadrant analysis** JAMES WALLACE, University of Maryland — Almost 50 years ago Bob Brodkey and his student, Corino, conceived and carried out a visualization experiment for the very near wall region of a turbulent pipe flow (JFM 37) that, together with the turbulent boundary layer visualization of Kline et al. (JFM 30), excited the turbulence community. Using a high speed movie camera mounted on a lathe bed that recorded magnified images in a moving frame of reference, they observed the motions of small particles in the sub- and buffer-layers. Surprisingly, these motions were not nearly so locally random as was the general view of turbulence at the time. Rather, connected regions of the near wall flow decelerated and then erupted away from the wall in what they called “ejections.” These decelerated motions were followed by larger scale connected motions toward the wall from above that they called “sweeps.” Brodkey and Corino estimated that ejections accounted for 70% the Reynolds shear stress at  $Re_d = 20,000$  while only occurring about 18% of the time. Wallace et al. (JFM 54) attempted to quantify these visual observations by conceiving of and carrying out a quadrant analysis in a turbulent oil channel flow. This paper will trace this history and describe the expanding use of these ideas in turbulence research today.

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Date submitted: 06 Aug 2013

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