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Critical layer structure in transitional Couette flows HUGH BLACKBURN, Monash University, PHILIP HALL, SPENCER SHERWIN, Imperial College London — A recent theoretical/numerical investigation (Hall & Sherwin 2010) demonstrates that vortex-wave interaction in the critical layer of a roll-streak system provides a driving mechanism that will maintain the coupled flow system in near-equilibrium. In addition the predictions made for the variation in the strength of the roll-wave system with Reynolds number asymptotically match those for the lower-branch states observed by Wang et al. (2007) in the Couette system. We use DNS of transitional Couette flows to examine two key predictions made by the theory. First, for fixed spanwise periodic wavelength, we examine the maximum streamwise periodic wavelength for which the flow does not relaminarize, since the theory suggests a wavelength below which equilibrium cannot be maintained. Second, we extract Reynolds stresses in the critical layer, and examine their relationship to observed roll structures, since the theory predicts that rolls are maintained by tangential gradients of Reynolds stress within the critical layer.
Hall P & Sherwin SJ (2010), Streamwise vortices in shear flows: harbingers of transition and the skeleton of coherent structures, *J Fluid Mech*. In press.
Wang J, Gibson J & Waleffe F (2007), Lower branch coheremt states in shear flows: transition and control, *Phys Rev Let* **98**, 204501.

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