"A vortical step model of the turbulent boundary layer"
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Thanks,
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Viscous versus inviscid exact coherent states in high Reynolds number wall flows[1] BRANDON MONTEMURO, JOE KLEWICKI, CHRIS WHITE, GREG CHINI, University of New Hampshire — Streamwise-averaged motions consisting of streamwise-oriented streaks and vortices are key components of exact coherent states (ECS) arising in incompressible wall-bounded shear flows. These invariant solutions are believed to provide a scaffold in phase space for the turbulent dynamics realized at large Reynolds number Re. Nevertheless, many ECS, including upper-branch states, have a large-Re asymptotic structure in which the *effective* Reynolds number governing the streak and roll dynamics is order unity. Although these viscous ECS very likely play a role in the dynamics of the near-wall region, they cannot be relevant to the inertial layer, where the leading-order mean dynamics are known to be inviscid. In particular, viscous ECS cannot account for the observed regions of quasi-uniform streamwise momentum and interlaced internal shear layers (or 'vortical fissures') within the inertial layer. In this work, a large-Re asymptotic analysis is performed to extend the existing self-sustaining-process/vortex-wave-interaction theory to account for largely inviscid ECS. The analysis highlights feedback mechanisms between the fissures and uniform momentum zones that can enable their self-sustenance at extreme Reynolds number.

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