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An investigation of the linear mechanisms in polymer drag-reduced turbulence using resolvent analysis[1] RYAN MCMULLEN, BEVERLEY MCKEON, California Institute of Technology — It is well-known that small amounts of high-molecular weight polymers can drastically reduce turbulent drag in a liquid (Toms, 1948). Furthermore, recent work has shown that studying polymers in turbulence can shed light on the nature of the self-sustaining mechanisms of wall turbulence (White and Mungal, 2008; Graham, 2014). The focus of this talk is an investigation of the linear mechanisms at play in polymer drag-reduced turbulent channel flow. The resolvent framework introduced by McKeon and Sharma (2010) for Newtonian turbulence is extended to the viscoelastic case in order to study the most-amplified velocity and polymer stretching modes, explored in the case of creeping flow by Jovanović and coworkers (Jovanović and Kumar, 2010; Lieu et al., 2013). Particular attention is given to the role of critical layers, which have been shown to be important in the dynamics of Newtonian turbulence (McKeon and Sharma, 2010). Additionally, comparisons will be made with the lower branch of the P4 family of exact coherent states, which closely reproduce statistical features of polymer drag-reduced turbulence close to maximum drag reduction (Park and Graham, 2015).

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