Abstract Submitted
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Coherent structure, amplitude modulation and higher order statistics in wall turbulence[1] BEVERLEY MCKEON, California Institute of Technology, ATI SHARMA, University of Sheffield — Coherent structure in wall turbulence is shown to be captured by the frequency-domain treatment of the Navier-Stokes equations as a directional amplifier proposed by McKeon & Sharma (2010). Simple combinations of the predicted response modes (which take the form of radially-varying travelling waves), consistent with the nonlinear triadic interaction known for wavenumber interactions, are offered which minimally predict all types of structures including hairpin vortices and modulated hairpin packets. One such combination is understood to form a turbulence "kernel," which, it is proposed, constitutes a self-exciting process analogous to the near-wall cycle. The phase relationships explain important skewness and correlation results known in the literature. It is shown that the local shear associated with very large scale motions acts to organize hairpin-like structures such that they co-locate with areas of low streamwise momentum. Compelling evidence for the theory is presented based on comparison to observations of structure and statistics reported in the experimental and numerical simulation literature and similarities with other analytical and empirical models are discussed

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