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Boundary layer streaming in viscoelastic fluids SEYED AMIR BAHRANI, MAXIME COSTALANGA, University of Paris-Diderot, Lab. MSC, LAURENT ROYON, University of Paris-Diderot, Lab. LIED, PHILIPPE BRUNET, University of Paris-Diderot, Lab. MSC, DSHE TEAM, ENERGY TEAM — Oscillations of bodies immersed in fluids are known to generate secondary steady flows (streaming). These flows have strong similarities with acoustic streaming induced by sound and ultrasound waves. A typical situation, investigated here, is that of a cylinder oscillating perpendicular to its axis, generating two pairs of counter-rotating steady vortices due to the transfer of vorticity from an inner boundary layer. While most studies so far investigated the situation of newtonian fluids, here, we consider the situation of a viscoelastic fluid. By using Particle Image Velocimetry, we carry out an experimental study of the flow structure and magnitude over a range of amplitude (A up to 2.5 mm, nearly half the cylinder diameter) and frequency (f between 5 and 100 Hz). We observe unprecedented behaviors at higher frequency (f >50 Hz) : at high enough amplitude, the usual flow with 2 pairs of vortices is replaced by a more complex flow where 4 pairs of vortices are observed. At smaller frequency, we observe reversal large scale vortices that replace the usual inner and outer ones in Newtonian fluids. The main intention of this work is to understand the influence of the complex and nonlinear rheology on the mechanism of streaming flow. In this way, another source of purely rheological nonlinearity is expected, competing with hydrodynamic nonlinearity. We evidence the effect of elasticity in streaming.

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