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The interaction of two spheres in a simple-shear flow of complex fluids.[1] MOHAMMADHOSSEIN FIROUZNIA, Ohio University, BLOEN METZGER, Aix-Marseille Universite, CNRS, GUILLAUME OVARLEZ , University of Bordeaux, CNRS, SARAH HORMOZI, Ohio University — We study the interaction of two small freely-moving spheres in a linear flow field of Newtonian, shear thinning and yield stress fluids. We perform a series of experiments over a range of shear rates as well as different shear histories using an original apparatus and with the aid of conventional rheometry, Particle Image Velocimetry and Particle Tracking Velocimetry. Showing that the non-Newtonian nature of the suspending fluid strongly affects the shape of particle trajectories and the irreversibility. An important point is that non-Newtonian effects can be varied and unusual. Depending on the shear rate, nonideal shear thinning and yield stress suspending fluids might show elasticity that needs to be taken into account. The flow field around one particle is studied in different fluids when subjected to shear. Then using these results to explain the two particle interactions in a simple-shear flow we show how particle-particle contact and non-Newtonian behaviors result in relative trajectories with fore-aft asymmetry. Well-resolved velocity and stress fields around the particles are presented here. Finally, we discuss how the relative particle trajectories may affect the microstructure of complex suspensions and consequently the bulk rheology.

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