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Taylor-Aris dispersion in the presence of shear-enhanced diffusion and variable mean flow GREGORY RUBINSTEIN, IVAN CHRISTOV, HOWARD STONE, Princeton University — Controlling the dispersion of colloidal suspensions is important in applications ranging from drug delivery to water purification. Previously, Griffiths and Stone [EPL (2012) 97, 58005] considered the influence of shear-induced diffusion on the Taylor-Aris dispersion of a colloidal suspension flowing in a cylindrical pipe. In this work, we extend their analysis to a radial outflow geometry, which features velocity variations along the flow direction. We found that the shear-induced diffusion due to the hydrodynamic interactions between the colloidal particles tends to decrease dispersion in the flow direction, as does the decrease in the velocity as the fluid flows radially outward. Using the method of multiple time scales, we derived an averaged dispersion equation that demonstrates the impact of these two effects. We also extended our methodology to coupled dispersion problems, in which the suspended particulate phase releases heat into the ambient fluid or the colloidal particles dissolve into the solvent medium.

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