Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Segregation of Binary Mixtures: Competing Effects of Gravity and Shear Rate Gradients KIMBERLY HILL, University of Minnesota, YI FAN, Northwestern University — Mixtures of particles tend to segregate when they flow. For example, when a dense binary mixture of different-sized particles flows down an inclined plane, the larger particles tend to go up (toward the free surface), and the smaller particles, down. However, this trend is not as simple as it might first seem. It has recently been demonstrated that under otherwise identical conditions the relative segregation fluxes in a binary mixture of particles are not monotonically dependent on particle size ratio. Further, for a single mixture, larger particles may rise or fall relative to the small particles, depending on subtle differences in local flow conditions. We have recently shown that a shear rate gradient drives segregation in dense flows, and that the direction depends on the partitioning of stress between species. The complicated segregation dynamics in gravity-driven flow may be due to competing effects of gravity and shear rate gradients in segregating particles. We combine a theory for gravity-driven segregation of granular materials (Gray and Thornton, Proc. R. Soc. A, 2005) with our theory for shear-driven segregation (New J Phys, in press) to study how these competing segregation effects can give rise to the variety of trends that have been observed.

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Date submitted: 05 Aug 2011 Electronic form version 1.4