Track 2

In contrast to several previous submissions in track 2, we would like to focus on dilute systems of fluidized grains in which the energydissipation is dominated by interparticle collisions rather than by the interstitial fluid (e.g. vibrofluidised systems with particle size above the sub-millimeter range). We point out that while the general theoretical framework of kinetic theory has been increasing in sophistication, several qualitative issues remain unresolved and a full convergence between experiment, simulation and theory is yet to be achieved. For example, it is not yet clearly established how many temperature fields are required to fully characterize a system with (i) frictional interactions, (ii) with bidisperse [1] or polydisperse grains, or (iii) non-spherical grains. Another issue is that large deviations from Maxwellian distributions of particle energies have been experimentally observed [2], and it is unclear whether major modifications of theory are required to accommodate these observations. Yet another example is the observation that there are significant correlations between velocities of colliding particles.

We are interested in creating a well-characterized experimental venue for testing several of these ideas. To this end, we have developed techniques for full-field visualizations of rotational motions of spherical and non-spherical particles in quasi-2-dimensional situations, and are currently working on perfecting techniques for 3-d tracking of particles in semidilute situations (volume fractions of up to 10 or 15%). These tests are supplemented by detailed measurements of interparticle collision parameters.

The experiments will be complemented by detailed simulations. Soft-sphere simulations are already available; it would be extremely desirable to abstract from the experiments a 3-d collisional model for rigid, inelastic, frictional particles. This would allow for efficient 3-d event-driven simulations in the style of the now-heavily used 2-dimensional collision model [Walton and Braun] developed by previous Morgantown DOE workshops in the 1980s.

The ultimate goal would be to provide practitioners of kinetic theory qualitative and quantitative inputs on the directions in which it is most necessary to further develop the theory.

[1] K. Feitosa, N. Menon, Breakdown of Energy Equipartition in a 2D Binary Vibrated Granular Gas, Phys. Rev. Lett. 88, 198301 (2002).

[2] F. Rouyer, N. Menon "Velocity Fluctuations in a Homogeneous 2D Granular Gas in Steady State", Phys. Rev. Lett. *85*(17), 3676-3679(2000).

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