Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Shock Wave Instability in Dissipative Granular Gases NICK SIRMAS, MATEI RADULESCU, University of Ottawa — The current study addresses the stability of shock waves propagating through dissipative granular gases. We perform molecular dynamics simulations of colliding hard disks accelerated by a piston. The collisions between the particles are modeled with a constant coefficient of restitution for activated collisions. An activated state is first established through shock compression, followed by a relaxation period until equilibrium is reached. Due to the existence of the activation threshold, the compacted region retains some thermal motion. Our numerical experiments reveal that the structure of these shock waves is unstable. Distinctive high density non-uniformities are formed, which take the form of convective rolls. We find that the characteristic spacing between the bumps is correlated with the relaxation length scale, which is dependent on the coefficient of restitution and shock strength. The results are also investigated in the framework of shock wave theory. Using analytical and numerical results for the shock Hugoniot, we show that both D'yakov-Kontorovich instability, and Bethe-Zel'dovich-Thompson instability can be ruled out. Instead, the results suggest that the clustering instability of Goldhirsch and Zanetti is the dominant mechanism controlling the shock instability.

Nick Sirmas
University of Ottawa

Date submitted: 12 Aug 2012 Electronic form version 1.4