

COLLISION DYNAMICS AND WHY THE ENTROPY “DEAD STATE” IS NOT UNIFORM

Andrew Foley

United States Coast Guard Academy, New London, Connecticut, USA

ABSTRACT

When two volumes of gas at different mean temperatures are mixed the first law allows us to predict the final temperature and the resulting entropy generation. To all intents and purposes the resulting system has reached a new equilibrium and one could be forgiven that all the particles making up the gas are now travelling at the same uniform speed. The reality is however that, no matter how long we wait, there will still remain considerable temperature (velocity) disparities between individual gas particles. This distribution has been described by Maxwell’s law which is invariably derived at a macroscopic statistical level. This paper describes a 2D particle, dynamics investigation of this velocity distribution and highlights how it is the very nature of the interaction of particles traveling in straight line motion with curved spherical ‘surfaces’ which results in the non-homogenous velocity distribution. Indeed it can be shown that individual collisions at the microscopic level result in “entropy destruction” as well as creation in order to keep this steady state velocity distribution. The implications of this on the definition of entropy and at the equilibrium position are also discussed.

Keywords: entropy, Maxwell velocity distribution, particle collision dynamics