Air Hockey Implies Chaos – Kristen Casalenuovo

I. Introduction
   a. Chaotic scattering definition
   b. Example of point particle in an electric field, b vs. theta *(draw on board)*
   c. What makes scattering chaotic is that for just small changes in b, there can be huge changes theta.
   d. Billiards – symbolic representation (frictionless, reflection) of chaotic scattering problem
   e. We are extending this problem to cases with friction.
   f. Thesis – With friction, there will be a significant difference in the output, but chaotic scattering will still occur.

II. Friction Dynamics
   a. Definition: force opposing tangential motion equal to coeff. of friction times the normal force.
   b. Draw examples of varying friction forces and spins on board and demonstrate using tennis balls and super balls.
   c. Collisions are not instantaneous, so…

III. Impulse Force
   a. Definition – change in force w.r.t. time *(draw integral on board)*
   b. Assumption – when Vtotal = 0, the ball will roll, and the rolling friction is inconsequential. Thus no more change in motion.
   c. Vnet-before*Vnet-after > 0. In these cases, we use locking impulse instead of the sliding impulse defined by the normal force.
   d. Locking impulse – change in force until time(Vtotal=0).

IV. Research
   a. Derived equations to define changes in forces during collisions with friction, translational velocity, and angular velocity.
   b. Wrote Java program to examine data and to animate system.
   c. We did find a significant difference in the output between cases with and without friction, and chaos still occurred.
   d. For more information, visit me in the poster session.