Physics NYA

# Collisions in Two Dimensions

**Objectives:** To study the conservation of total momentum and energy for a system consisting of two colliding pucks on an air table.

**Procedure:**

- Level the air table carefully. Use two pucks of different mass***. Measure and record their mass***.

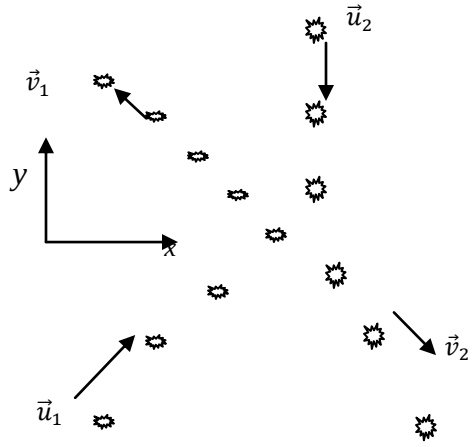
- Put a fresh piece of paper on the air table and make sure it is flat and without bumps or folds. Place the two pucks carefully on the air table. Check that both pucks move around the table without friction(i.e. at constant velocity).

- Check the electrical connections and set the timer for ***100 ms per spark***

- Launch the pucks with different velocities so that they collide gently in the middle of the table. Avoid direct head-on collisions. Practise several times before activating the spark timer. *Be sure both **pucks are in motion** over the carbon paper **before starting the spark** timer.*

- After obtaining a good set of tracks(fig.1), remove the paper. Nota that when you turn the paper over, everything is reversed left to right or up to down. So, before turning the paper, mark on it the initial direction of motion (i.e. u-velocity) and the mass of each puck.

- Examine the tracks to verify that they are straight with the ***dots fairly equally spaced especially just before and just after the collision***. (Why is this important?)




**Measurements and Calculations:**

- From the tracks, calculate the **magnitude** and find the **direction** of the **velocity** of both pucks **just before** $(\overrightarrow{u_1},\overrightarrow{u_2})$ and **just after** $(\overrightarrow{v_1},\overrightarrow{v_2})$, the collision; chose a length for the speed unit and draw them on the paper. If there is evidence of some friction, it is important that the velocities (both magnitude and direction) obtained be those as near as possible to the point of collision. Measure the angle between each velocity vector and some reference axis Ox (which could be one of the tracks).

Figure 1

- Take axe Oy perpendicular to Ox and use the component method to calculate the x and y components of the ***total momentum*** *before* and the **total momentum** *after* the collision.

- Calculate the ***total kinetic energy*** of the two pucks *before* and *after* the collision.

**Conclusions:**

- Is the total momentum of the system conserved (to two significant figures)? Remember that momentum is a vector so that either both its x and y components or both its magnitude and direction must be conserved.

- Is the collision elastic? Explain.