**Experiment 5: Physical Pendulum**

**Electronic setup:** The 750 interface should be powered on (green light comes on). Connect the motion sensor (yellow plug into jack 1, black plug into jack 2) to the SW750 interface. The PhysPendulum program and the write-up can be found in the 8.01L sub-folder of the “Students’s Home” folder on the desktop. If you get an error message, something is turned off or unplugged, so you need to check your setup.

**Mechanical setup:** The pendulum is made by hanging a metal ruler over a pivot. Locate the stand so the ruler can hang over the edge of the table as shown in the writeup photo. The ruler should be four to six inches in front of the motion sensor when hanging at rest. Set the motion sensor on its narrow beam.

**Important Note:** To time the period accurately, **you should place a target (a hard object like a clipboard or book) about 0.5 m away**—for the motion sensor to detect when the ruler has moved aside. Also, the motion sensor can give weird results for distances closer than $\approx 10–15$ cm. If you get strange-looking data, try sliding the ruler out on the rod.

**Taking Data:**

1. Choose “Measure” from the pull-down menu. Pull the bottom end of ruler aside by the desired distance (about 10 cm, don’t make it too big), then release the ruler and click the bright green RUN button. **Take some care** to release the ruler so that it swings in a vertical plane; if it “wobbles” you may get strange results.

2. The graph in the writeup shows typical results for a run.

3. Position the marker lines at the very beginning of pulses as many periods apart as you can (use the cursor to get the marker line close then the arrow keys to fine-tune the position) and then read off the times (X positions) in the boxes above the graph.

4. The start of a pulse is determined by the measured distance falling below the flat line between pulses. To get accurate results, **make sure to position the marker line at the very first point where the distance drops for both pulses.**

5. Calculate the difference between the two times (RedX–BlueX), count the number of pulses, and compute the period using a calculator.

6. **Don’t forget that each swing makes two pulses so from the 1st pulse to the third is 1 period, 1st to 5th is 2 periods, etc.** To cross-check each measurement, simply repeat the run watching and counting swings.

**Modifying the moment of inertia:**

1. Modify the moment of inertia of the pendulum by using the binder clip to attach the 50 gm brass weight to the ruler.

2. The small hole in the center of the weight can be used to identify fairly accurately where the center of mass of the weight is located.

3. Measure the period and report the results for three positions spanning a fairly wide range. The “position” in the table is the distance from the top end of the ruler to where the center of mass of the extra weight and clip is located.