# P1310L, Angular Momentum
# Lab 12, Work Sheet

Submitted by: ______________________ Experiment's date: ______________________

Team members:

1.- ______________________ 2.- ______________________

3.- ______________________ 4.- ______________________

## Introduction

*Write a short paragraph about the purpose of this lab.*

## Analysis

### Orbiting Puck

1. Calculate the speeds at $r_{\text{max}}$ and $r_{\text{min}}$, using the distance between the two dots and the spark frequency. These speeds are the perpendicular components of the velocities at those points.

2. Calculate the angular momentum using $|L| = mrv_\perp$ at both $r_{\text{max}}$ and $r_{\text{min}}$.

3. Calculate the percent error of the angular momentum above. If the angular momentum is conserved, they should be equal, so make one of them the theoretical and the other the experimental.

4. What is the direction of the angular momentum of the puck?

5. If the air table had no friction, then energy would be conserved. Assume this is true. Yet the puck clearly has greater kinetic energy at $r_{\text{min}}$ than at $r_{\text{max}}$. So how is energy conserved? Explain.

## Changing of Moment of Inertia

6. Suppose your initial moment of inertia and angular velocity are $I_i$ and $\omega_i$, respectively. If extending your arms doubles your moment of inertia so that $I_f = 2I_i$, then what is $\omega_f$ in terms of $\omega_i$? Show your work!

7. For the same condition as above, calculate and compare the initial and final rotation energies using $K_{\text{rotation}} = \frac{1}{2}I\omega^2$. Why are they different? Explain.

## Spinning Bicycle Wheel

8. Sketch and explain what happened in steps 4 and 6, when the wheel velocity was shifted 45 degrees off the horizontal.

9. For the steps 9 and sketch and explain why re-orienting left or right produces the same effect.

10. Sketch and explain what happened in step 11: inverting the angular momentum from pointing up to pointing down

11. If the initial spin rate of the wheel were same for the steps 6, 9, and 11, would your rotation rate be the same in each? Explain why.

12. We stated in the background that the angular speed of the wheel does not change when reoriented even though it induces rotation in you; kinetic energy is clearly not conserved. If the initial kinetic energy of the system was the rotational energy of the wheel - which remains constant - where did your rotational energy come from?

## Conclusions

*Summarize your results and write a brief reflection on the experiment; in particular, comment on whether the theory makes reasonable predictions despite the observed variability.*

[1] This is an adaption from S. Sugaya's original version