

# M11 Labs

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4:27 PM

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Notes

## Lab 11.1: **Force and Circular Motion**

Take a pen apart so that you just have the lower barrel.

Thread a string through the barrel and tie one end to one washer and the other end tie to two.

Measure about 6 in of string to be on the point end of the pen and mark the string on the blunt side of the pen with an easy to see mark.

Twirl the string with the point end up so that the mark on the string stays at the location just below the blunt end. Have someone time the amount of time it takes to twirl 20 full cycles. Do this 5 times and average the results.

Add two more washers at the lower end and try again.

Next, in an environment where damage can be prevented, twirl again but snip the lower string and note the direction the washers travel.

# Lab 11.2



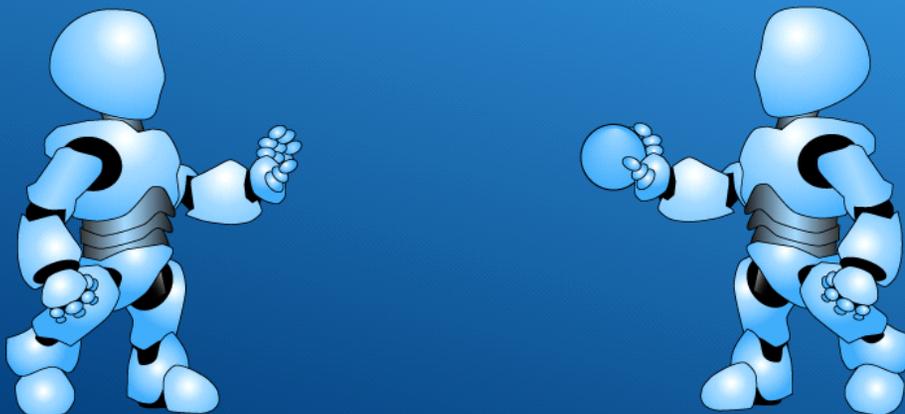
## The “Bent Space and Time” Theory of Gravity

### Materials

- A soft seat cushion from a couch [or a soft bed—list which one you used]
- A bowling ball or heavy rock
- A marble
- Eye protection such as goggles or safety glasses

Move the cushion to the floor if it isn't level. Lay the bowling ball on the very center of the cushion. Note what happens to the marble. Then Take the bowling ball off the cushion and smoothed it out so that it was reasonably flat again. I rolled the marble slowly, straight across the cushion, but not near the center. Put the bowling ball back in the center of the cushion and rolled the marble along the same path as before, with the same slow speed. Note the path that the marble takes.

# Lab 11.3



## 11.3 -

### The Graviton Theory of Gravity

### Materials

- Two balls [the text says baseball-sized are best, but any will do—list what you used]
- Two people to help you
- A stopwatch or a watch with a second hand
- A large, open space
- Eye protection such as goggles or safety glasses

I took one ball for myself and handed the other to one of my helpers. The other helper held the stopwatch. I stood about 1 foot away from the helper with the ball. The helper with the stopwatch started the stopwatch and at

started the stopwatch and at the same time yelled “go.” At that moment, I threw the ball to my other helper, while [he/she] threw the ball to me. Then, right away, we threw the balls back to one another so that I had the same ball I originally had. [This all needs to happen in less than a second.] Every second, my helper with the stopwatch yelled “go” again, and I exchanged balls with my other helper and then exchanged them back again. We did this about 10 times.

“Step 5”: Then, both my helper with the ball and I each took a giant step backward, away from each other. We repeated the exchanging and re-exchanging balls every second for about 10 times.

We repeated step 5 three or four times, continually stepping farther and farther away from each other. I noted if the procedure got harder or easier as we moved farther away from each other.