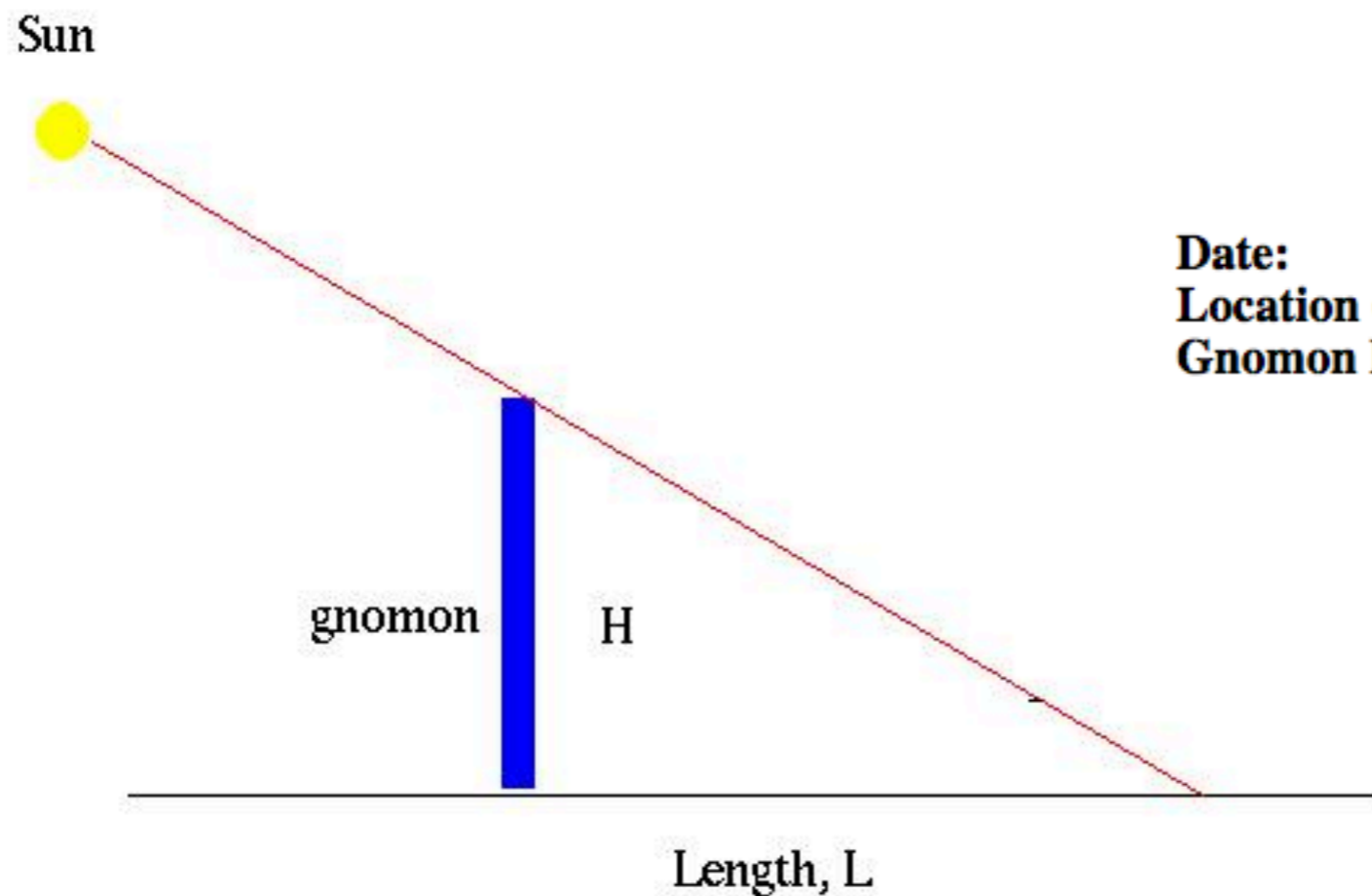


Homework 2: Sun Observations

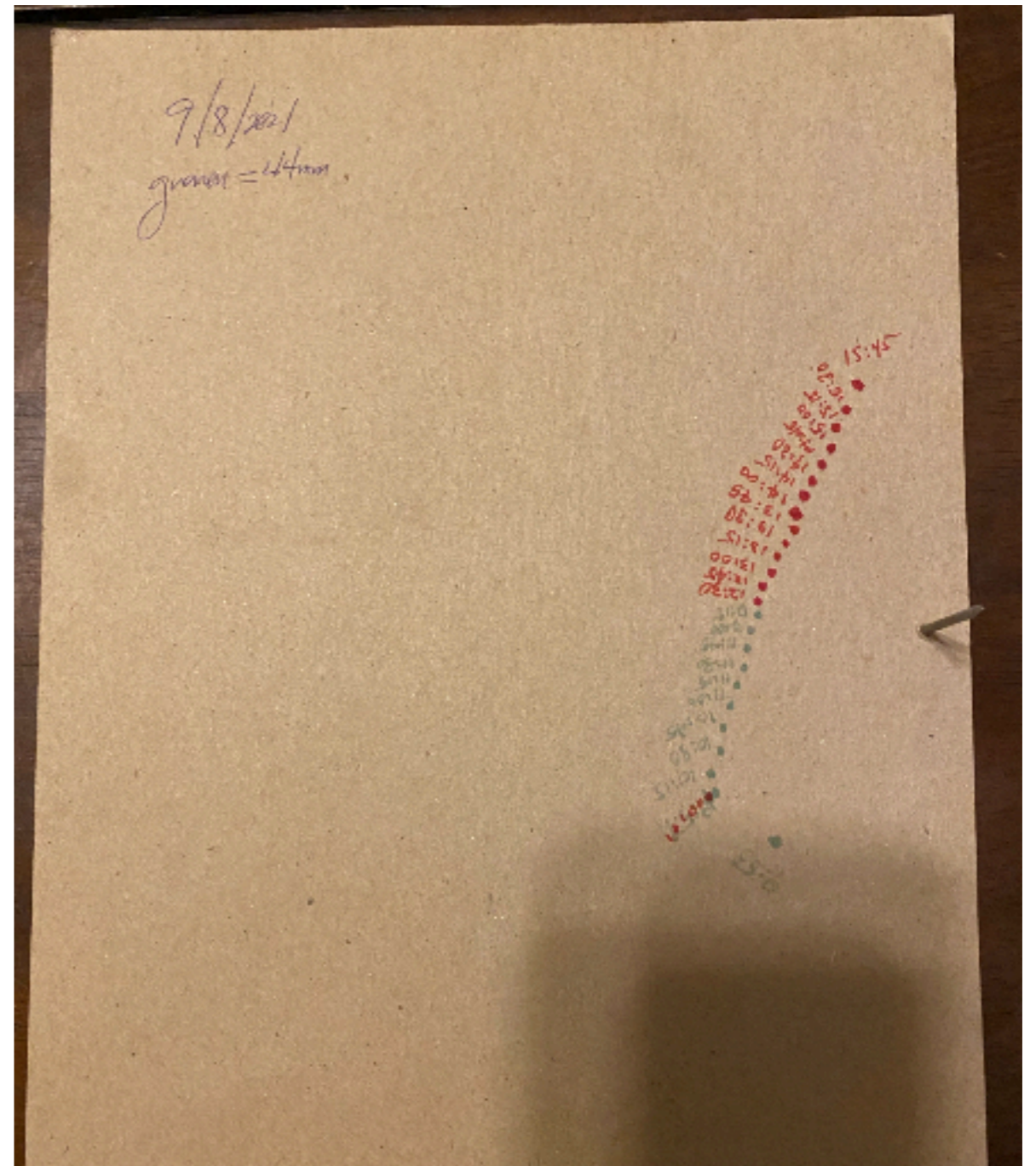
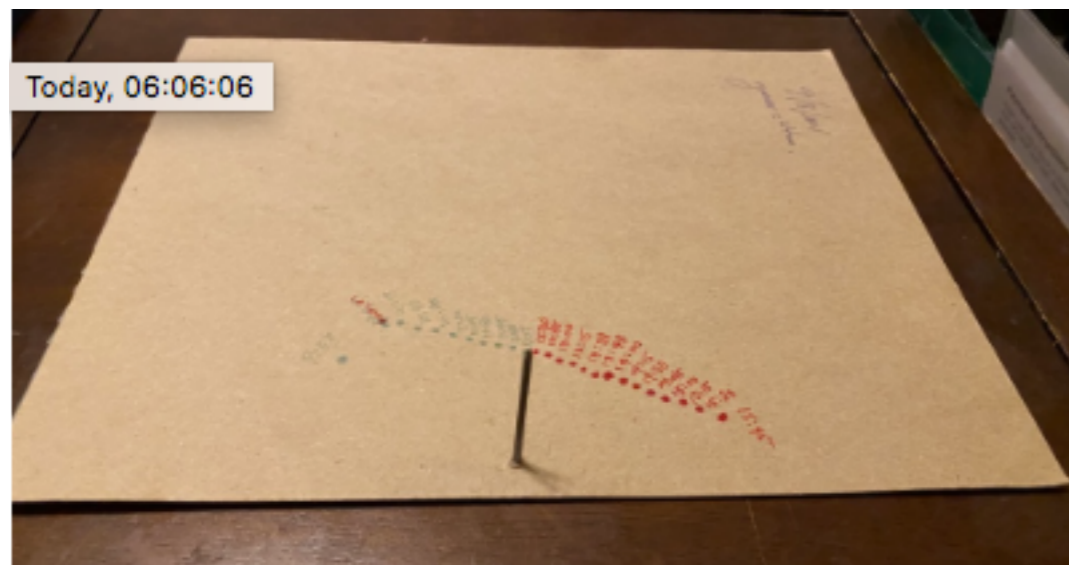
The next few slides show a couple of things for the solar observation exercise.



Date: September 8, 2021
Location (city is good enough): Eugene, OR
Gnomon Height, H: 44 mm

Homework 2: Sun Observations

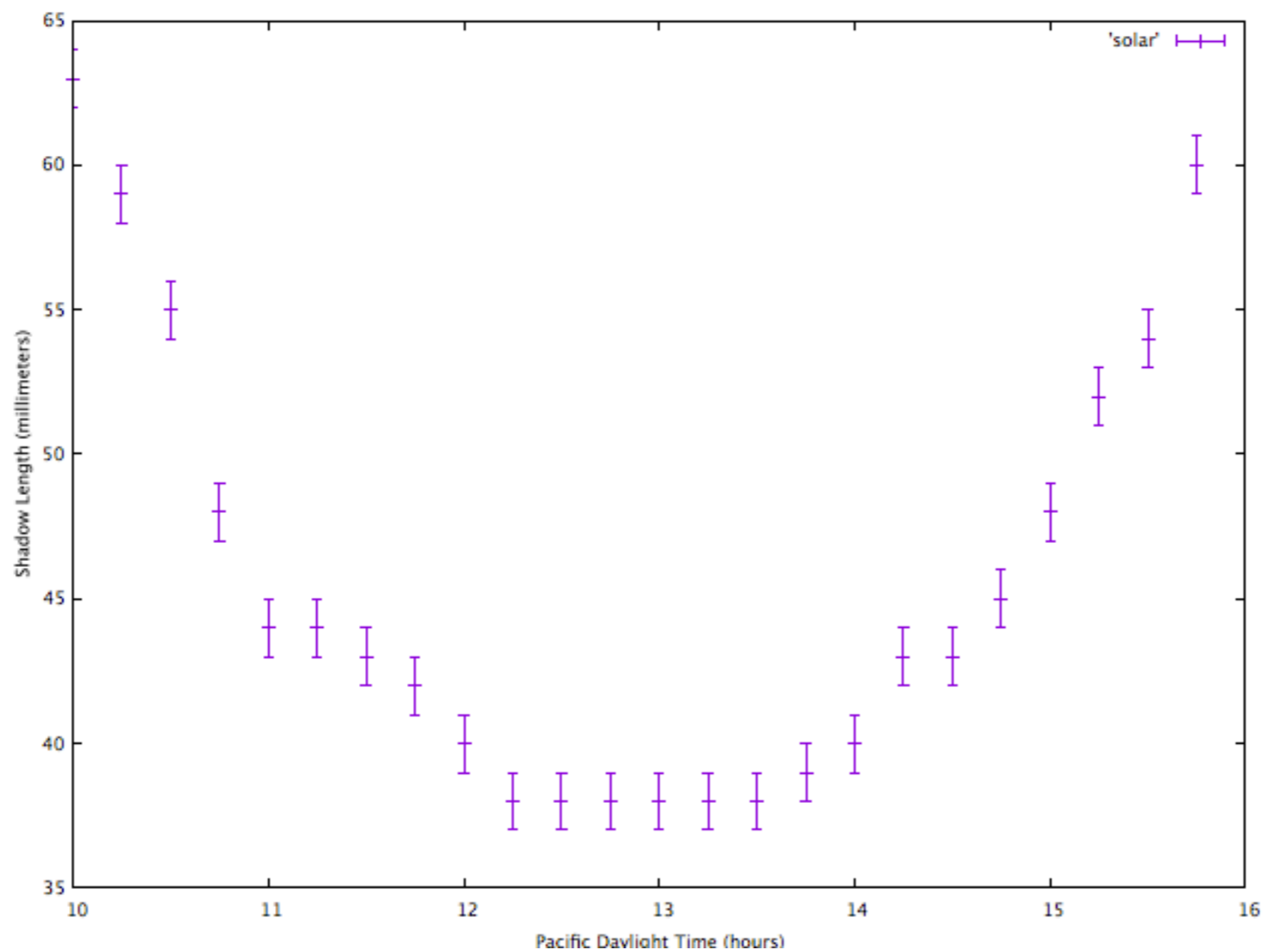
Simple set-up for the solar observation exercise.



I grabbed a cardboard (8.5"x11") and poked a nail through it (see above and right). I tried to make the nail vertical and the sheet lie flat. I placed the sheet outdoors on a level surface and measured the length of the nail's shadow at intervals of 15 minutes (the dots of the sheet). I entered the results in a Table and plotted the data making a graph.

Time	Length, L	Time	Length, L	Time	Length, L	Time	Length, L
10:00	63	11:30	43	1:00	38	2:30	43
10:15	59	11:45	42	1:15	38	2:45	52
10:30	55	12:00	40	1:30	38	3:00	48
10:45	48	12:15	38	1:45	39	3:15	52
11:00	44	12:30	38	2:00	40	3:30	54
11:15	44	12:45	38	2:15	43	3:45	60

The data were taken on September 8, 2021 in Eugene, OR. The lengths in the table are in units of millimeters and the times are Pacific Daylight Time.



I plotted data acquired on September 8, 2021 in Eugene, OR. The height of the gnomon was 44 mm. The size of the errorbars was estimated based on the width of the shadow cast by the gnomon, it was broad, and the divisions on the ruler used, 1 millimeter divisions. There are other kinds of errors, perhaps the gnomon was not precisely vertical, the surface on which the gnomon was placed was not flat and/or was not horizontal,

Estimating the time at which the shadow is shortest, the time of local noon, is difficult. To find the center, I assumed that the shape of the curve should be symmetric around local noon, that is, if I folded the curve about its center point flipping the left hand part about the center and laying it over the right hand part, the curves would lie on top of each other. Can do the exercise in other ways.

Can you suggest others?

The exercise suggests that local noon is around 13 h, around 1 pm. At this time the length of the shadow is around 38 mm. The ratio of the gnomon height to the shadow length is around $h/L = 1.2$

Based on the table, the altitude of the Sun on the date of observation was around 50° .

Looking up the values for the Sun on September 8, 2021 for Eugene, OR, we find the maximum elevation of the Sun was 49.4° at 1:09 pm.

For extra credit, perform this exercise later in the term (wait for a month or more, say in November).