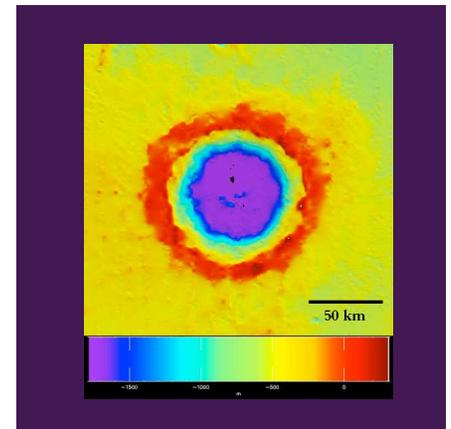
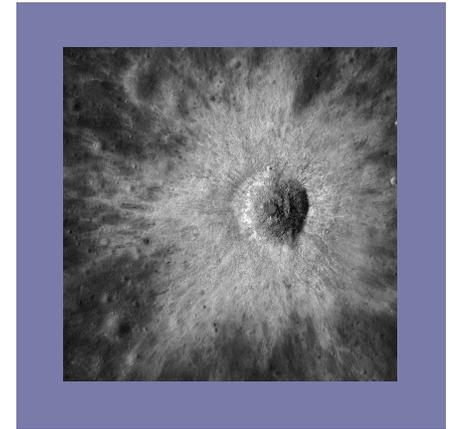
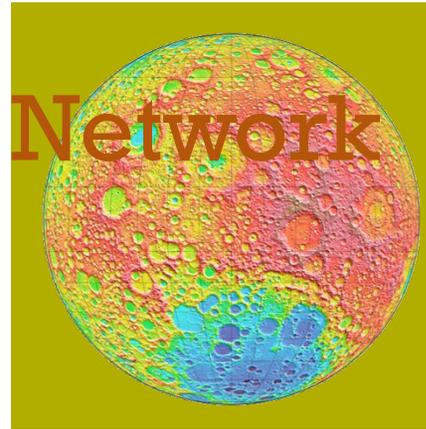




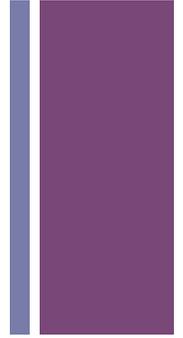
# Galileo Teacher's Network

The Moon (and more)



Presenters:  
Erin Wood  
Matthew Benjamin  
Alex Thom

# + Think-Pair-Share



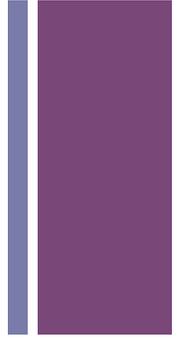
Rules:

- ☑ Think and write (1 minute)
- ☑ Discuss with a partner (3 minutes)
- ☑ Share with the group

*What does science mean to you?  
Generate 3 key words.*

## + Sticky Note Activity

*What do you expect to gain by attending this workshop today?*

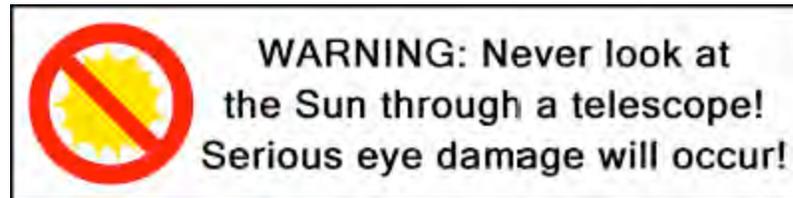




# Project ASTRO

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## Galileoscope Assembly



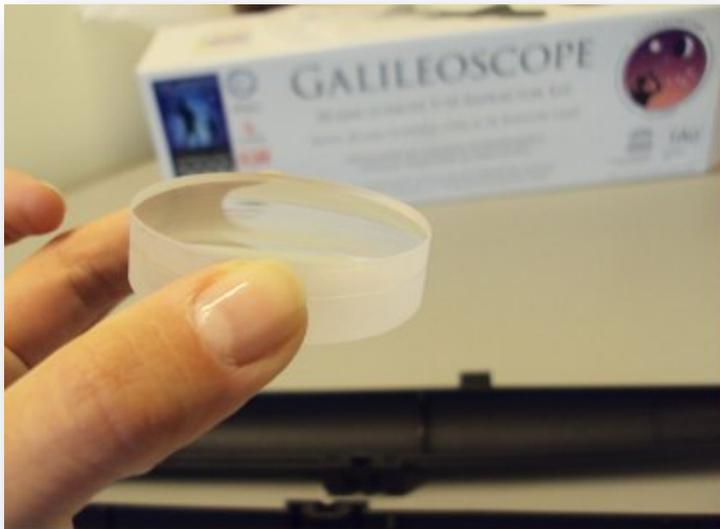
**THE GALILEOSCOPE IS NOT A SOLAR  
TELESCOPE AND SHOULD NEVER BE  
POINTED AT THE SUN!**



+

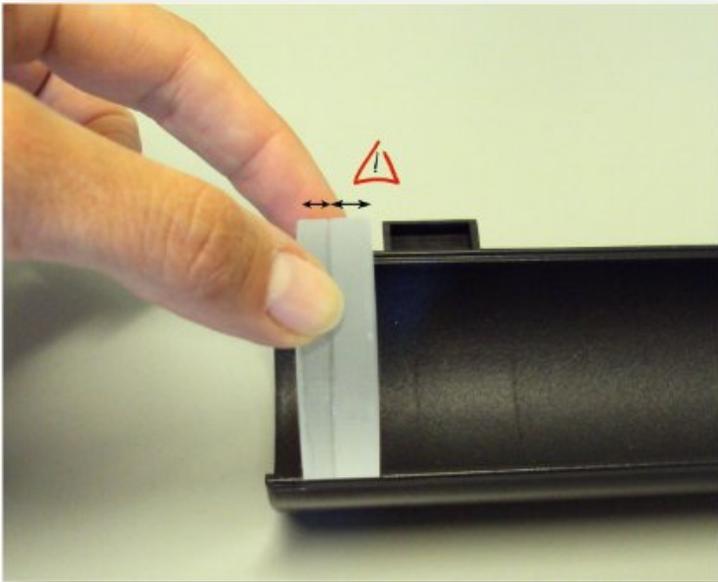
**Open the Galileoscope box and make sure that all parts are included.**

Parts are stacked in several layers. First you'll see a sheet with assembly instructions and a little plastic bag containing a paper sticker, a metal nut, and four rubber rings. Remove these and place them on a work table.



## + Examine the Objective lens (the lens that resides at the front of the telescope)

Examine the 50-mm (2-inch) diameter objective lens; handle the lens only by the edges, preferably while using a piece of the tissue paper it was wrapped in, or wearing rubber gloves.



## + Seating the Objective lens

Note that the objective lens (the lens in the front of the telescope) is actually two lenses cemented together. One lens is thinner, and the other is thicker. Insert the objective lens into the groove at the front (wide) end of the telescope main tube half so that the thinner lens points forward, out of the telescope, as shown above.



**+ Make sure you have the included  $\frac{1}{4}$ -20 tripod nut**

The Galileoscope will not work very effectively without a tripod. It's very important to make sure that the tripod nut is seated properly.



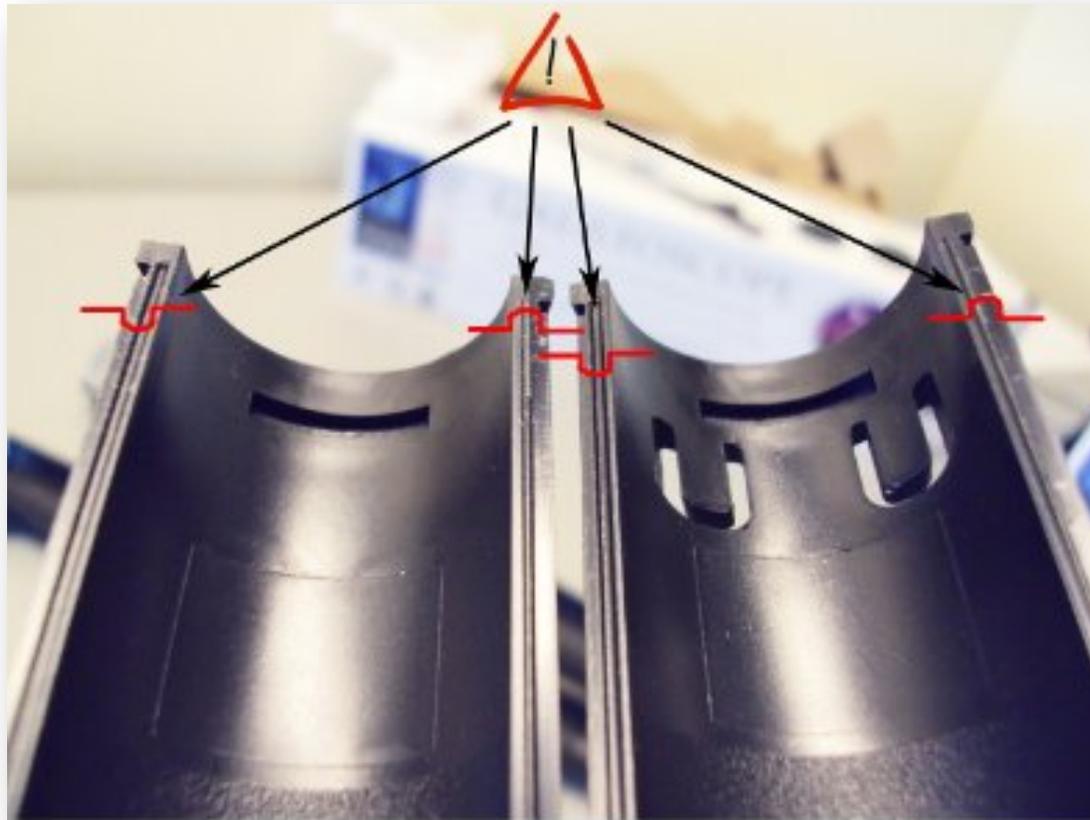
+ How to seat the  $\frac{1}{4}$  tripod nut correctly

Insert the  $\frac{1}{4}$ -20 tripod nut into the slot in the middle of the telescope main tube half. To seat the nut securely, make sure it is oriented as shown above, with one of its “points” (not one of its flat sides) facing up.



## Assembling the Focuser tubes

Lay the two focuser tube halves on the table, oriented with their interiors facing up. Note that one end of each tube is rough on the inside, and the other end is smooth. (On one tube half, the smooth end has two “U” shaped cutouts. Lay the tube halves so that the two smooth ends match and the two rough ends match (see next slide for a side by side comparison).



## Joining the focuser tubes

Again, note the “U” shaped cut outs as well as the smooth/rough areas are lined up. Additionally, there are interlocking areas on the edges of the focuser tube halves.



## Combining focuser tube halves

Join the two focuser tube halves and hold them together with your hands



Focus tube halves have now been joined.



## Clamp ring

Slide the small main-tube clamp ring onto the focuser tube, with the wider end of the ring facing away from the end of the tube with the two U-shaped cutouts.



+

Secure the focuser tube  
with small “O” rings

Secure the two ends of the focuser tube with the two ***small*** rubber O-rings, which fit in grooves around each end of the focuser tube as shown in the next two slides.



Small “O” ring placement on focuser tube - image 1



+

First small “O” ring successfully installed at one end of the focuser tube



## Small “O” ring placement on focuser tube - image 2

The small “O” ring should fit snugly in the groove of each end of the focuser tube.



+

Second small “O” ring successfully installed  
at the viewing end of the focuser tube



## Joining the focuser tube to the main telescope tube

As shown in the photo below, make sure that the end of the focuser tube with the two U-shaped cutouts is protruding out the back (narrow) end of the telescope main tube, along with the main-tube clamp ring, and that the other end of the focuser tube lies between the two baffles closest to the narrow end of the main telescope tube.



## Focuser tube placement con't.

Be sure that the other end of the focuser tube lies between the two baffles closest to the narrow end of the main telescope tube.



**+ Double check your Galileoscope assembly**

Your Galileoscope should now look like this (The telescope is not completed yet however).



+ Telescope body assembly

Place the second half of the main tube over the first half (the one already on the table or in the V-blocks/stands). Make sure the objective lens and  $\frac{1}{4}$ -20 tripod nut fit securely into their slots in the top half of the tube.



+

## Tripod mount

If the telescope doesn't feel or look "correct" (i.e. not fitting together tightly), inspect the telescope body, making sure that the tripod nut is properly seated.



## Properly seated tripod nut

This is what a properly seated tripod mounting bolt should look like once the telescope tube halves are joined.



**+ Securing the telescope  
body together**

Secure the two halves of the body together by sliding the small main-focusing tube clamp ring onto the back of the telescope body.

*Continued on next slide.*



+

## Securing the front of the telescope with the dew shield

The large lens shade/dew cap is shown being inserted onto the front of the telescope.



+

Your Galileoscope should now look like this.



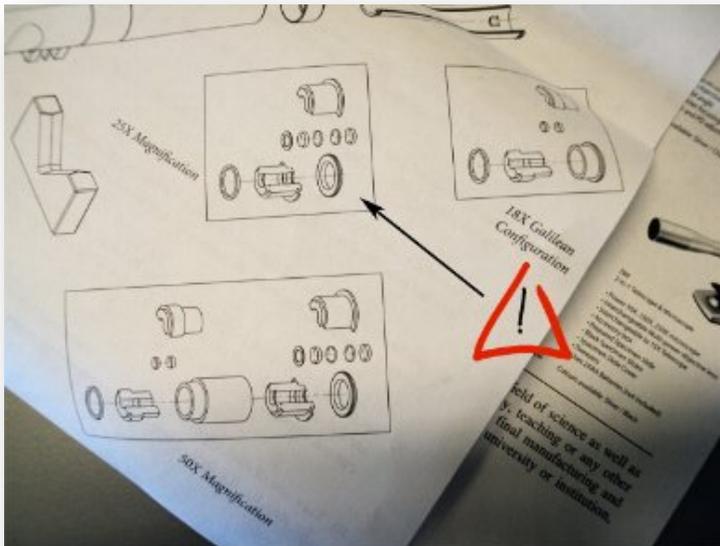
+

Optional large “O” rings are supplied for additional securing of the telescope halves.

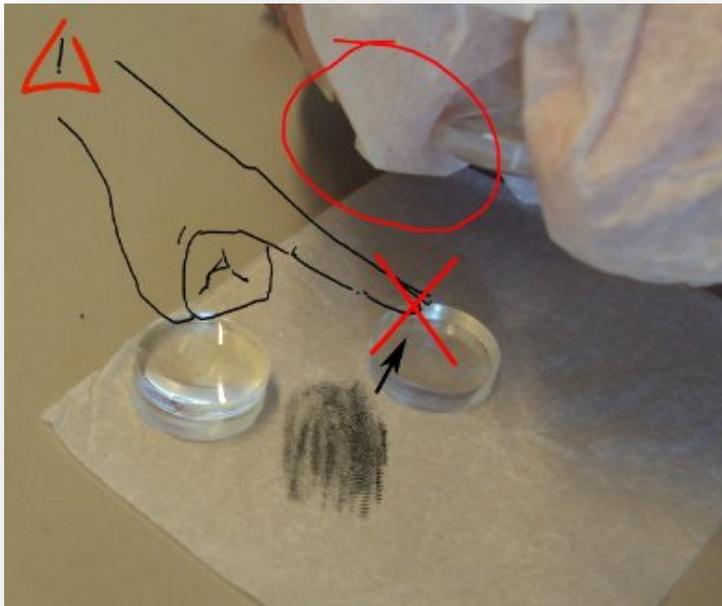


## Large “O” ring placement (optional)

Place the two large O-rings around the telescope main tube, in the channels provided for this purpose (indicated by arrows in the photo above). These will hold your Galileoscope together more securely. ***If*** you decide to do this, remove the lens shade/dew cap first, then replace it, and be careful not to tear the O-rings when stretching them over the two sighting posts on the top of the tube.



+ Assembling the 25X eye piece

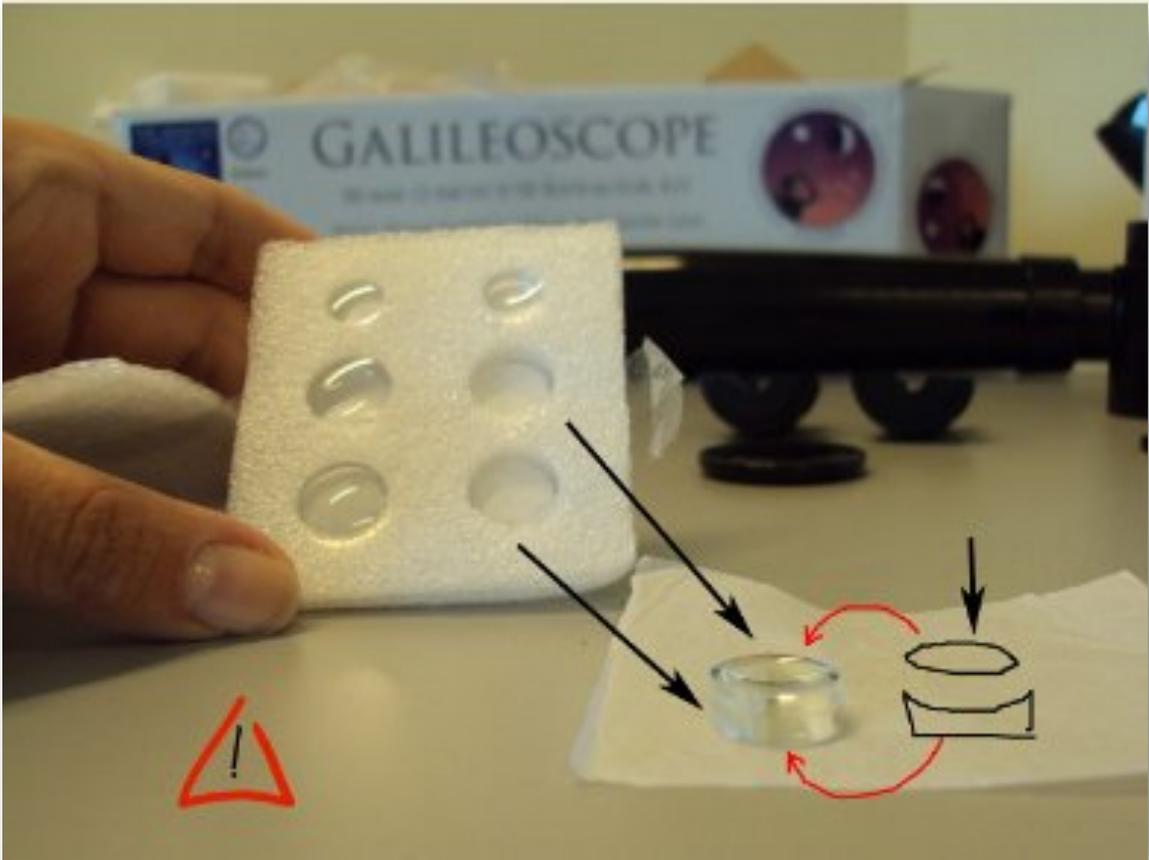


## + Use caution when handling the lenses!

Be sure to use the supplied tissue paper, or rubber gloves while handling the lenses. Oil, dirt/dust, etc can adversely affect the performance of your Galileoscope!



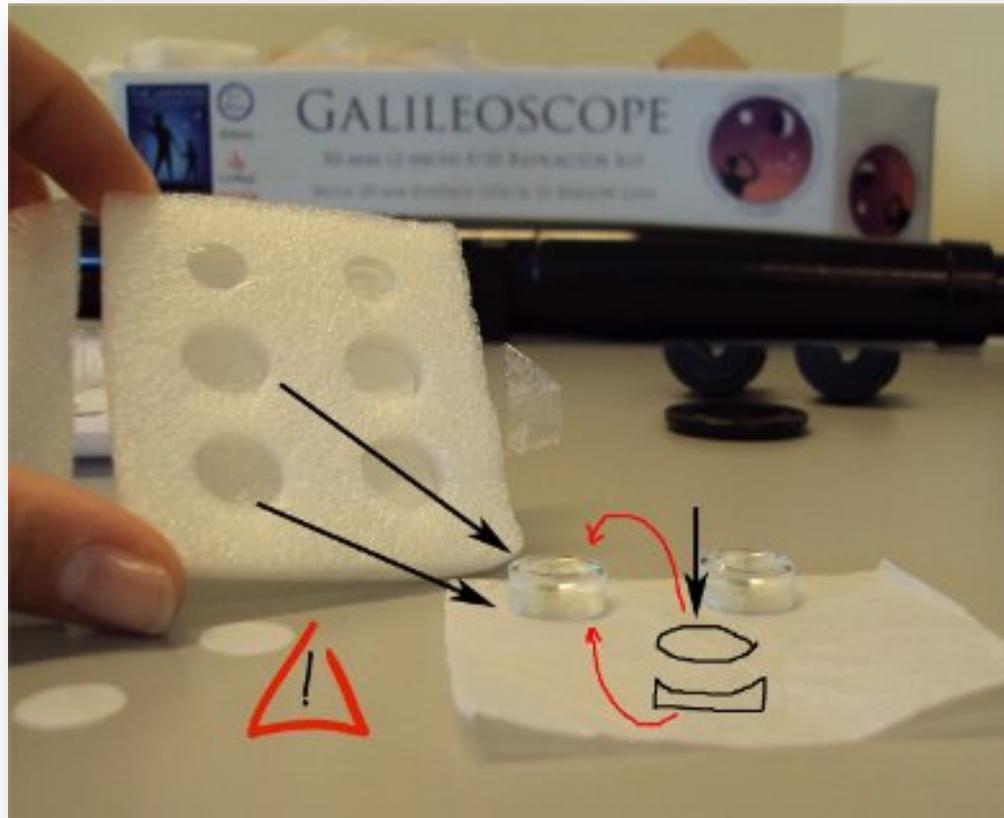
Both convex lenses are on the middle row



Both concave lenses are on the bottom row

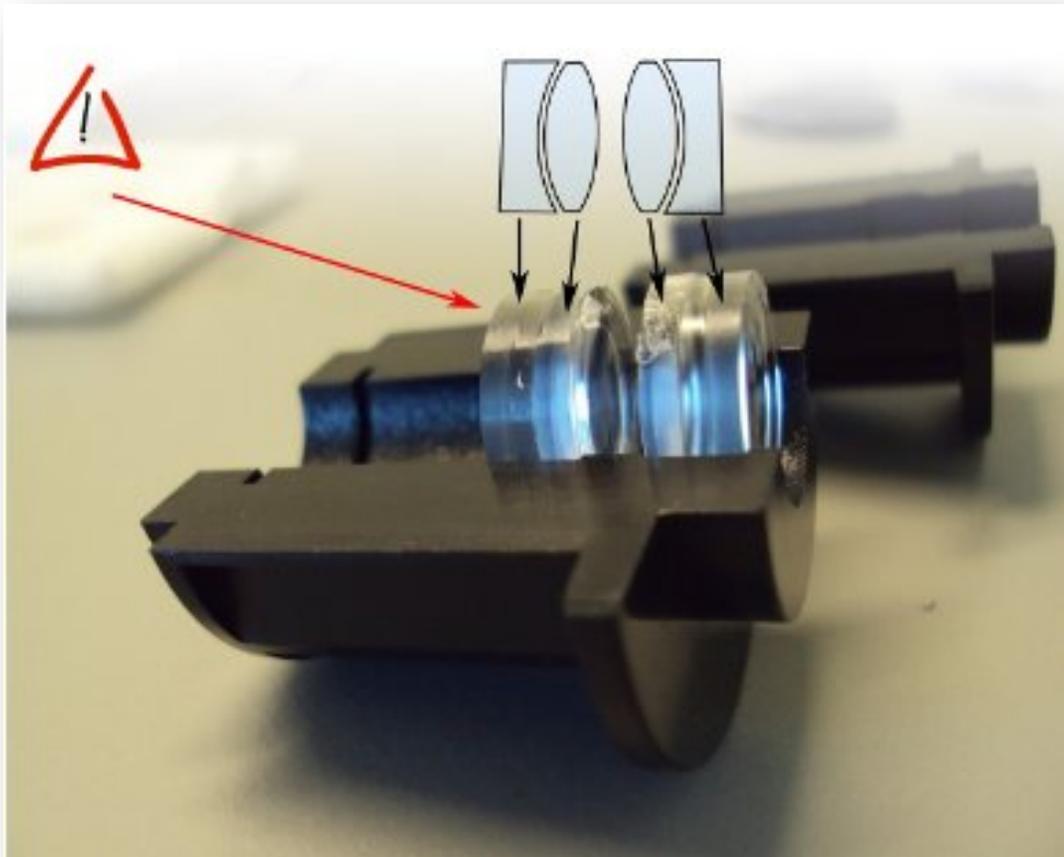
### Lenses for the 25X eye pieces

Examine the four main eyepiece lenses which are about 14 mm (a little over a half inch) in diameter. As before, it is best to handle the lenses with the supplied tissue paper, or rubber gloves touching only their edges, to avoid fingerprints. Two of the lenses are flat on one side and concave (curved inward on one side). The other two lenses are convex (curved outward on both sides). Take one of each type of lens and place them together as shown above.



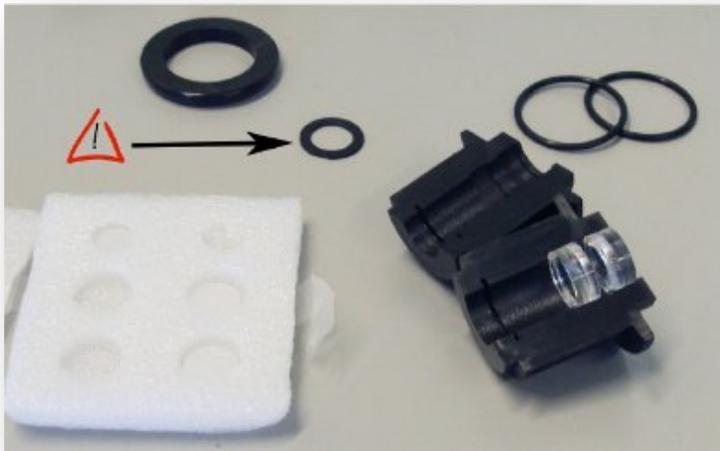
## Make a second set of lenses for the 25X eyepieces

Repeat with the other two main eyepiece lenses. As before, the concave (curved inward on the one side) lens is located on the bottom row, the convex lens (curved outward on both sides) is located in the middle row of the Styrofoam lens holder.



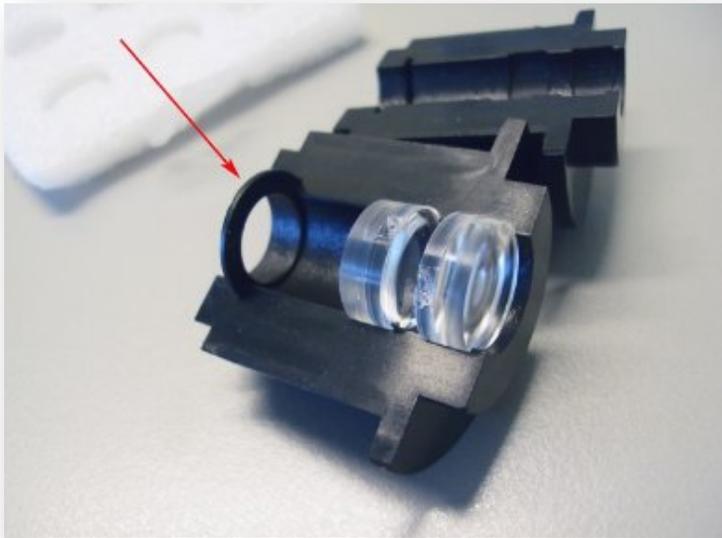
## Main eyepiece barrel assembly

Take one half of the main eyepiece barrel, & Insert the two eyepiece lens pairs into the appropriately sized slots of the barrel. Be sure the flat sides of the lens pairs point away from each other (that is, both sets of lenses point toward the ends of the eyepiece barrel)



## + Eyepiece ring/field stop

Insert the tiny, thin eyepiece ring/field stop into the thin slot in the main eyepiece barrel half.



+ Eyepiece ring/field stop completion

You should now have something that looks like the photo above.



+ Joining the eyepiece  
barrels

Join the second half of the main eyepiece barrel with the first half (the one you just assembled), taking care that the lenses and fieldstop ring fit into the appropriate slots on the second half as you bring the halves together.



+ **Visually examine the 25X  
lens barrel**

The 25X lens barrel should look like the  
above photograph.



+ Attaching the eyepiece  
clamp ring

Secure the two halves with the large main eyepiece clamp ring,  
which goes on the end closest to the lenses.



+ Upper 25X eyepiece ring assembly complete

Note the positioning of the large main 25X eyepiece clamp ring.



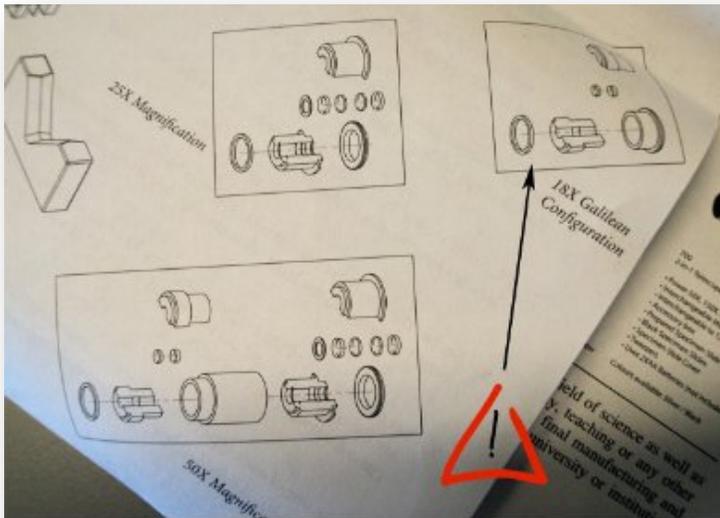
+ Small 25X eyepiece clamp ring

Secure the lower 25X eyepiece barrel assembly with the small eyepiece clamp ring at the opposite end of the eyepiece barrel assembly.



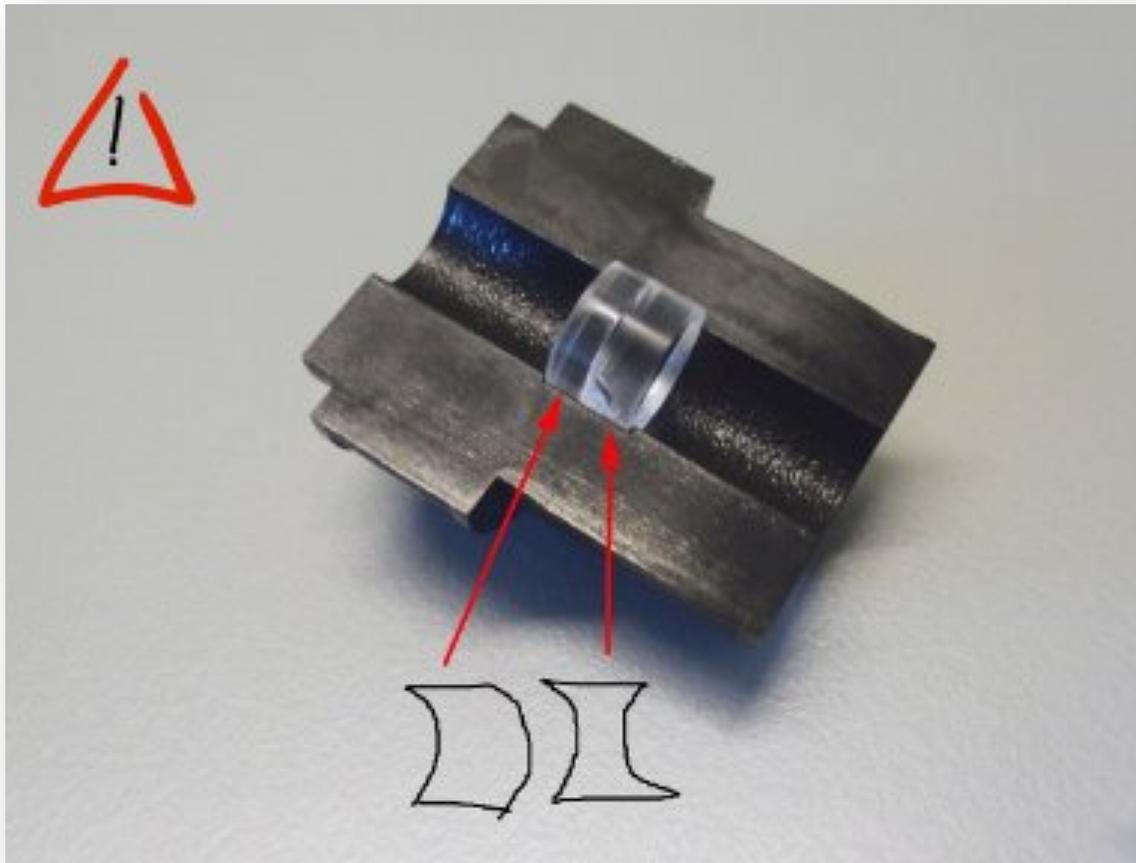
## + Completed

Insert the eyepiece fully into the end of the focuser tube with the lenses facing outward. The Upper eyepiece ring assembly (the larger one) will prevent the eyepiece from going too far into the focuser tube.



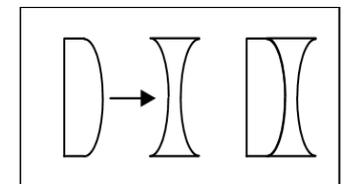
## + 18X lens assembly

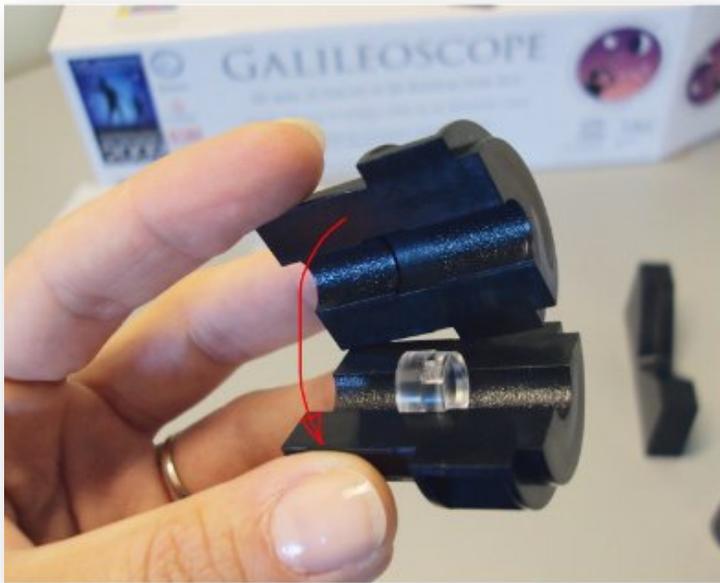
The 18X lens can also be used as a single lens in place of the 25X lens. Simply replace the 25X eye piece with the (fully) assembled 18X eye piece.



## Assembling the 18x lens components

The other lens has one flat side and one convex (curved outward) side. Place them together as shown in the above illustration (or the illustration on the right). Place the lens pair into the slot in one half of the auxiliary eyepiece barrel, which is narrower and has a smaller central opening than the main eyepiece barrel. Be sure the lens that is thin in the middle faces the narrow/bottom of the barrel, as shown above. Again, do not touch the lenses with your fingers; use tissue paper or rubber gloves!





+ Joining the auxiliary 18X  
eyepiece barrels

The first component to be assembled for the Barlow lens is the 18X eyepiece. Join the second half of the auxiliary 18X eyepiece barrel to the first half, taking care that the lenses fit into the slot on the second half as you bring the two halves together..



+ **Securing the auxiliary  
eyepiece barrel**

Secure the wide/top end of the barrel with the second *small* eyepiece clamp ring; you used the first such ring when you assembled the upper eyepiece ring assembly for the regular/normal eyepiece.



+

Completed auxiliary 18X  
eye piece barrel

The completed auxiliary eyepiece barrel should look like the above photograph.



+

## To complete the 18X eyepiece

Insert the auxiliary eyepiece barrel into the auxiliary eyepiece cap. You may have to use gentle pressure. The two pieces will “snap” together. Be sure not to force the two components together!



**+ Completed 18X eyepiece  
barrel assembly**

This eyepiece can be used as an alternative eyepiece to the 25X eye piece you previously assembled as well as being a part of the Barlow lens assembly.



+ Alternative configurations

Either of these eye pieces can be used in your Galileoscope. Additionally, we can combine both eye pieces to increase viewing magnification. Note, increased magnification doesn't always make for a better viewing experience.

# Stations



In groups (We will assign), 20 minutes per station

3 stations:

✦ Dark Side of the Moon (Matt Benjamin to lead)  
in the hallway

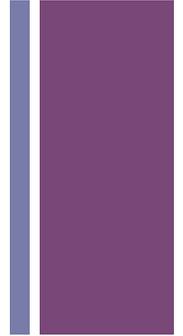
+

✦ Predicting Moon Phases (Erin Wood to lead) in  
this room

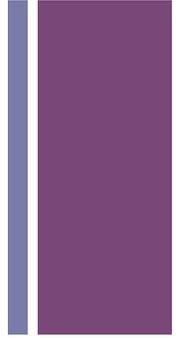
✦ Modeling Moon Phases (Alex Thom to lead) in  
A201 around the corner

+ At each station

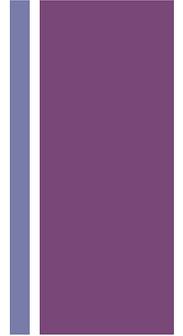
*You will find a sign with questions to consider! Write down the processes you used to come to your conclusions.*



+ Time to share processes!

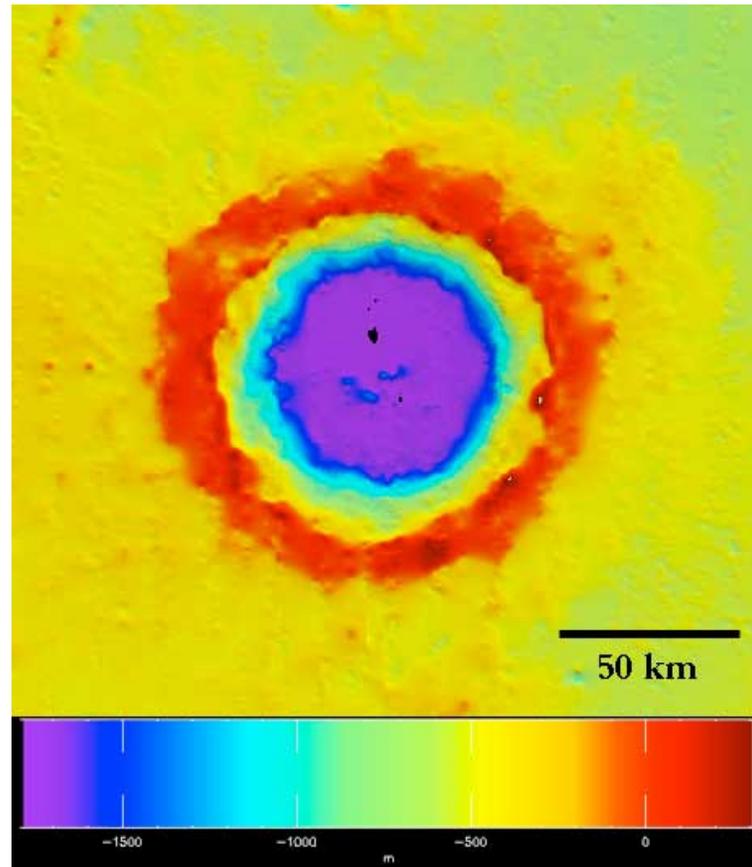
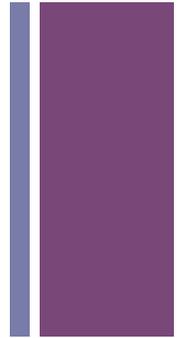


# + Seeing the Invisible

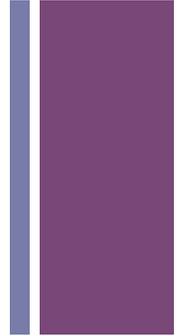


- Remote sensing is a way of gathering information about an object remotely
- Uses the electromagnetic spectrum
- Two types: Active and passive
  - Active: sending a “pulse” that hits an object and “observing” what is reflected/absorbed/or transmitted back. Example: Radar/Lidar
  - Passive: observations of specific wavelengths an object either emits or absorbs (or reflects). Typically the origin of the light is the Sun (but not always, like in the case of residual heat from radioactivity). Example: Cameras and Spectrographs
- Often involves objects or properties of objects we cannot see with our eyes

- + Copernicus crater observed by the Lunar Orbiter Laser Altimeter (LOLA) onboard the Lunar Reconnaissance Orbiter (LRO)

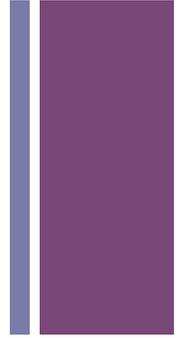


# + What you will do



- Grab a box and skewer
- Do not open the box
- Explore the box with the tools provided
- Think about the processes you are using in your exploration
- Draw what you think is in the box
- You will have time to revise your drawing

# + Think-Pair-Share

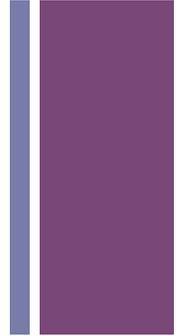


Rules:

- ☑ Think and write (1 minute)
- ☑ Discuss with a partner (3 minutes)
- ☑ Share with the group

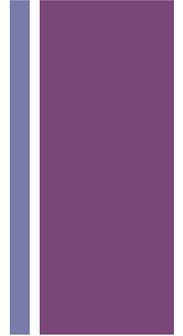
*I used to think.... But now I  
know.....*

# + Astronomical Events



- Look for a total Lunar eclipse just before dawn on December 10<sup>th</sup>
- Asteroid 2005 YU55 will pass within 324,000 km of Earth (closer than the orbit of the moon) and be visible through a telescope on November 8<sup>th</sup> and 10<sup>th</sup>. I would not advise trying to see it with the small scopes (it will pass through the constellation Pegasus), but it may be a good opportunity to discuss with students how far away it actually is from Earth.

# + Slides and Materials



- Visit:

<http://lasp.colorado.edu/home/education/workshops/GEN>