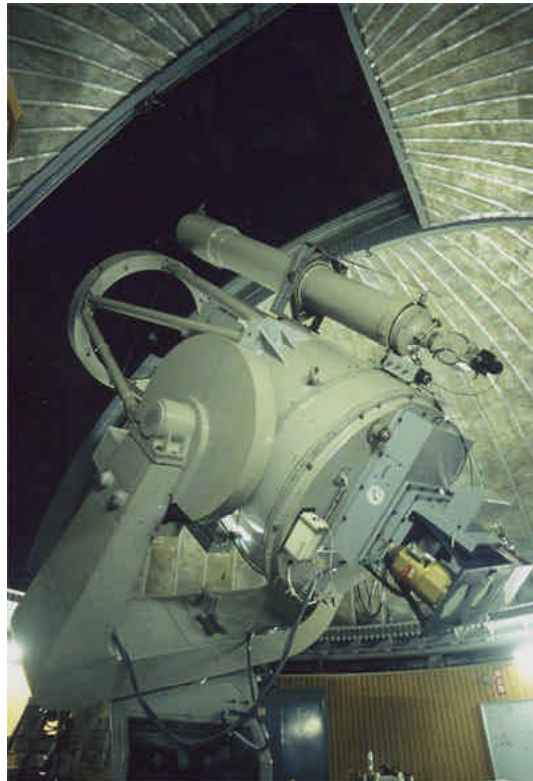


Story Behind the Birth of 91-cm Reflector Telescope

The 91-cm Reflector Telescope, the first large-aperture telescope manufactured in Japan, was produced by Nippon Kogaku K.K. (now Nikon Corporation). Since the telescope has an equatorial fork mount and is designed to use the Cassegrain focus exclusively, the entire structure is compact. While the 188-cm Reflector Telescope is used primarily for researching stars through spectroscopic observations, the main purpose of the 91-cm reflector telescope is photometric research through photoelectric photometry observations; thus, these two telescopes complement one another.

Photoelectric photometry, which became popular in the 1950s, was frequently used for variable star observations and stellar color measurements due to its high photometric accuracy. Because of this, photoelectric photometry instruments gradually came to dominant the observing time on existing telescopes in many countries. This created momentum to establish dedicated telescopes for photoelectric photometry instruments in order to secure observing time.



As a result, 91-cm telescopes were built in Europe and the United States. Following suit, Japan also considered introducing a 91-cm equatorial reflector telescope for photoelectric photometry. But at that time, Japan had already ordered a 188-cm telescope from a foreign manufacturer, and purchasing another from overseas was not considered viable. Through the efforts of the Director General of Tokyo Astronomical Observatory and others who felt that it should be possible to produce this level of telescope domestically, it was established that Nippon Kougaku could make such a telescope. What's more Nippon Kougaku agreed to produce the telescope at cost.

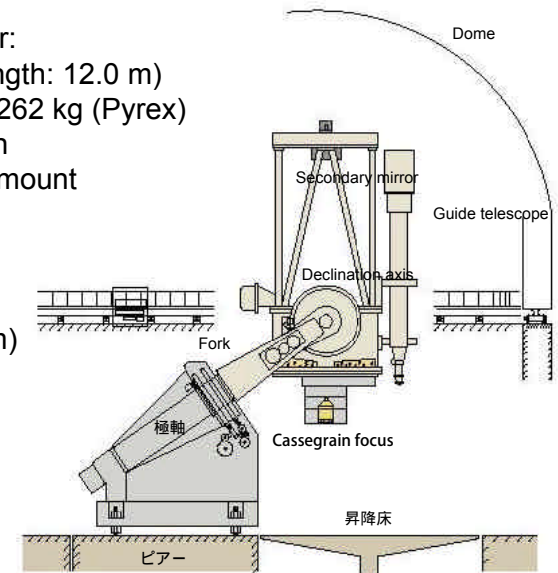
Today, the 91-cm Reflector Telescope has been reconfigured into a wide-field near-infrared camera and continues to be used for observations. With this story in mind, try your hand at crafting a paper model of the first Japan-made large-aperture telescope. It's a great way to learn about telescope structure.

The 91-cm Reflector Telescope's main specifications

- Primary mirror diameter:
91 cm (focal length: 12.0 m)
- Primary mirror weight: 262 kg (Pyrex)
- Focus type: Cassegrain
- Mount: Equatorial fork mount
- Weight: 6 tons

Guide Telescope

- Aperture: 20 cm
(focal length: 250 cm)
- Field of vision: $1^{\circ} 7'$



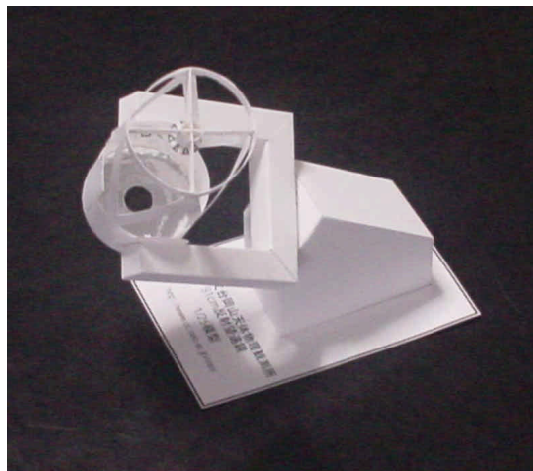
Designed by Seichi Sakamoto (NAOJ)

91-cm Reflector Telescope Paper Model Construction Project for a Child with Adult Assistance, Expert Course (crafting instructions)

Tools and materials: box cutter, ruler, aluminum tape, glue (wood glue works well)

1. Preparation: Copy the two paper model cutout sheets onto Kent paper or similar thick paper. Next, paste aluminum tape on the reverse side of the primary and secondary mirrors. After that, cut out all 23 model parts by cutting along the bold lines on the model sheets. Next, make incisions and cut out the holes indicated by an “x” by cutting along the bold lines. Mountain-fold along the dot-dash lines, and valley-fold along the dashed lines. Note that thin dotted lines indicate an overlap width for gluing parts together and should not be creased.

2. Assemble the primary mirror and telescope body tube: First assemble the telescope body tube, and attach the baffle to the hole in the center of the primary mirror. After that, attach the primary mirror to the primary mirror cell, and fix them to the bottom end of the body tube. Finally, attach the declination axis gears to the outside of the mirror tube's declination axis.



3. Assemble the secondary mirror: Assemble the top unit, and fix the secondary mirror to the tip of the unit. After that, assemble the spiders and attach the top unit to the intersection of the spiders.

4. Assemble the fork: First attach the polar axis (fork side) to the hole at the center of the fork, and then start working on the fork's prongs. Complete the assembly while taking care to make sure that the declination axis tabs are folded out to pass through the holes in the declination axis gears and the body tube.

After that, put the declination axis tabs through the declination axis holes on the body tube from outside and then spread them outward to temporarily fix them. Fold the declination axis tabs back down inside the body tube as needed to secure them to the declination axis. Note that the declination axis tabs should not be bonded to the body tube.

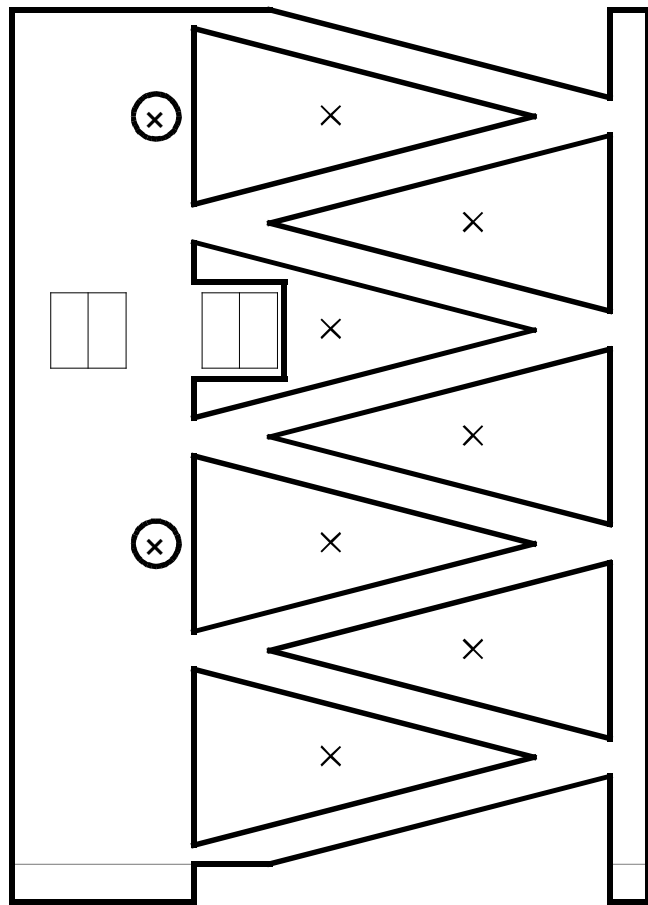
5. Assemble the mount: Adjust the diameter of the polar axis (mount side) so that the fork-side polar axis can slide snugly into it during assembly. Then fix the mount-side polar axis to the inside of the mount. Finally, fix those parts to the base.

6. Attach the secondary mirror: Attach the spiders to the inside of the body tube top ring at the support strut joints so that the spiders from a cross when seen from above.

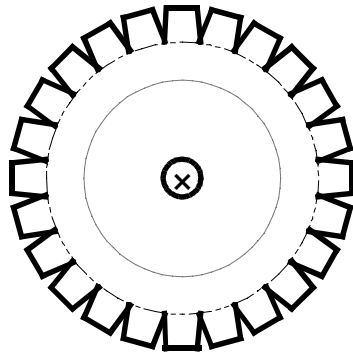
7. Assemble the guide telescope: Assemble the guide telescope, glue together the eyepiece, body tube (1), body tube (2), and body tube (3) in that order, and then use the attachment to fix them to the main telescope's body tube. Coloring: You can color you telescope any color you'd like. Refer to the NAOJ webpage for pictures of the actual telescope coloration.



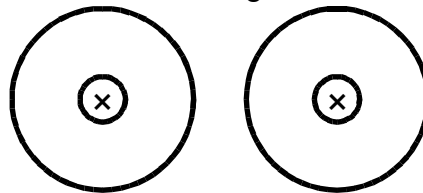
91-cm Reflector Telescope Paper Model Construction Project for a Child with Adult Assistance, Expert Course (1/2)



Primary mirror cell

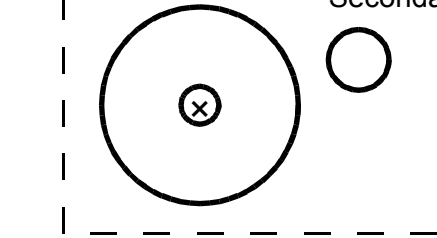


Declination axis gear



Primary mirror

Secondary mirror

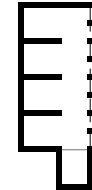


Stick aluminum tape on the back here

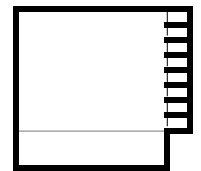
Polar axis (fork side)



Secondary mirror attachment



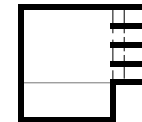
Baffle



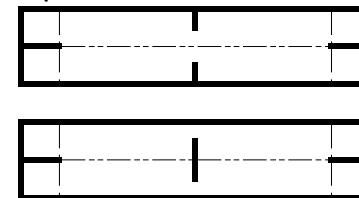
Polar axis (mount side)



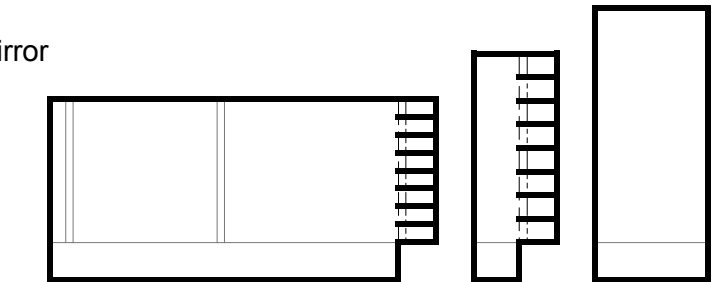
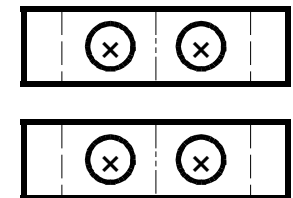
Guide telescope eyepiece



Spider



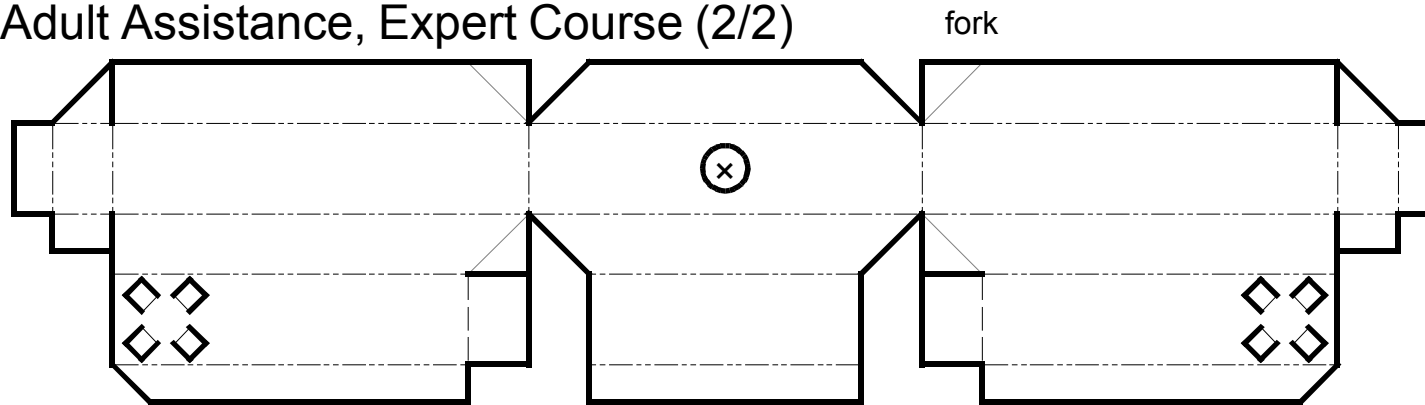
Guide telescope attachment



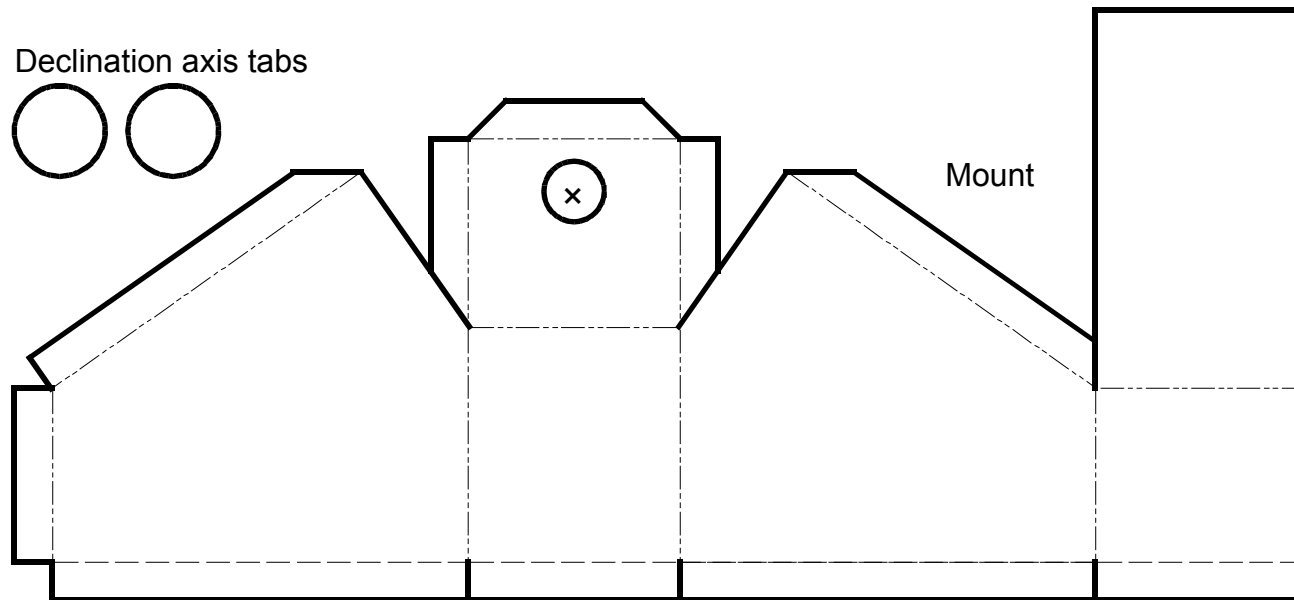
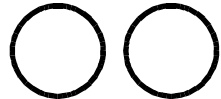
Guide telescope body tube (1) (2) (3)

91-cm Reflector Telescope Paper Model Construction Project for a Child with Adult Assistance, Expert Course (2/2)

2cm = 7m



Declination axis tabs



Base

