On Wednesday the 7th of January Steve, G7HEP and Chris G1VNA gave a Presentation and demonstration of the DWARF3 Smart telescope.

The presentation is split into two parts, Steve did a history of telescopes and explained details of Telescope History and Design.

Chris then went on to describe and demonstrate the DWARF3 Smart Telescope.

Various telescopes were on display to demonstrate the differences between types. We are very grateful to Janice, Chris G7WCF's XYL for bringing along her SeeStar S50 Smart telescope so that we could see a different type of Smart Telescope.

THE AMATEUR (ASTRONOMICAL) TELESCOPE

A (very!) abbreviated account of
HISTORY, CONSTRUCTION AND USE

G7HEP

Part of a comprehensive slideshow
originally produced for F&DARC
December 2014

Telescope, *n.* A device having a relation to the eye similar to that of the telephone to the ear, enabling distant objects to plague us with a multitude of needless details.....Ambrose Bierce

The Devil's Dictionary

Practical lenses and mirrors

- First practical lenses were convex
- Concave lenses were harder to produce, and probably were not available until the 15th C.
- All these lenses would be reckoned today as being of poor quality, having spherical and chromatic aberrations.
- Likewise the first practical curved mirrors produced in Venice at the same time using reflective amalgam coatings were not too good either...........

Improved quality

- As lenses and mirrors became more common, so their quality improved.....
- In 1570, Englishman Thomas Digges described a device made by his father by means of which it was said that letters on the inscriptions of coins could be read “from a distance”, and even see what was happening “in private places” from 7 miles away.........
- The military uses of the “Perspective Glass” were described by the late 16th C.

Telescope development

- 1608: Jan Lippershay, a Dutch spectacle maker applied for a patent for a telescope……and was denied.

- Almost a year later *Galileo* saw a telescope in Venice, and copied it when he got home. Magnification 3X

- Galileo later made instruments with lenses up to 1.75” diameter and 33X magnification

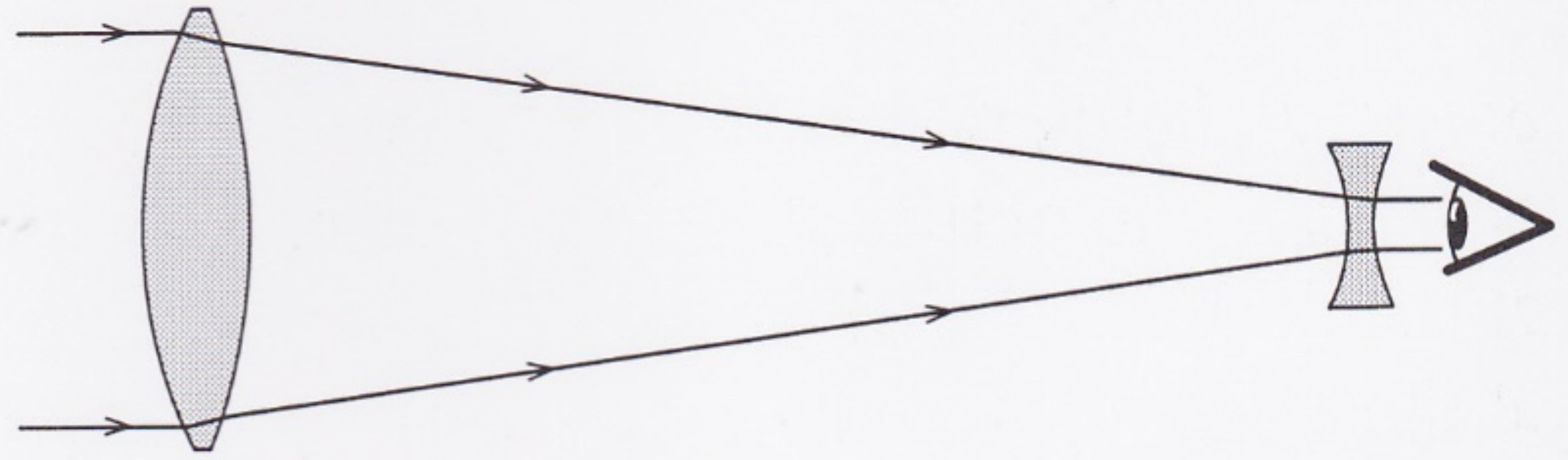
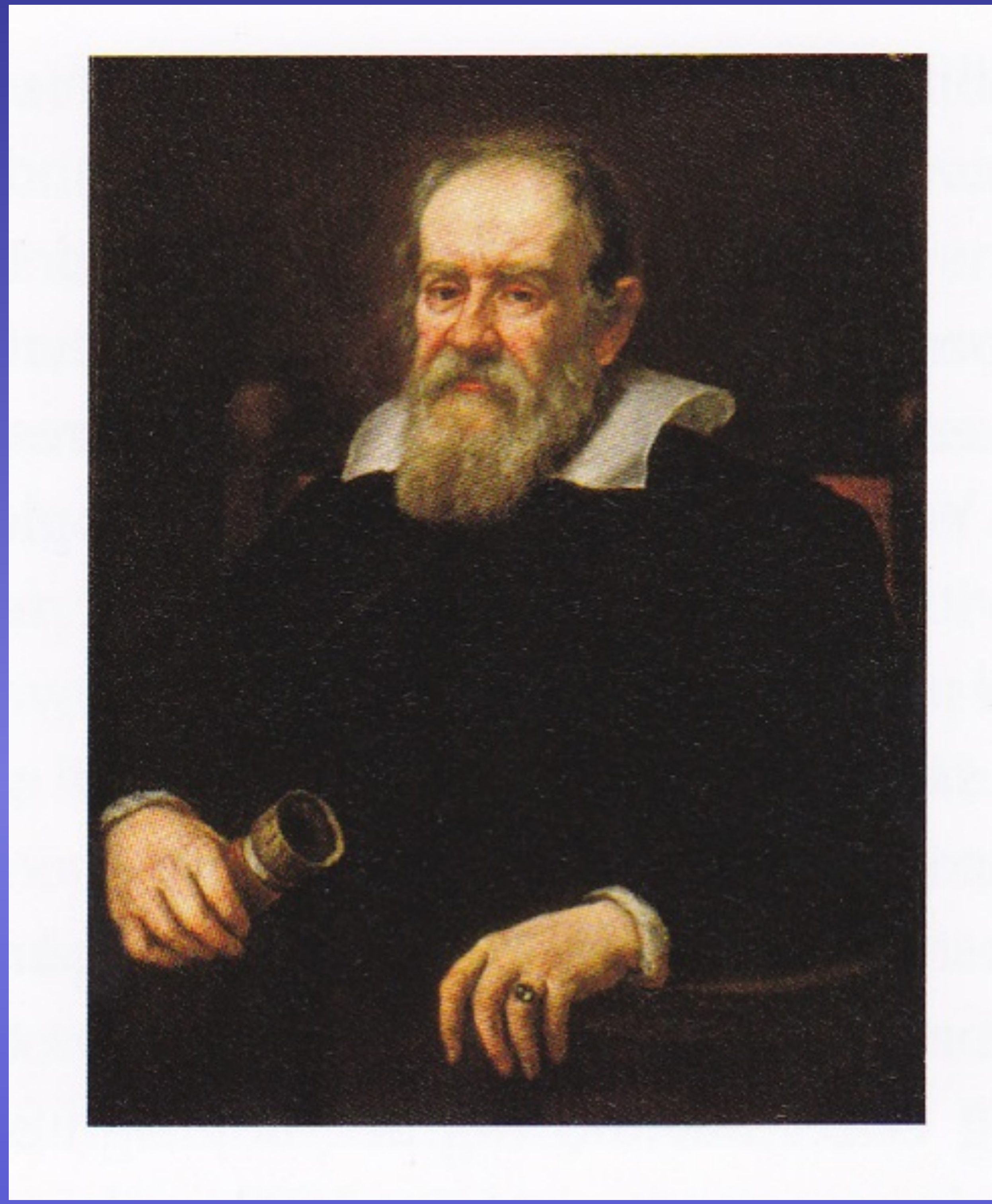


Figure 1: Galilean Telescope

Galileo – and his telescope



9 Galilean telescope, inscribed with the name of Jacob Cunigham,1661.

Galileo

- A keen observer and user of the instruments he made – and quick to realise its potential to make his fortune…..
- Saw that the moon was not smooth, but covered with craters and mountains.
- Saw that Venus waxed and waned through moon-like phases – could only be explained if Venus circled the Sun (rather than the Earth)
- Resolved the Milky Way into thousands of stars
- Saw and recorded 4 moons orbiting Jupiter
- Was baffled by Saturn, which appeared to have ear-like appendages, and which disappeared in later years

Keplerian Refractor

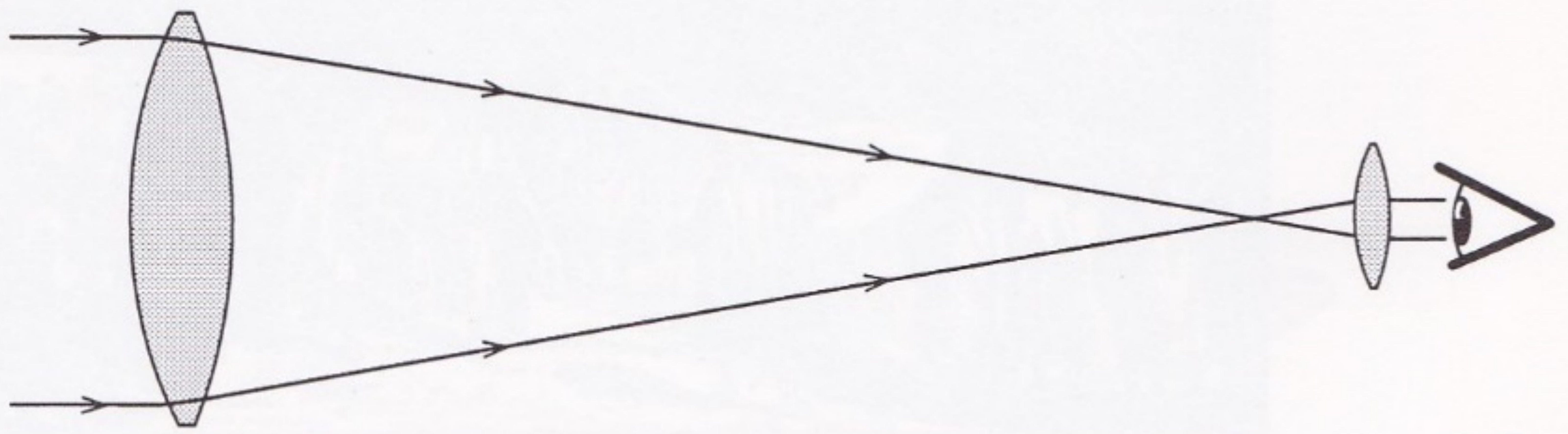
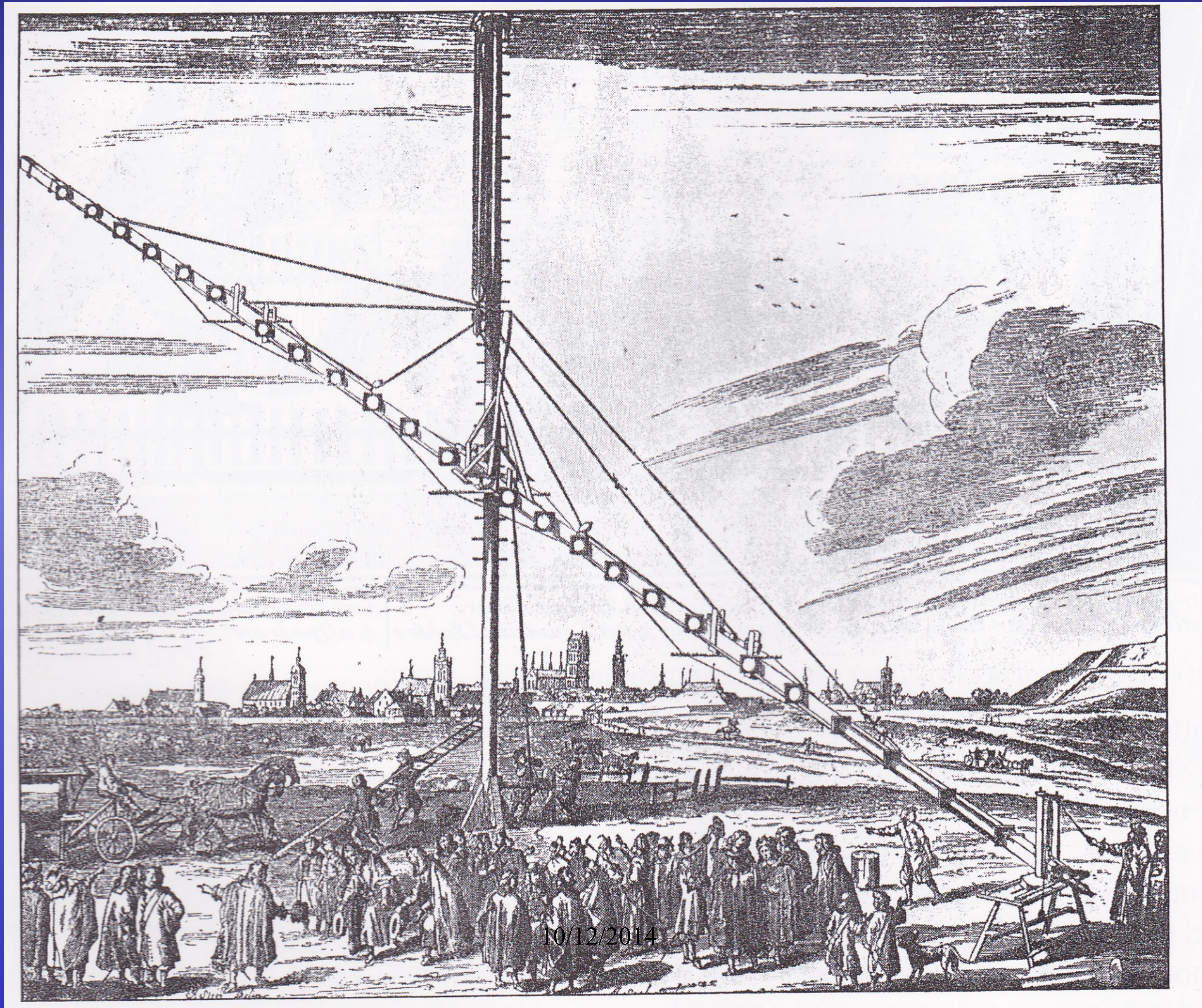


Figure 2: Keplerian Refractor

- Galileo's concave eyepiece gave his telescopes a very narrow field of view, and limited magnification
- Kepler's use of a convex eyepiece lens solved this problem but presented the viewer with an inverted image.

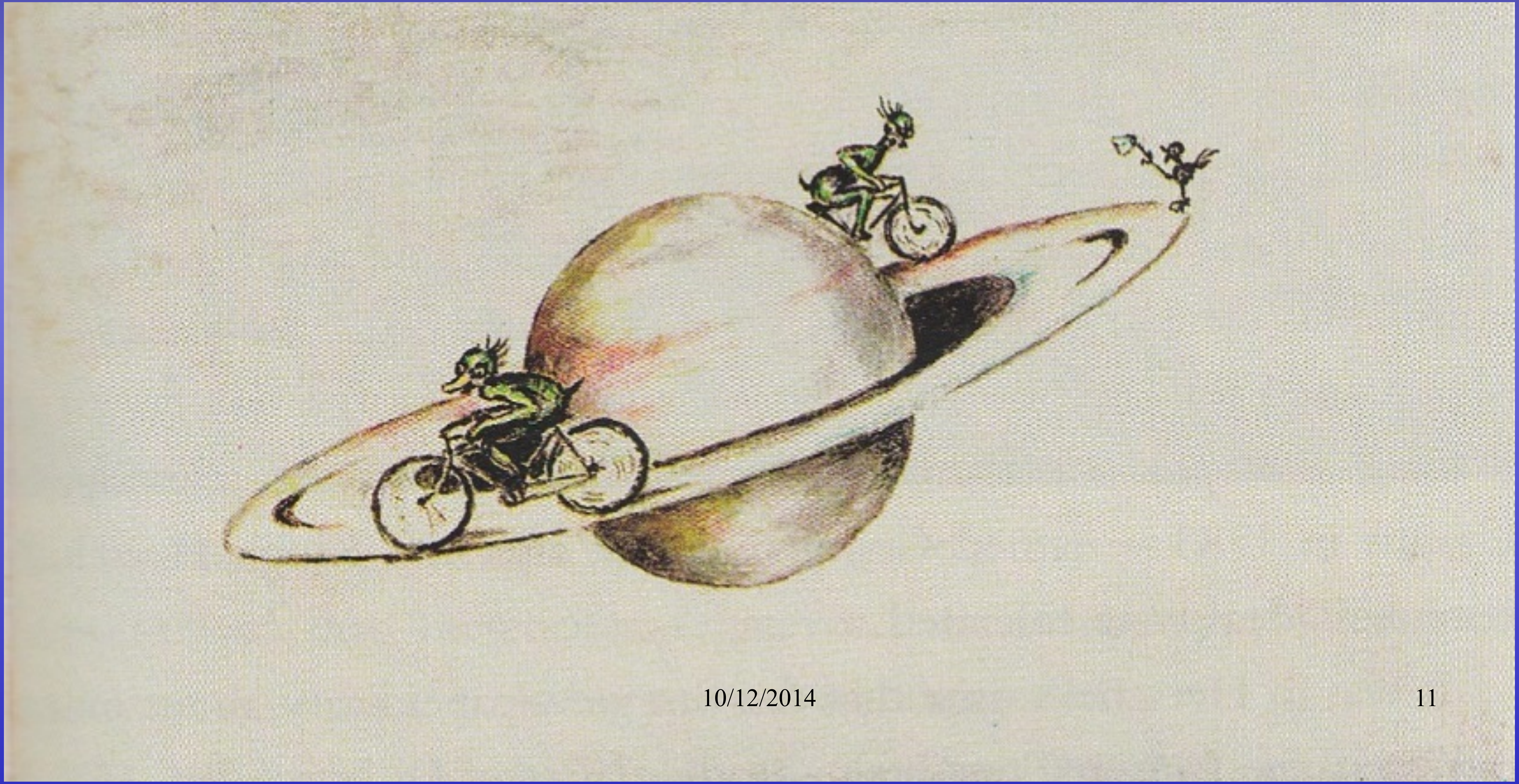
Hevelius' 150 foot telescope (1642)



Hevelius' 150 foot telescope being erected, circa 1642

Saturn’s rings resolved

- Christian Huygens was able to resolve the mystery of Saturn’s “ears” using a 23 foot refractor with a 2.3” objective.



In pursuit of the short length aberration-free telescope (1)

- James Gregory (1663) proposed using a concave (paraboloid) mirror, rather than a convex lens, as the telescope's objective.

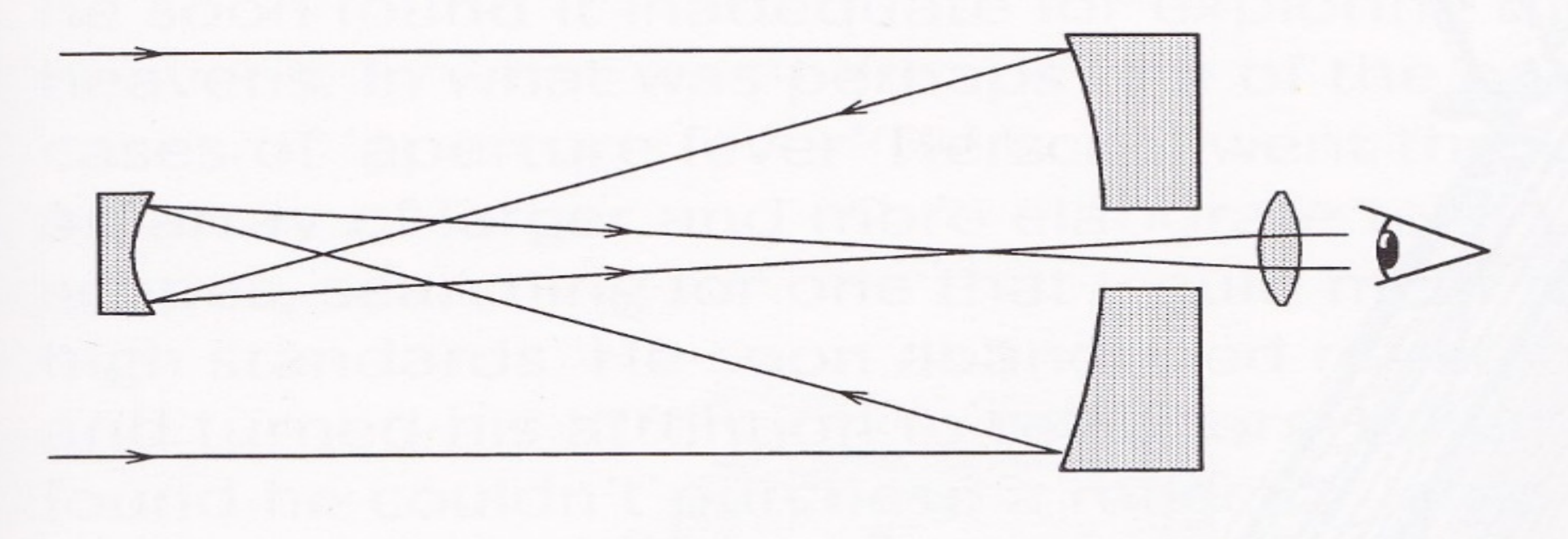


Figure 3: Gregorian Reflector

- Was not successfully made until 1674, by *Robert Hooke*
- Solved the spherical aberration problem

In pursuit of the short length aberration-free telescope (2)

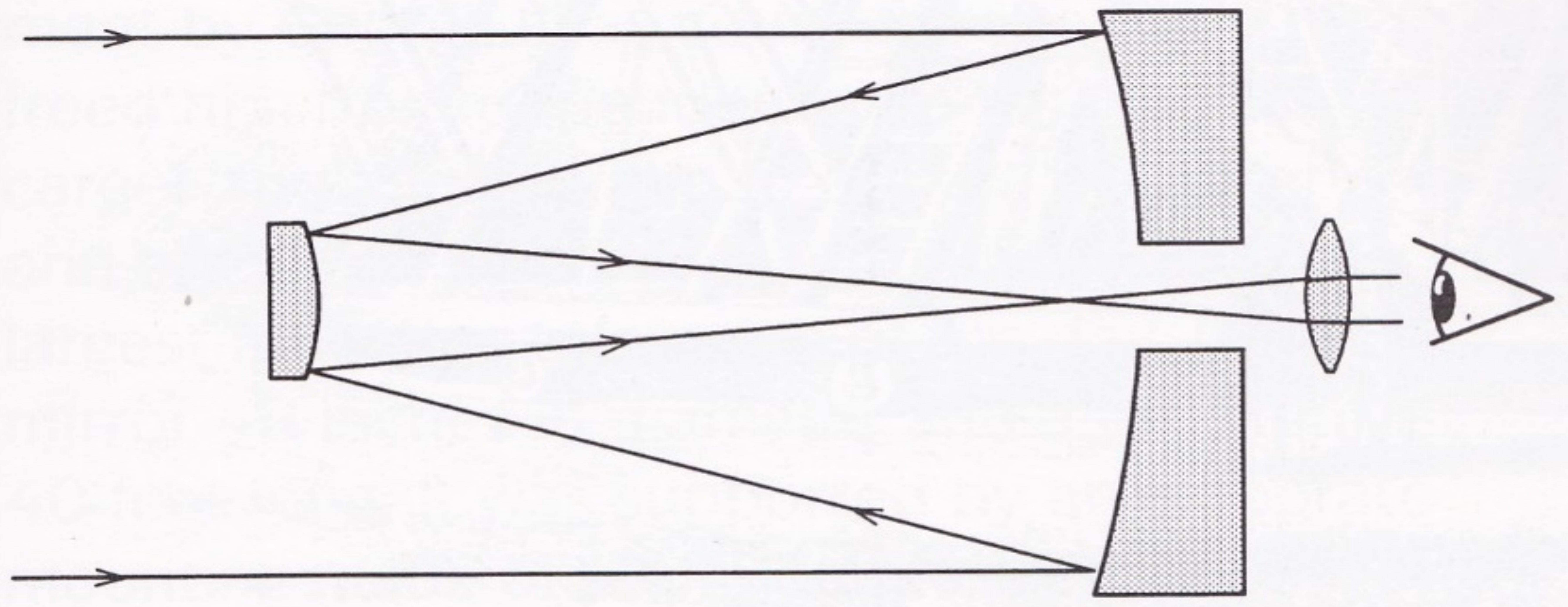


Figure 4: Cassegrain Reflector

- Proposed 1672 by Guillaume Cassegrain using a spherical primary and convex secondary mirror

In pursuit of the short length aberration-free telescope (3)

- The Newtonian Reflector (ca. 1675): a spherical primary mirror, and flat secondary mirror.
- Extremely simple, and the basis of all reflecting telescopes today

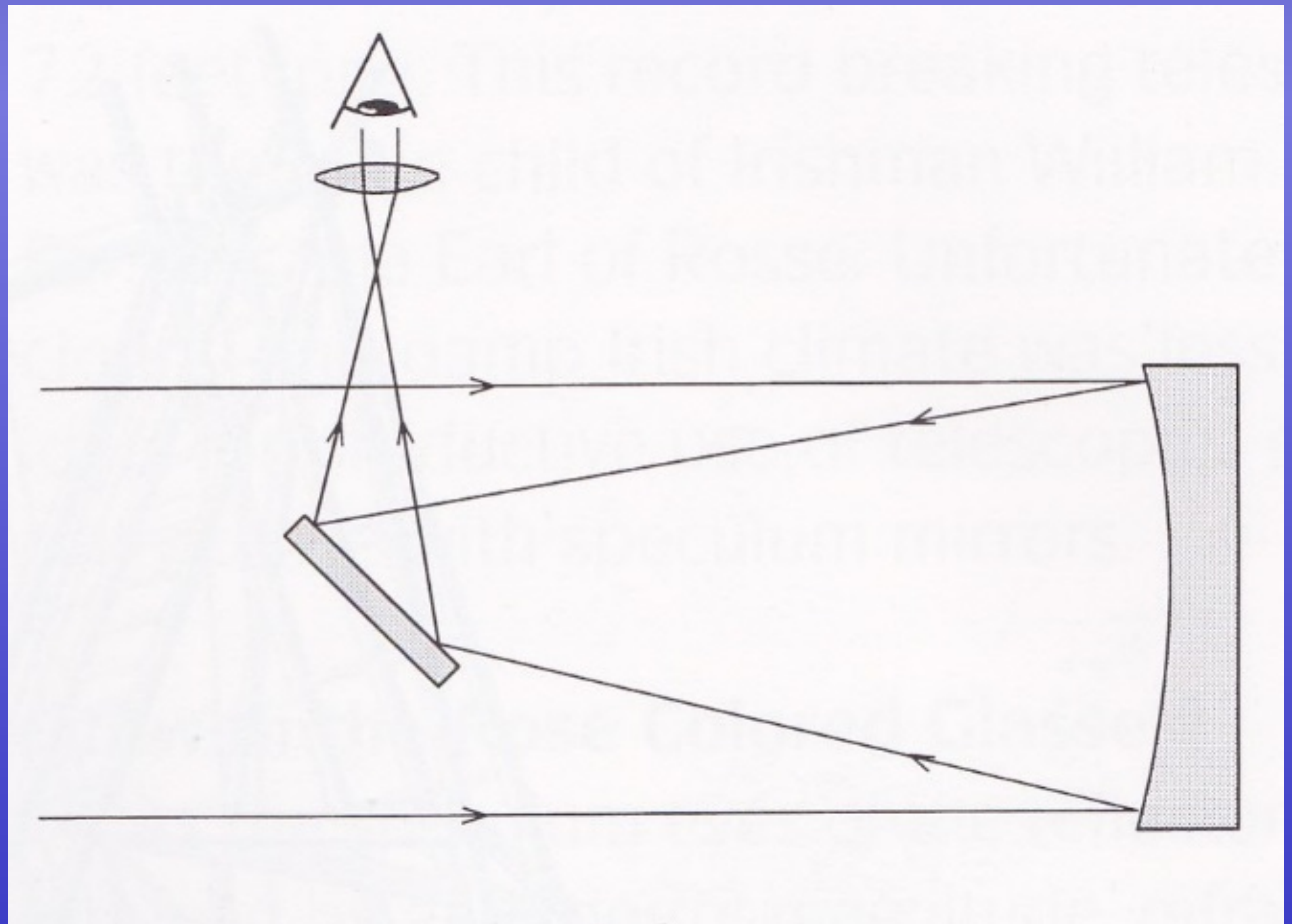
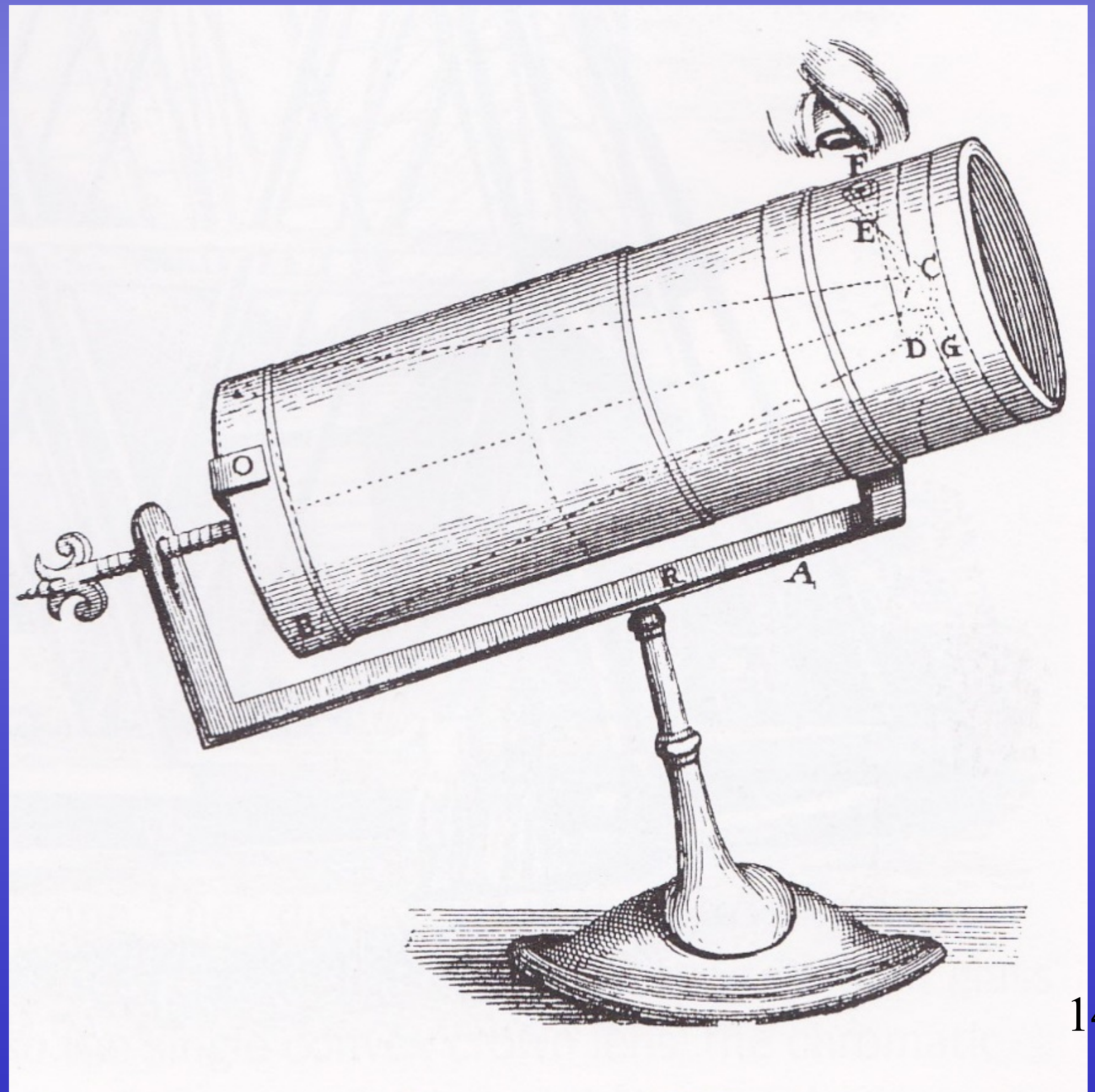


Figure 5: Newtonian Reflector

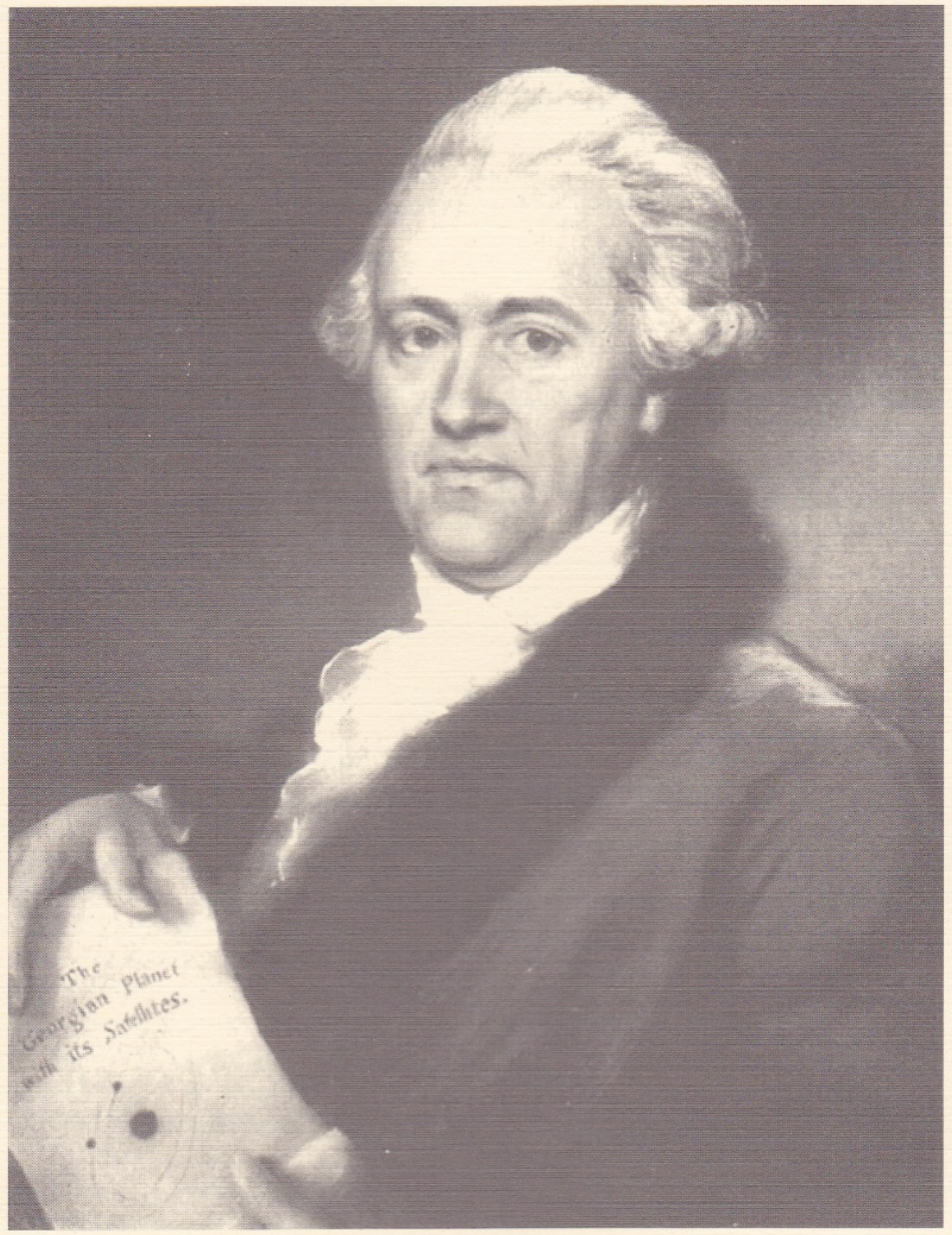


Model of Newton's reflector, circa 1675

William Herschel (1738-1822)

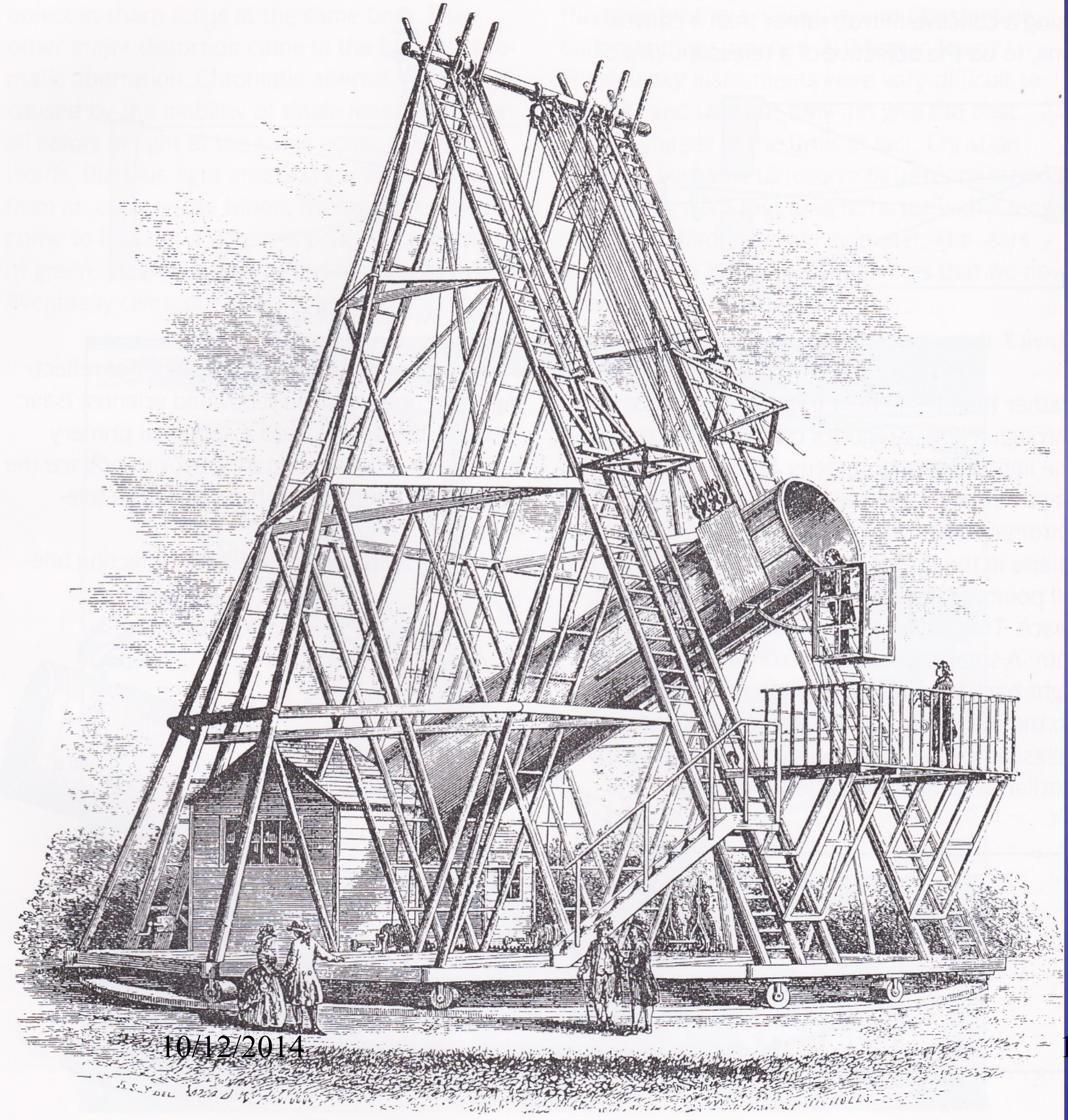
- Pioneer reflecting telescope developer, German immigrant, musician (organist of the Octagon Chapel, Bath, and Director of the Bath Orchestra).
- Began his Astronomical Journal in 1774, using a 6.2” aperture, 7 foot focal length Newtonian telescope containing a “most capital *speculum*” of his own manufacture. (New King St., Bath)
- First to confirm the existence of binary or double stars (1797)
- Discovered Uranus in 1781
- Built 20’ focal length 12” and 18.7” aperture telescopes, and used them to discover over 2,400 *nebulae.*
- Constructed more than 400 telescopes during his career

Herschel



"Sir William Herschel. A pastel portrait by J. Russell, 1794" from *William Herschel* by Angus Armitage. Thomas Nelson and Sons, Ltd., London. pg. 21, (plate courtesy of Yerkes Observatory).

40 foot telescope with 48" reflector >>



Herschel's 40-foot telescope with 48-inch reflector, 1789.

The Leviathan of Parsonstown

- The apex of development of speculum telescopes, built by Irishman William Parsons, Earl of Rosse in 1845
- Had a 6-ton mirror with a diameter of 6 feet
- Mounted between masonry walls 56 feet high and 72 feet long.
- Not a success in the Irish climate

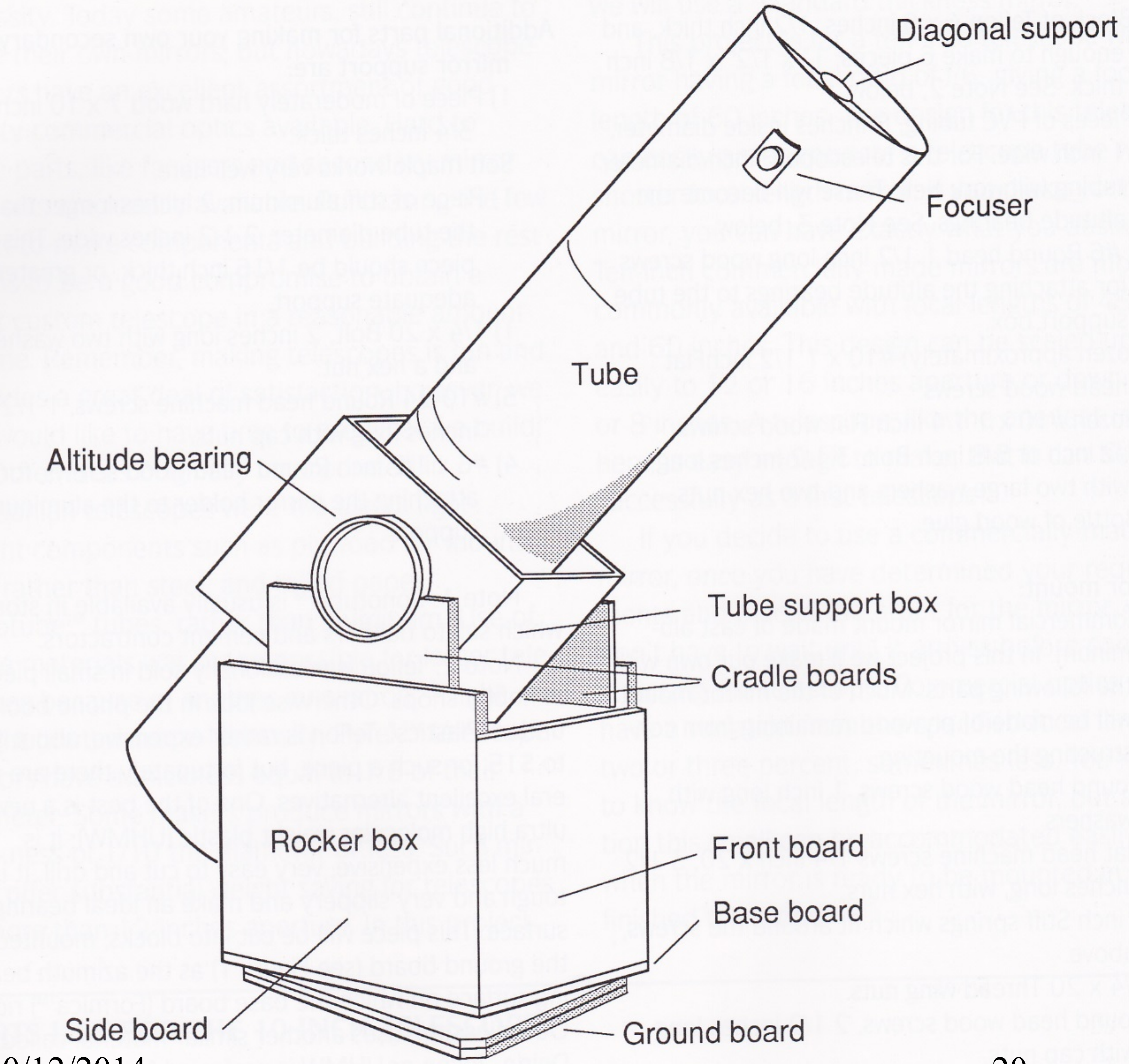
The Leviathan of Parsonstown

Amateur telescopes today

- Refractors still in use today. Some fine instruments in the range 3” to 8” but they are expensive. Optical alignment not required.
- Reflectors now use mirrors of low-expansion glass, and are justifiably popular, not only because they’re *outwardly simpler* than refractors, but tend to be lighter and are made with wider apertures.
- Commercial reflectors range from 3” to 12” or more. Amateur-built instruments up to 30” or so.
- Most high-end compact instruments are hybrid designs: Schmidt-Cassegrains and Maksutovs, commercially available from around 4” to 14”. These have the advantage that they do not require *optical alignment*.

Telescope Mounts (1)

- A telescope is not going to give its best performance unless it is rigidly mounted, yet at the same time be easily pointed to any part of the sky.
- Apart from a sturdy tripod, either an *Alt-azimuth* or an Equatorial Mount will be needed.
- The simplest mount is the Alt-azimuth, which allows the telescope to traverse through 360 degrees horizontally (*azimuth),* and be elevated from level to vertical (*altitude)*



The Dobsonian telescope

Telescope Mounts (2)

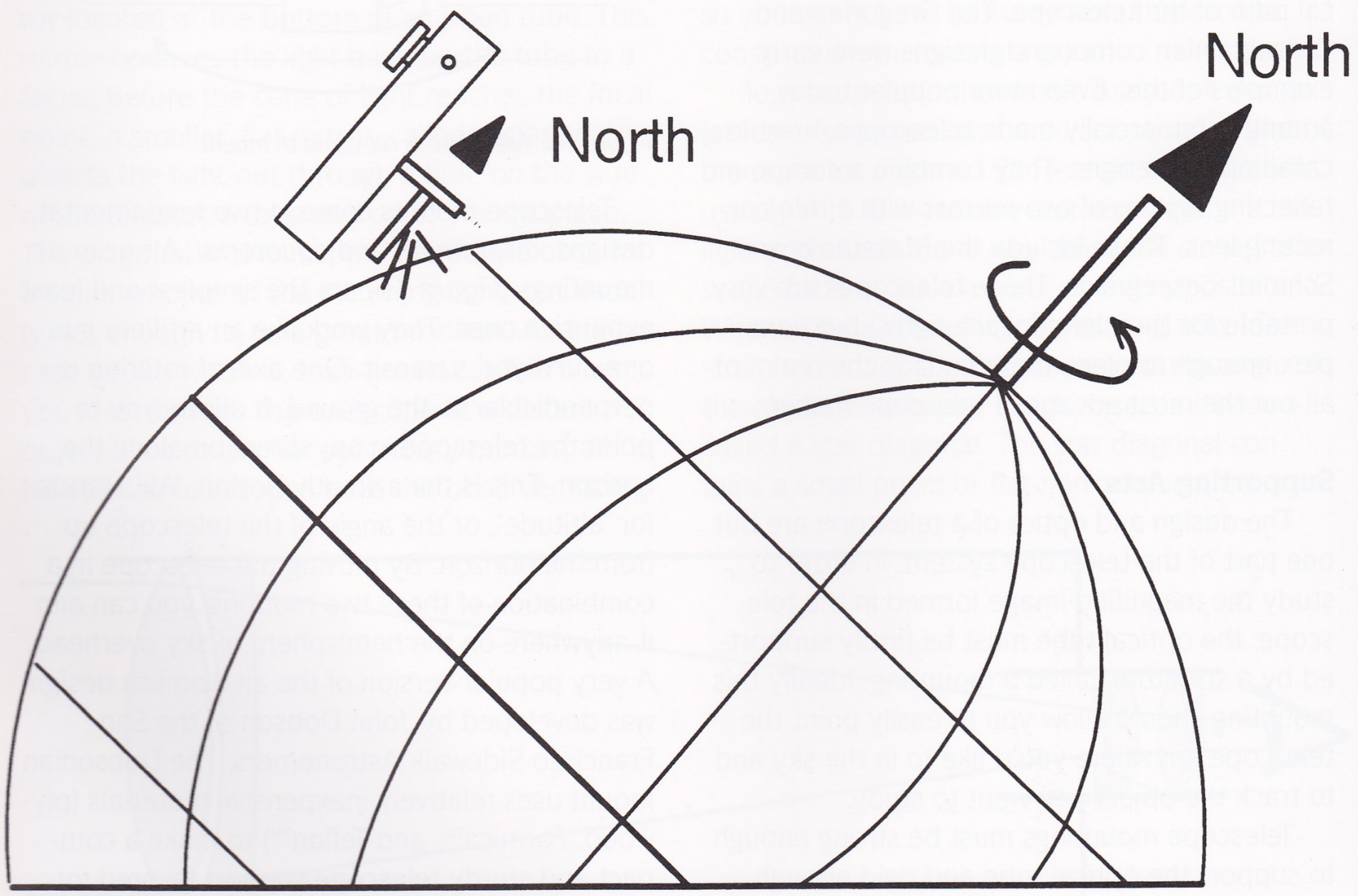


Figure 17: Telescope polar axis parallel to Earth's rotation axis

Advantages of the Equatorial Mount

- If accurately aligned, tracking a star requires motion in only one axis (rather than two for an Alt-azimuth mount).
- Best alignment for *astrophotography*
- Can be motorized in both axes
- With a “Go-To” microprocessor-controlled handset, can locate any celestial object visible from a given location.

“Go To” telescopes (1)

- Very popular – once set up, will find any object for you.
- 3 star alignment with rest position pointing North
- Disadvantages: system might choose an alignment star that’s obscured by e.g. trees

  Can take several minutes to set up

  Requires a power supply.

"Go To" telescopes (2)

- Advantages: no real knowledge of the sky required

  tracks stars automatically as they revolve around the N pole. Also tracks planets

  Essential for astrophotography, but requires meticulous set-up

  Works well with both Alt-Az and Equatorial mounts for visual observation

The solar telescope

- Simply an ordinary telescope with a Solar observation filter in place over Objective lens
- Can then be pointed at the Sun to see sunspots, solar prominences, etc.
- Absolutely essential that filter is firmly attached so it can't fall off in use
- Means that you can be a warm sunshine astronomer (as well a cold night one)

Magnification: is more better?

- NO
- Image will be less bright
- Field of view will be restricted
- Telescope will be more sensitive to vibration
- Aberrations present within the optical system will be magnified too
- It’s all a compromise: there’s no point in using more magnification than allows you to see the object clearly

So what's best then?

- Today all telescopes from reputable manufacturers will give good results
- For Sun, Moon, and planetary observations even quite small telescopes (*small aperture*) work well.
- But to *resolve* deep sky objects, the bigger the objective lens (or the mirror) – the better

- Ultimately, the best telescope may be the one you’ll carry and use, rather than leave it home because it’s too big………

That concludes Steve’s half of the presentation Chris’s half now continues with

A description and demonstration of the DWARF3 Smart telescope

The Dwarf 3 Smart Telescope

An Overview

CARS 07/01/2026

The Dwarf 3 is a smart telescope.

Why “Smart”?

Smart because you can have very good images with little input, Some explanation of the basic principles of Astrophotography will help here.

Astrophotography uses the high sensitivity of CMOS (Complimentary Metal Oxide Semiconductor) sensors to image these objects. But even these devices will not produce a useable, sometimes not even visible image!

So, the trick is to align and stack these images to produce a visible and hopefully stunning image.

M33 Triangulum

Galaxy © Steve

This is the basis for all modern Astrophotography.

Why, you may ask, don't you just increase the exposure time to compensate for the dim object you are trying to image?

Here we see an example of what happens when a camera is pointed at the night sky and the shutter left open with no tracking.

This is what happens, obviously to a much less effect when, tracking is applied but ineffective, the stars become streaks as in the example below

The second factor to take into consideration when considering a long exposure is noise.

The trick here is to find a balance between tracking and exposure time to produce clean images which can be successfully stacked to provide a useful image.

Caldwell 49

Rossetta Nebula

©R/Astrophotograpy

In a conventional Astrophotography set up the various components, Telescope, mount, focuser, imaging camera, guide scope, guide camera and computer to integrate it all are separate components, each one costing either around the cost of the Dwarf 3 or hundreds more.

Here we see an example of a tracked and stacked image of M31, the Andromeda Galaxy, this consists of 200 images, each of 30 Seconds taken on the Dwarf 3 on December 19th last year.

M31 Andromeda Galaxy © Chris

So how does a Smart Telescope, in this case the Dwarf 3, produce these images?

By polar alignment, then a series of short exposure images (<120 seconds) are taken and stacked, producing a final image.

Messier 8

Lagoon Nebula

The Dwarf 3 can not only capture Deep Sky Objects but also the Moon and Sun

© Chris

© Chris

The last Sun of 2025!

DWARF 3 Specifications:

35mm telephoto periscope lens with multi element extra low dispersion elements

3.4mm wide angle lens

Focal Length150mm tele 3.4mm wide (737mm and 45mm equivalent in 35mm format)

Sensor Sony IMX678 Starvis 2

Built in Filters for visual, Astro and Dual band

For more info goto dwarflab.com

Any Questions?

HAPPY NEW YEAR