Helpful to Know About Telescopes When Doing Astro Stuff

Powers of a telescope
light gathering power
area hence diameter^2
biggest one are segmented or multiple mirror
angular resolution (or simply resolution or resolving power)
diffraction limits resolution
depends on diameter & wavelength
smaller numbers are better
\[ \alpha = 2.5 \times 10^5 \frac{\lambda}{D} \]
\[ \alpha = \text{resolution in seconds of arc, } \lambda = \text{wavelength, } D = \text{telescope diameter} \]
\(\lambda\) and D must be in the same units of length
overcome by large "synthetic" diameter
scopes like the VLT, VLA, ALMA
they use interference to make multiple telescopes act as one big one

Limitations on telescope powers
Earth's atmosphere
has windows-allows only certain colors to pass through
overcome by high flying planes and satellite telescopes
distorts the view-as if we from the bottom of a swimming pool
overcome by adaptive optics and lasers to make artificial stars
civilization, i.e. light pollution
like having a full moon every night all night long
limits the faintest magnitude possible
wavelength of light used
gamma rays are hard to focus, poor resolution
x-rays are hard to focus but easier than gamma rays
UV is strongly absorbed by the atmosphere
IR is absorbed by water vapor, telescopes emit IR unless cooled
radio has long wavelengths, as a result has poor resolution, must be made very large to work

How are Telescopes Used?
imaging with film in the past, CCDs today
true color and false color reveals information
spectroscopy
tells composition, temperature, radial velocity
timing
measure how light varies with time
pulsating stars, orbiting stars, exploding stars, pulsars and quasars

Special telescopes
neutrino telescopes
detects neutrinos from the Sun and deep space
LIGO
gravity wave telescope
"sees" merging black holes