quite different, probably based on absolute energy units. However, the traditional magnitude scale is so deeply rooted in the astronomical literature, both amateur and professional, that it is unlikely to go away, and thus it is important to understand it.

Magnitude Difference **m**	Brightness Ratio
1	2.5
2	6
3	16
4	40
5	100

After the invention of the telescope, astronomers could see stars much fainter than the 6th magnitude, so the scale was extended in the same way to higher numbers. The 30-inch telescope at our research observatory, Rosemary Hill, has photographed stars as faint as 22nd magnitude, 2.512^{16} or 2.5 million times fainter than the faintest star you can see with your unaided eyes! Similarly, there are objects brighter than 1st magnitude stars, so the scale has to be extended in the other direction as well. The planet Venus gets as bright as -4; the full Moon is near -13; and the Sun is about -26.

When Galileo first turned a telescope on the heavens, around 1609, he saw myriad stars that before had been invisible to the naked eye. The Milky Way, the dim band of diffuse light that spans the sky, was seen to be composed of countless faint stars. The explanation is simple. The dark-adapted human eye has a diameter of about 8 mm. A large binocular has lenses nearly 10 times larger than this. Since the area of a lens - and hence the amount of light it collects - is proportional to the square of the lens diameter, the binocular collects almost 100 times as much light as the naked eye. Referring to the table above, we see that the binocular should show stars nearly 5 magnitudes fainter than the naked-eye limit, a prediction that is confirmed by actual observations.

We have now illustrated the second reason astronomers incessantly lobby for ever larger telescopes. Not only do the big instruments have superior resolving power; they are also capable of detecting much fainter objects. Needless to say, there are many more faint objects in the sky than bright ones. With the unaided eye you can see about 5000 stars, but with the binoculars described above, you could detect over a million! The figure at the right illustrates how larger and larger telescopes reach fainter and fainter magnitudes. The figure shows the faintest stars visible in telescopes of various apertures. The figure is conservative; a keen eye in an optimum environment may see 1 to 1.5 magnitudes fainter. A slight extrapolation suggest that we should see stars of about 16th magnitude in the 30-inch reflector at University of Florida Rosemary Hill Observatory, and this is confirmed by experience. (*Much* fainter stars can be recorded by long photographic or CCD exposures.) Data from J. B. Sidgwick, *Amateur Astronomer's Handbook*, Macmillan, N. Y., 1955.