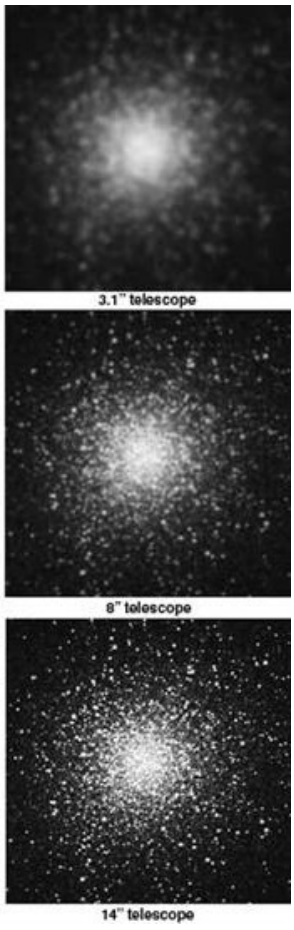


The images to the left show what the star cluster Messier-13 would look like to three different telescopes with apertures of 3.1, 8.0 and 14.0 inches. Notice that as the aperture increases, the fuzzy smudges seen by the smallest telescope become increasingly more clear to see as the aperture increases. This is an example of Optical Resolution, which is sometimes called the Resolving Power of a telescope.

To make the clearest photographs of stars, planets, or even people, it helps to use the largest lens or aperture to make crisp, clear images. Astronomers also want the highest resolutions possible so that they can study the smallest details on a planet surface, or in a distant galaxy.

Telescope resolution at optical wavelengths can be calculated using the simple formula:

$$R = \frac{134}{D}$$

where D is the diameter of the objective in millimeters, and R is the resolution in seconds of arc. (There are 3600 seconds of arc in 1 angular degree).

For example, a pair of binoculars with D = 50 mm, provides a resolution limit of R = 2.8 arcseconds. A small 8-inch telescope for which D = 200 mm, provides R = 0.67 arcseconds.

Problem 1 – An astronomer wants to design a system that will let him study craters on the moon that are about 0.1 arcseconds in diameter as seen from Earth. What is the minimum-sized aperture he needs to conduct his study?

Problem 2 – The Hubble Space Telescope has a diameter of 2.4 meters. What is its maximum resolution?

Problem 3 – Two telescopes are combined in an instrument called an interferometer, which creates a single telescope with a diameter of 640 meters. What is the maximum resolution of this system?

Problem 1 – An astronomer wants to design a system that will let him study craters on the moon that are about 0.1 arcseconds in diameter as seen from Earth. What is the minimum-sized aperture he needs to conduct his study?

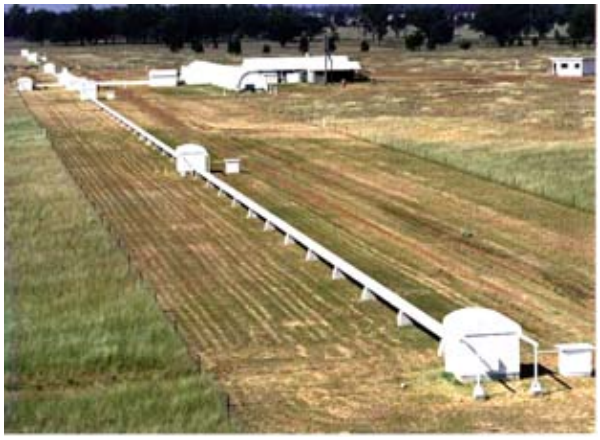
Answer: 0.1 = 134/D so D = **1340 millimeters (53 inches)**.

Problem 2 – The Hubble Space Telescope has a diameter of 2.4 meters. What is its maximum resolution?

Answer: R = 134/2400 = **0.06 arcseconds** or 60 milliarcseconds

Problem 3 – Two telescopes are combined in an instrument called an interferometer, which creates a telescope with a diameter of 640 meters. What is the maximum resolution of this system?

Answer: R = 134/640000 = **0.0002 arcseconds or 0.2 milliarcseconds**.



A photo of the Sydney University Stellar Interferometer (SUSI) is a long-baseline optical interferometer located approximately 20km west of the town of Narrabri in northern New South Wales, Australia. The equivalent diameter of the optical aperture for this instrument is 640 meters.