What's up in Astronomy By Eric Erickson

Offered Title: Next Generation Telescopes

In my article about the next big space-based telescope, the James Webb Space Telescope, I kind of disrespected the new big ground-based scopes. So, let me rectify that slight.

No one in their right mind would spend millions and billions of dollars on a telescope if it didn't promise big science and lots of important data. There are lots of very smart people out there pooling their resources, negotiating land use rights, cutting big deals, and signing contracts for telescopes. Really big telescopes.

The era of big telescopes was started with the Mount Wilson 100" Hooker telescope. In 1917 it was a beast. It heralded in a new wave of cosmologic discovery. Edwin Hubble (Hubble Telescope) observed that the Milky Way was just one galaxy among many. Oh, yeah, and that our universe appears to be expanding! Mount Wilson remained the big boy until 1949 when Mount Palomar gained the biggest scope, the 200" Hale telescope. It was instrumental in astronomer's identifying quasars, very active supermassive black holes in distant galaxies. Mount Palomar was the big boy until 1975 until construction of the Soviet BTA-6 telescope, measuring 236".

The progress of building ever larger scopes slowed as it became extremely costly and difficult to make the mirrors. You see, these mirrors were all single pieces of glass, monolithic. They are very difficult to cast, anneal, and figure. The last and largest monolithic mirrors cast were for the Large Binocular Telescope, at 331" each, in 2004.

In the 1990s two technologies emerged that opened new opportunities for developing larger ground-based telescopes. They were adaptive optics and segmented mirrors. Adaptive optics adjusts the telescope optics to compensate for the constantly changing atmosphere. Segmented mirror arrays allow for larger total mirror diameters, by using multiple smaller/lighter mirrors that focus to the same point as the equivalent size monolithic mirror.

However, even with their new technology most ground based telescopes cannot compete with Hubble in terms of visible light and near infrared resolution. A few of the largest newer ones can beat Hubble at certain wavelengths, and a new crop of massive telescopes is on its way. Each telescope's proposed opening date is in parentheses.

The Large Synoptic Survey Telescope (2020), with its 331" mirror is a monolithic design and is a specialty design. It will survey the entire available sky every night.

Not to be out "monolithed" The Giant Magellan Telescope (2024) will have seven 331" monolithic mirrors, six encircling a central mirror, with light gathering equaling an 885" mirror!

The Thirty Meter Telescope (2028) is a segmented design with a diameter of 1181"!

Finally, the European Extremely Large Telescope, a segmented design (2024), has a planned 1535" diameter!

The last three scopes will surpass Hubble in most areas, but the James Webb Space Telescope will beat them in deep infrared imaging.

What's in the Sky?

November 4; dusk; South-southwest: Mars is less than 1 degree from Delta Capricorni