SPACE RESEARCH

15-6-2020

EYES IN SPACE-SPACE TELESCOPES

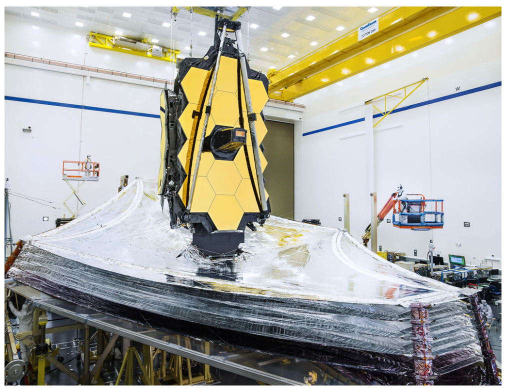
PILLARS OF CREATION

From the dawn of humankind to a mere 400 years ago, all that we knew about our universe came through observations with the naked eye. Then Galileo turned his telescope toward the heavens in 1610. The world was in for an awakening.Saturn, we learned, had rings. Jupiter had moons. That nebulous patch across the center of the sky called the Milky Way was not a cloud but a collection of countless stars. Within but a few years, our notion of the natural world would be forever changed. A scientific and societal revolution quickly ensued.In the centuries that followed, telescopes grew in size and complexity and, of course, power. They were placed far from city lights and as far above the haze of the atmosphere as possible. Edwin Hubble, for whom the Hubble Telescope is named, used the largest telescope of his day in the 1920s at the Mt. Wilson Observatory near Pasadena, Calif., to discover galaxies beyond our own.

Hubble, the observatory, is the first major optical telescope to be placed in space, the ultimate mountaintop. Above the distortion of the atmosphere, far far above rain clouds and light pollution, Hubble has an unobstructed view of the universe. Scientists have used Hubble to observe the most distant stars and galaxies as well as the planets in our solar system.Hubble's launch and deployment in April 1990 marked the most significant advance in astronomy since Galileo's telescope. Thanks to five servicing missions and more than 25 years of operation, our view of the universe and our place within it has never been the same.

Hubble has made more than 1.3 million observations since its mission began in 1990.Astronomers using Hubble data have published more than 15,000 scientific papers, making it one of the most productive scientific instruments ever built. Those papers have been cited in other papers 738,000 times.Hubble has no thrusters. To change angles, it uses Newton's third law by spinning its wheels in the opposite direction. It turns at about the speed of a minute hand on a clock, taking 15 minutes to turn 90 degrees.

NEXT GENERATION SPACE TELESCOPE



James Webb Space Telescope :The James Webb Space Telescope, a NASA-led project in collaboration with the European and Canadian space agencies, will be world's next premier space science observatory. Webb will solve mysteries of our solar system, look beyond to distant worlds around other stars, and probe the mystifying structures and origins of our universe.

Webb will study every phase in the history of our universe, ranging from the first luminous glows after the Big Bang to the formation of solar systems and the evolution of our own solar system. Webb will open up new windows to study the atmospheres of planets around other stars and how it relates to exoplanet systems.

Mission Goals: Search for the first galaxies or luminous objects formed after the Big Bang.Determine how galaxies evolved from their formation until now.Observe the formation of stars from the first stages to the formation of planetary systems.Measure the physical and chemical properties of planetary systems, including our own Solar System, and investigate the potential for life in those systems.

A RETIRED LEGEND

The centuries-old quest for other worlds like our Earth has been rejuvenated by the intense excitement and popular interest surrounding the discovery of hundreds of planets orbiting other stars. There is now clear evidence for substantial numbers of three types of exoplanets; gas giants, hot-super-Earths in short period orbits, and ice giants. The challenge now is to find terrestrial planets (i.e., those one half to twice the size of the Earth), especially those in the habitable zone of their stars where liquid water might exist on the surface of the planet.The Kepler Mission is specifically designed to survey our region of the Milky Way galaxy to discover hundreds of Earth-size and smaller planets in or near the habitable zone and determine the fraction of the hundreds of billions of stars in our galaxy that might have such planets.

When a planet passes in front of a star as viewed from Earth, the event is called a “transit”. On Earth, we can observe an occasional Venus or Mercury transit. These events are seen as a small black dot creeping across the Sun —Venus or Mercury blocks sunlight as the planet moves between the Sun and us. Kepler finds planets by looking for tiny dips in the brightness of a star when a planet crosses in front of it—we say the planet transits the star.Once detected, the planet's orbital size can be calculated from the period (how long it takes the planet to orbit once around the star) and the mass of the star using Kepler's Third Law of planetary motion. The size of the planet is found from the depth of the transit (how much the brightness of the star drops) and the size of the star. From the orbital size and the temperature of the star, the planet's characteristic temperature can be calculated. From this the question of whether or not the planet is habitable (not necessarily inhabited) can be answered.

Since transits only last a fraction of a day, all the stars must be monitored continuously, that is, their brightnesses must be measured at least once every few hours. The ability to continuously view the stars being monitored dictates that the field of view (FOV) must never be blocked at any time during the year. Therefore, to avoid the Sun the FOV must be out of the ecliptic plane. The secondary requirement is that the FOV have the largest possible number of stars. This leads to the selection of a region in the Cygnus and Lyra constellations of our Galaxy.

The loss of a second of the four reaction wheels on board the Kepler spacecraft in May 2013 brought an end to Kepler's four-year science mission to continuously monitor more than 150,000 stars to search for transiting exoplanets. Developed over the months following this failure, the K2 mission represents a new concept for spacecraft operations that enables continued scientific observations with the Kepler space telescope. K2 became fully operational in May 2014 and is expected to continue operating until 2017 or 2018.Using the transit method to detect brightness changes, the K2 mission entails a series of sequential observing "Campaigns" of fields distributed around the ecliptic plane and offers a photometric precision approaching that of the original Kepler mission. Operating in the ecliptic plane minimizes the torque exerted on the spacecraft by solar wind pressure, reducing pointing drift to the point where spacecraft attitude can effectively be controlled through a combination of thrusters.

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CITATION

video: https://www.youtube.com/watch?time_continue=234&v=3yij1rJOefM&feature=emb_logo and images by nasa.gov

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