James Webb Space Telescope: Science Opportunities and Mission Progress

The James Webb Space Telescope, the planned successor for the Hubble Space Telescope and the Spitzer Space Telescope, is making excellent technical progress. It will carry four instruments to cover the wavelength range from 0.6 to 28 µm with imaging, spectroscopy, and coronography, and will have a deployable 6.5 m aperture telescope cooled to about 40 K. It will be launched by an Ariane 5 vehicle from French Guiana to reach an orbit around the Sun-Earth Lagrange point L2. Two of the flight instruments are completed and in test, all 18 of the beryllium primary mirror segments have been polished warm, and 5 of them have been coated with IR-reflecting gold. I will describe the scientific programs that future users are likely to propose, ranging from the first objects to form after the big bang, to the assembly of galaxies, the formation of stars, and the potential detection of planetary systems capable of supporting life. I will also outline the remaining work for the project, including testing the telescope and instrument package end-to-end at the gigantic vacuum chamber at Johnson Space Center, and developing and testing the deployable sunshield.

John C. Mather

Dr. John C. Mather is a Senior Astrophysicist at NASA’s Goddard Space Flight Center in Greenbelt, Maryland, where he specializes in infrared astronomy and cosmology. He received his Bachelor’s degree in physics at Swarthmore College and his PhD in physics at the University of California at Berkeley.

As an NRC postdoctoral fellow at the Goddard Institute for Space Studies (New York City), he led the proposal efforts for the Cosmic Background Explorer (74-76), and came to GSFC to be the Study Scientist (76-88), Project Scientist (88-98), and the Principal Investigator for the Far IR Absolute Spectrophotometer (FIRAS) on COBE. He and his team showed that the cosmic microwave background radiation has a blackbody spectrum within 50 parts per million, confirming the Big Bang theory to extraordinary accuracy.

The COBE team also discovered the cosmic anisotropy (hot and cold spots in the background radiation), now believed to be the primordial seeds that led to the structure of the universe today. It was these findings that led to Dr. Mather receiving the Nobel Prize in 2006.

Dr. Mather now serves as Senior Project Scientist (95-present) for the James Webb Space Telescope, the successor to the great Hubble Space Telescope.