The University of Texas at San Antonio

UTSA Physics and Astronomy

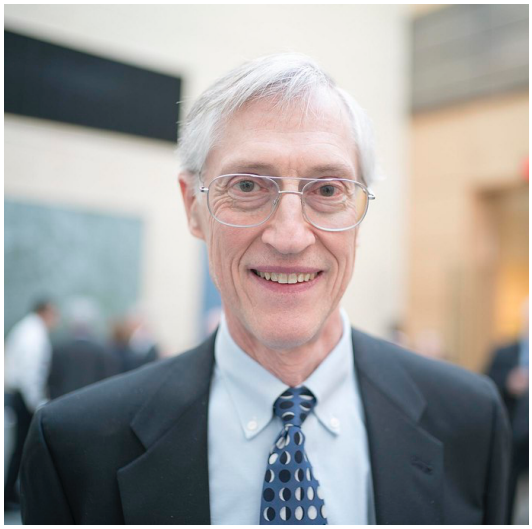
Friday, April 5, 2024, at 11:00 AM, NPB 5.140

Discoveries with JWST and What Comes Next

John C. Mather

Nobel Laureate and (former) Senior Project Scientist, James Webb Space Telescope

The JWST, with its 6.5 m hexagonal mirror and its 4 infrared instruments, has yielded remarkable surprises. The first galaxies are brighter and hotter than expected, and they aren't round but are elongated into bananas and cigars. Galaxies and even individual stars are frequently found at high redshift, through gravitational lensing. The first black holes we can find are extremely bright and sometimes surrounded by immense clusters of galaxies. Pairs of Jupiter-mass objects (JMBOs) have been discovered in the Orion nebula, upending theories of planet formation. Some new stars are observed in their dusty cocoons, and some with their orbiting disks of dust are observed edge-on, so we can test our stories of formation. Hot, large exoplanets have atmospheres that we measured in transit spectroscopy, but no small planets around M stars have detectable atmospheres, alas, for the search for signs of life elsewhere. I will tie the JWST results to cosmological predictions, with galaxies arising from density fluctuations measured with the cosmic microwave background radiation, discuss the effects of cosmic dark matter and dark energy, and consider the future of astronomy. Miraculous discoveries await.



Dr. John C. Mather is a Senior Astrophysicist and was the Senior Project Scientist for the James Webb Space Telescope (JWST) at NASA's Goddard Space Flight Center. Since the project start in 1995 until 2023, he led the JWST science teams. As a postdoctoral fellow at NASA's Goddard Institute for Space Studies, 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. With the COBE team, he showed that the cosmic microwave background radiation has a blackbody spectrum within 50 parts per million, confirming the expanding universe model to extraordinary accuracy. The COBE team also made the first map of the hot and cold spots in the background radiation (anisotropy), the spots that nucleated the formation of galaxies. Dr. Mather received the Nobel Prize in Physics (2006) with George Smoot for the COBE work.

Faculty Host: Prof. Eric Schlegel