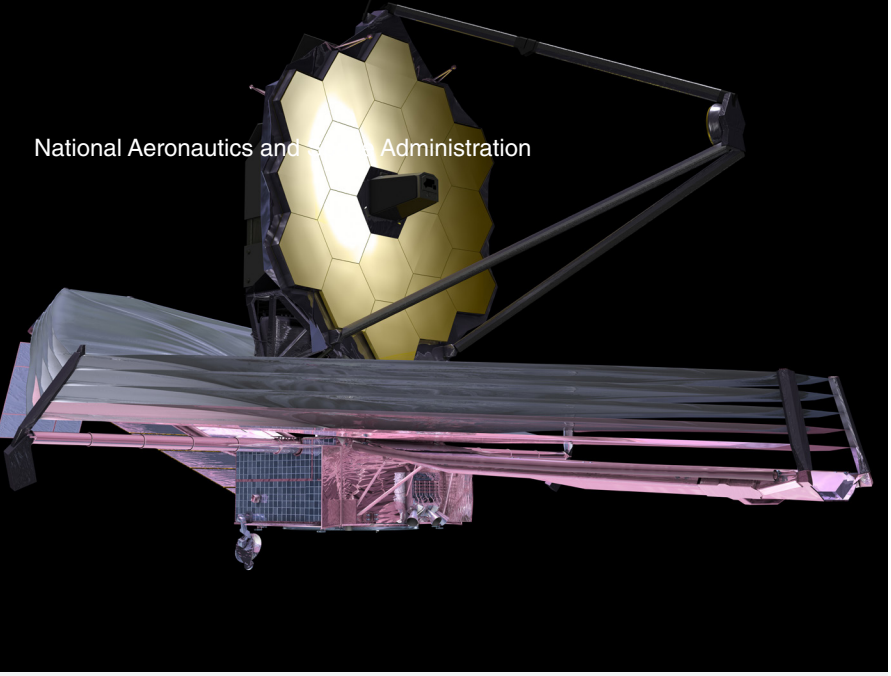


Optics

Hybrid Architecture Active Wavefront Sensing & Control

A method for performing high speed wavefront sensing and control to overcome thermal instabilities in a segmented primary mirror telescope

NASA's Goddard Space Flight Center has developed a Hybrid Architecture Active Wavefront Sensing & Control system which provides a method for performing high speed wavefront sensing and control to overcome thermal instabilities in a segmented primary mirror telescope. This method utilizes the on-board fine guidance sensor that is already needed to maintain fine guidance control (pointing) of the telescope.

BENEFITS

- Improved thermal stability—greatly improves thermal stability/fine phasing architecture of a UV-optical telescope
- Simplified—using the fine guidance sensor star image for guiding and fine phasing, the need for other more complex ways of achieving very accurate sensing and control for UV-optical applications is eliminated
- Cost efficient—the technique is less expensive to implement than edge sensors, laser trusses, or a center of curvature null

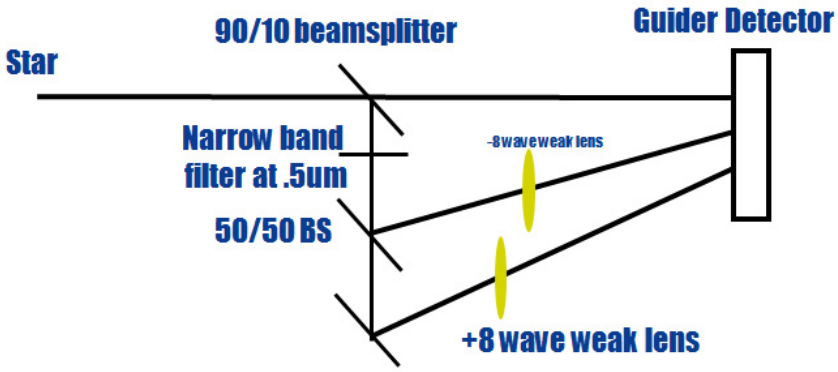
technology solution

THE TECHNOLOGY

The Active Wavefront Sensing & Control method was developed to improve the thermal stability/fine phasing update architecture of a UV-optical telescope by a factor of 4 (the improvement from a 2um diffraction limited telescope to a 500nm diffraction limited telescope).

For the James Webb Space Telescope (JWST), fine phasing of the primary mirror segments is achieved using phase retrieval, which requires moving a filter wheel, pointing at a star, and using the main science camera. JWST fine phasing updates of the primary mirror segments occur every 14 days. In between updates, the architecture relies on passive thermal stability to keep the wavefront error within limits. This can be a challenge for the 2um JWST. In fact for a 500nm diffraction limited UV-Optical telescope, the JWST wavefront sensing and control and passive thermal stability architecture will not suffice as the mirror and composite structure are not sufficiently stable to meet an acceptable allocation (e.g., about 5nm RMS).

Therefore NASA developed this new Hybrid Architecture Active Wavefront Sensing & Control Method that improves the update architecture yet has a limited impact on the overall complexity of the system, particularly of the primary mirror system.



Schematic of the Hybrid Architecture Active Wavefront Sensing and Control system

APPLICATIONS

The technology has several potential applications:

Ground segmented observatories – using a laser guide star or other similar scheme

Space systems – if a method for combining it with a star image is doable

PUBLICATIONS

U.S. Patent 8,044,332

More Information

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