SIM 'Lite' Space Interferometry Mission

QUICK FACTS

SIM PLANETQUEST

OVERVIEW

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SIM Team
Science Team
JPL Management
Northrop Grumman

SCIENCE

Rotational Synthesis Imaging

SIM will be the first phase-stable optical interferometer ever built, with fringes stable to better than 1/100 of a wavelength over time scales of many minutes, a capability which is not likely to be achieved any time soon with ground-based instruments owing to the perturbing effects of the terrestrial atmosphere. In this respect, SIM will provide complex fringe visibility data (fringe amplitude and phase) of a quality to rival the best ground-based radio interferometers such as the Very Large Array, and do so at wavelengths that are a factor of 1,000,000 smaller. This feature of SIM is, of course, the reason for SIM's enormous astrometric accuracy, but in principle it also permits use of SIM data to image astronomical objects using the techniques of synthesis imaging that are well known from radio astronomy. The practical difficulties of doing this on faint targets of arbitrary complexity demand large collectors and a range of interferometer baselines from very short to very long (and many baselines in between), characteristics that SIM unfortunately does not have in its current configuration. However, such instruments promise to provide orders of magnitude in performance improvement over filled-aperture telescopes, and it is likely that space optical/UV/IR telescopes of the future will increasingly be designed to operate in this way. In that case, a clear demonstration of the utility of these imaging techniques using real data obtained from real spacecraft would be of significant importance in spurring the development of future technology. The limitations of the available collector area and interferometer baselines in the current design dictate that the targets chosen for this demonstration be relatively bright and simple in structure.

SIM will permit imaging high surface brightness, low-complexity targets with more than 4 times the best resolution attainable with the Advanced Camera on the Hubble Space Telescope. The present SIM design includes astrometric science interferometers at 10 meters, and guide interferometers at ~8.5 meters. For the present demonstration it is essential that the guide interferometers also be usable for science observations

During its coherence time, MIRIAH uses huge sparse arrays (16 VLA) filled as an MF on its disc(s) instead of on RCVR antennae like SIM, which is why SIM is unable to use Synthesis Imaging, for then its antennae would be too large for satellites. And, MIRIAH's VLA size ***cycles*** (sinusoidal) twice per orbit, ***which is extremely deterministic***, as all VLA are perpendicular to one of the 8 isometric axes of ROSÆ, with its ***ponderous*** 3-D Angular Momentum, obeying ***both*** of the Uncertainty Principle's ***two*** error residual limits, in which ***two*** PA (Power-Aperture) are needed with PA-1 using ***narrow*** bandwidth, to keep satellite antennae small, and XCVR relaying (not RCVR – as in this Figure) so PA-2 can use ***wide*** bandwidth to enable ***laser*** illumination onto ***nanotechnology*** memories (e.g.., disc(s), etc.).

This figure is a functional diagram of MIRIAH, which shows the coherence relation between the Phase Closure Interferometers, and the Illumination Interferometers, as well as the Power-Apertures (PA), in which PA-1 is the hologram building PA, and PA-2 is the final image depositing PA.

In every case, during PA-!, MIRIAH focuses on the Fourier Plane using a lower coherent frequency signal, which “Writes” the Matched Filter (MF) onto a disc(s), or other nanotech memory, as a hologram. Then, during PA-2, it focuses on the Image Plane, and “Reads” the disc(s), or other nanotech memory, using a higher frequency signal. The Lower frequency “Write” can in practice be VHF, or UHF, or Microwave, or Millimeter Wave. The higher frequency can be an Infrared, or laser frequency (a wavelength ratio of perhaps 1,000,000 to one). In every case, the diameter of the collimated “Read” illumination of the MF must be equal to (or slightly greater than) the diameter of the nanotech Disc(s) or other memory. Clearly, nanotechnology has made synthesis imaging practical from Satelites.