

The Space Terahertz Observatory (STO): A 10-meter-class Far-Infrared Telescope for Origins Research

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1 Scientific Investigation

1.1 Overview

Here we describe the scientific motivation and technology for a 10-meter-class Space Terahertz Observatory (STO) (Figure 1). STO would 1) conduct origin studies of planets, stars, and molecular clouds; 2) trace the life cycle of the Interstellar Medium (ISM) and star formation rate throughout the Galaxy; 3) determine the deuterium abundance in nearby molecular clouds and Galactic Center; and 4) observe the distribution of atomic and molecular gas in nearby and distant galaxies. STO will achieve these goals through high spectral and angular resolution observations of C, O, N, HD, and H₂O lines in the far-infrared. The science goals of STO can be achieved either through a dedicated mission or by implementing heterodyne instrumentation on SAFIR and extending its operational lifetime. STO science objectives are closely aligned with many of those found in the *Origins Roadmap* and drive the creation of a new generation of heterodyne instrumentation that benefits directly from technologies developed for the Herschel HIFI instrument.

| | |
|---------------------------|--------------------------------|
| Primary Mirror Diameter | 9.0m |
| Angular resolution | 1.7" – 16" |
| Spectral resolution | $\lambda/\Delta\lambda = 10^6$ |
| Wavelength range | 60 – 540 μm |
| # of spectroscopic pixels | 288 |
| Lifetime | >5 yr |
| Orbit | L2 |

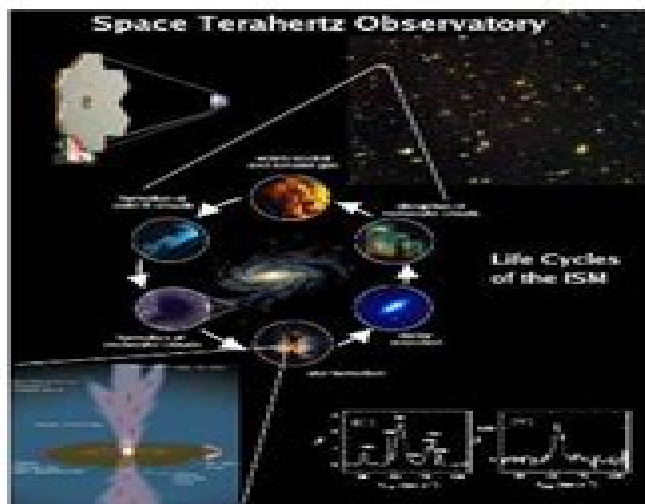


Figure 1: The Space Terahertz Observatory will provide a powerful probe of our cosmic origins: the evolution of galaxies, stars, planets, and the chemical elements of life.

1.2 Impact on Origins Research

STO addresses all major enterprise objectives in the 2003 *Origins Roadmap*:

- A. Understanding how today's Universe of galaxies, stars and planets came to be. By exploring star for-

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Emilie Sanchez



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