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 beterodyne 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	1.2

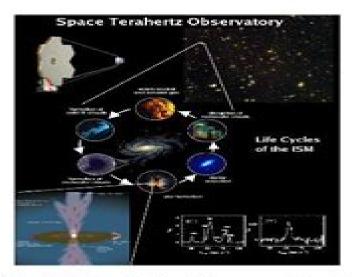


Figure 1: The Space Terahertz Observatory will provide a powerful probe of our cosmic origins; the evolution of galaxies, stars, planets, and the chemical elements of life.

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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Table of Contents Space Research And Technology Proceedings Of Symposia

- 1. Understanding the eBook Space Research And Technology Proceedings Of Symposia
 - The Rise of Digital Reading Space Research And Technology Proceedings Of Symposia
 - Advantages of eBooks Over Traditional Books
- 2. Identifying Space Research And Technology Proceedings Of Symposia
 - Exploring Different Genres
 - o Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
- 3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Space Research And Technology Proceedings Of Symposia
 - User-Friendly Interface
- 4. Exploring eBook Recommendations from Space Research And Technology Proceedings Of Symposia
 - Personalized Recommendations
 - Space Research And Technology Proceedings Of Symposia User Reviews and Ratings
 - Space Research And Technology Proceedings Of Symposia and Bestseller Lists

- 5. Accessing Space Research And Technology Proceedings Of Symposia Free and Paid eBooks
 - Space Research And Technology Proceedings Of Symposia Public Domain eBooks
 - Space Research And Technology Proceedings Of Symposia eBook Subscription Services
 - Space Research And Technology Proceedings Of Symposia Budget-Friendly Options
- 6. Navigating Space Research And Technology Proceedings Of Symposia eBook Formats
 - ∘ ePub, PDF, MOBI, and More
 - Space Research And Technology Proceedings Of Symposia Compatibility with Devices
 - Space Research And Technology Proceedings Of Symposia Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Space Research And Technology Proceedings Of Symposia
 - Highlighting and Note-Taking Space Research And Technology Proceedings Of Symposia
 - o Interactive Elements Space Research And Technology Proceedings Of Symposia
- 8. Staying Engaged with Space Research And Technology Proceedings Of Symposia
 - o Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Space Research And Technology Proceedings Of Symposia
- 9. Balancing eBooks and Physical Books Space Research And Technology Proceedings Of Symposia
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Space Research And Technology Proceedings Of Symposia
- 10. Overcoming Reading Challenges
 - o Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Space Research And Technology Proceedings Of Symposia
 - Setting Reading Goals Space Research And Technology Proceedings Of Symposia
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Space Research And Technology Proceedings Of Symposia
 - Fact-Checking eBook Content of Space Research And Technology Proceedings Of Symposia
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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