

Emerging Technologies for Astrophysics Missions (ETAM)

Rhonda Morgan

ExEP Deputy Chief Technologist

Jet Propulsion Laboratory, California Institute of Technology

2 September 2026

© 2026 California Institute of Technology. Government sponsorship acknowledged

This document has been reviewed and determined not to contain export controlled technical data.



Innovation

“The electric light bulb did not come from continuous improvement of candles”



CRITICAL AND EMERGING TECHNOLOGIES LIST UPDATE

A Report by the
FAST TRACK ACTION SUBCOMMITTEE ON CRITICAL AND
EMERGING TECHNOLOGIES
of the
NATIONAL SCIENCE AND TECHNOLOGY COUNCIL

February 2024

- Advanced Computing
 - Advanced Engineering Materials — Advanced Composite and Meta-materials
 - Advanced Gas Turbine Engine Technologies
 - Advanced and Networked Sensing and Signature Management
 - Advanced Manufacturing — Additive Manufacturing and Nanofabrication
 - Artificial Intelligence — AI/ML (for technology applications rather than data mining)
 - Biotechnologies
 - Clean Energy Generation and Storage
 - Data Privacy, Data Security, and Cybersecurity Technologies
 - Directed Energy
 - Highly Automated, Autonomous, and Uncrewed Systems, and Robotics
 - Human-Machine Interfaces
 - Hypersonics
 - Integrated Communication and Networking Technologies
 - Positioning, Navigation, and Timing (PNT) Technologies
 - Quantum Information and Enabling Technologies — Quantum Sensing (single-photon detection)
 - Semiconductors and Microelectronics
 - Space Technologies and Systems
- Astrophotonics

Emerging Technologies for Astrophysics Missions Workshop

Sponsored by NASA's Astrophysics Division

Objective:

Identify candidate emerging technologies that may offer science enabling capabilities or significant impact to astrophysics space missions.

- March 25-27, 2025 at NASA ARC
- ~ 60 invited **Subject Matter Experts**
- Academia, industry, gov't labs, NASA Centers
- In-person only



<https://www.nasa.gov/emerging-technologies-for-astrophysics-missions-workshop/>

Pre-Workshop Webinar

Objective: Inform the Workshop participants of APD's science goals and capability needs.

Topic	Time (EST)	Intended Results	Speakers
Introduction	12:00 pm – 12:30 pm	- Goals of upcoming Workshop - Define the boundaries of NASA's Astrophysics Division - Goals of today's Webinar	Dr Mario Perez NASA Headquarters
NASA Astrophysics Science	12:30 pm – 1:20 pm	- Science goals of NASA's Astrophysics Division - Community-envisioned mission concepts that could achieve the science	Dr John O'Meara Keck Observatory
NASA Astrophysics Capability Needs and Challenges	1:20 pm – 2:10 pm	- NASA Astrophysics capability needs - What makes NASA Astrophysics missions challenging?	Dr Brendan Crill NASA JPL Dr Opher Ganel NASA GSFC
NASA Astrophysics Platforms	2:10 pm – 2:50 pm	– NASA's available platforms for testing and advancing technologies – Current funding opportunities	Dr Dominic Benford NASA Headquarters
Additional Q&A	2:50 pm – 3:00 pm	- Each talk has 10 min of Q&A included in the time.	

<https://www.nasa.gov/etam-workshop-webinar-presentation-slides/>

Emergent Technology Themes

Astrophotonics

(as applied to spectroscopy and imaging)

Artificial Intelligence and Machine Learning Algorithms

(for technology development)

Advanced Materials

(meta-materials,
nanofabrication, additive
manufacturing, composites)

Quantum Sensing

(including imaging and
calibration)

- Landscape presentations of state of the field
- Breakout sessions by the four disciplines
- Cross-pollination sessions for interdisciplinary insights

What the Workshop Was and Was NOT



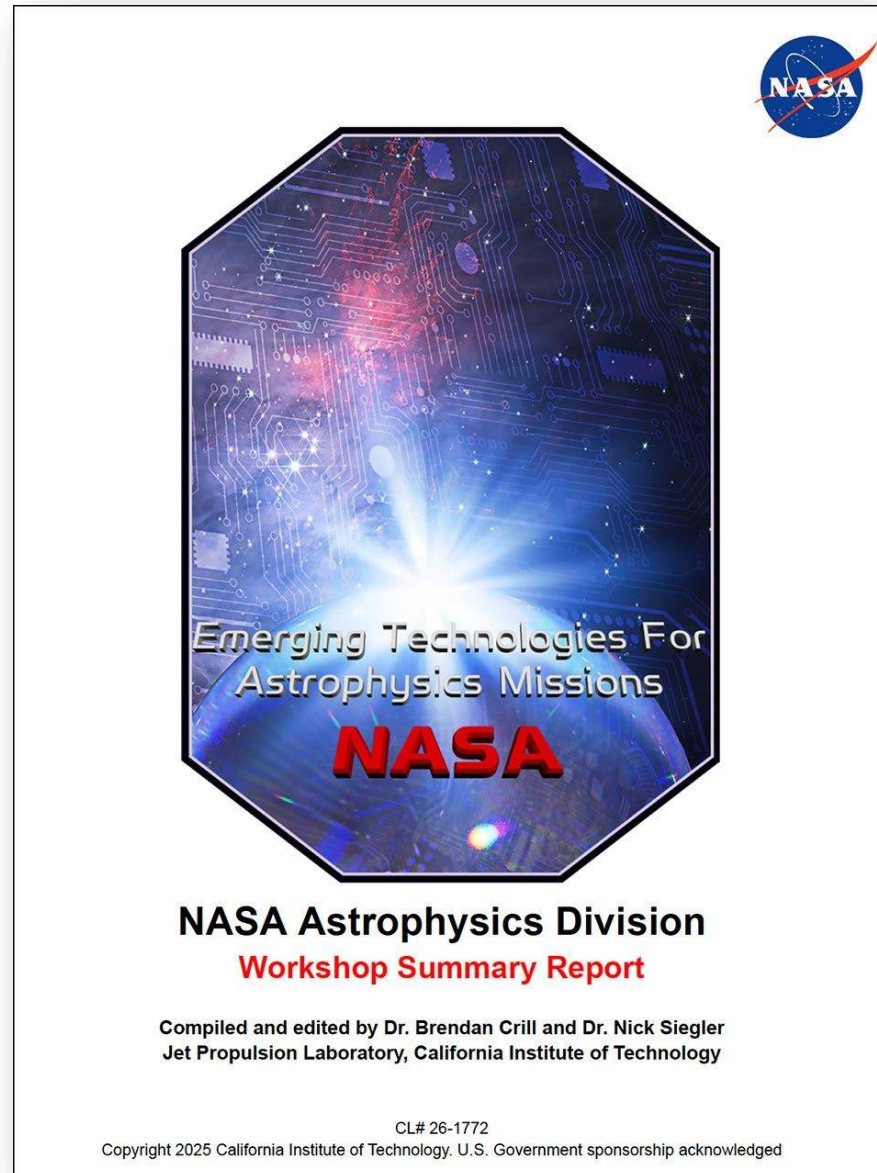
- Not intended to create more R&D activities
- Not intended to solve concrete problems, but to identify applications
- Yes, to true technological breakthroughs
- Yes, to move disruptive ideas to a higher technology readiness levels
- Yes, to push innovative solutions on their path to mission infusion

Breakout Groups Created Lists of Prioritized Technologies

Technology	Description / Capabilities	Science Applications & Benefits	Technical Benefits	Key Challenges
Programmable Photonic Integrated Circuits (PICs)	Reconfigurable photonic circuits using Mach Zehnder Interferometer meshes for adaptive optical processing on chip.	Exoplanet imaging and spectroscopy; optical signal processing for different observation modes.	Miniaturization, adaptability, and software-defined optics.	Waveguide loss, broadband performance, power consumption.
Space-Qualified Laser Frequency Combs (LFCs)	Dense grid wavelength calibrators using stabilized laser combs for high-precision spectroscopy.	Enables ultra-precise wavelength calibration for spectroscopy and timing distribution.	Provides an absolute wavelength standard, supports metrology and multiplexing.	Space qualification, power and bandwidth constraints.
Integrated Photonic Spectrometers	Fully integrated spectrometers using AWGs or other designs for compact dispersion and spectral measurement.	Ideal for multi-object and integral field spectroscopy; stable high-resolution measurements.	Reduces size and mass of spectrometers, provides thermal stability.	Bandwidth and efficiency limits, detector integration.



ETAM Workshop Summary Report Available



<https://bit.ly/4zRfgEC>