PHYSICS OF THE COSMOS

PROGRAM ANALYSIS GROUP

REPORT TO THE ASTROPHYSICS ADVISORY COMMITTEE

GRANT TREMBLAY | CHAIR, PHYSPAG EXECUTIVE COMMITTEE

31 MARCH 2022

PHYSICS OF THE COSMOS
PROGRAM ANALYSIS GROUP

The 2022 **PhysPAG Executive Committee**

Chair	Grant **Tremblay**	Smithsonian Astrophysical Observatory
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New Members!	Athina **Meli**	North Carolina Agricultural & Technical State Univ.
New Members!	David **Pooley**	Trinity University

PCOS **NASA Colleagues**

PS	Valerie **Connaughton**
DPS	Sanaz **Vahidinia**
CS	Brian **Williams**
	Jake **Slutsky**
	Stephanie Clark

Currently Active **Science Interest Groups**

X-ray SIG
Inflation Probe SIG
Gravitational Wave SIG
Gamma Ray SIG
Cosmic Ray SIG
Cosmic Structure SIG

PhysPAG Activities (since the October 2021 APAC)

Astro2020 Released 😮 *JWST* Launched 🎉

(Virtual) **Gamma & Cosmic Ray SIG meetings** in lieu of (canceled) AAS Winter meeting

PhysPAG EC Review of the **PCOS Technology Gap List**

Large (160 person) event at **AAS HEAD 19** (Pittsburgh + Virtual)

Expanding Participation in Astrophysics efforts (see Ryan Hickox' talk)

Proposed creation of new SAGs (New Great Observatories, TDAMM)

GRSIG Meeting at forthcoming April APS Meeting (NYC)

Multiple PhysPAG Activities at forthcoming AAS Meeting (Pasadena)

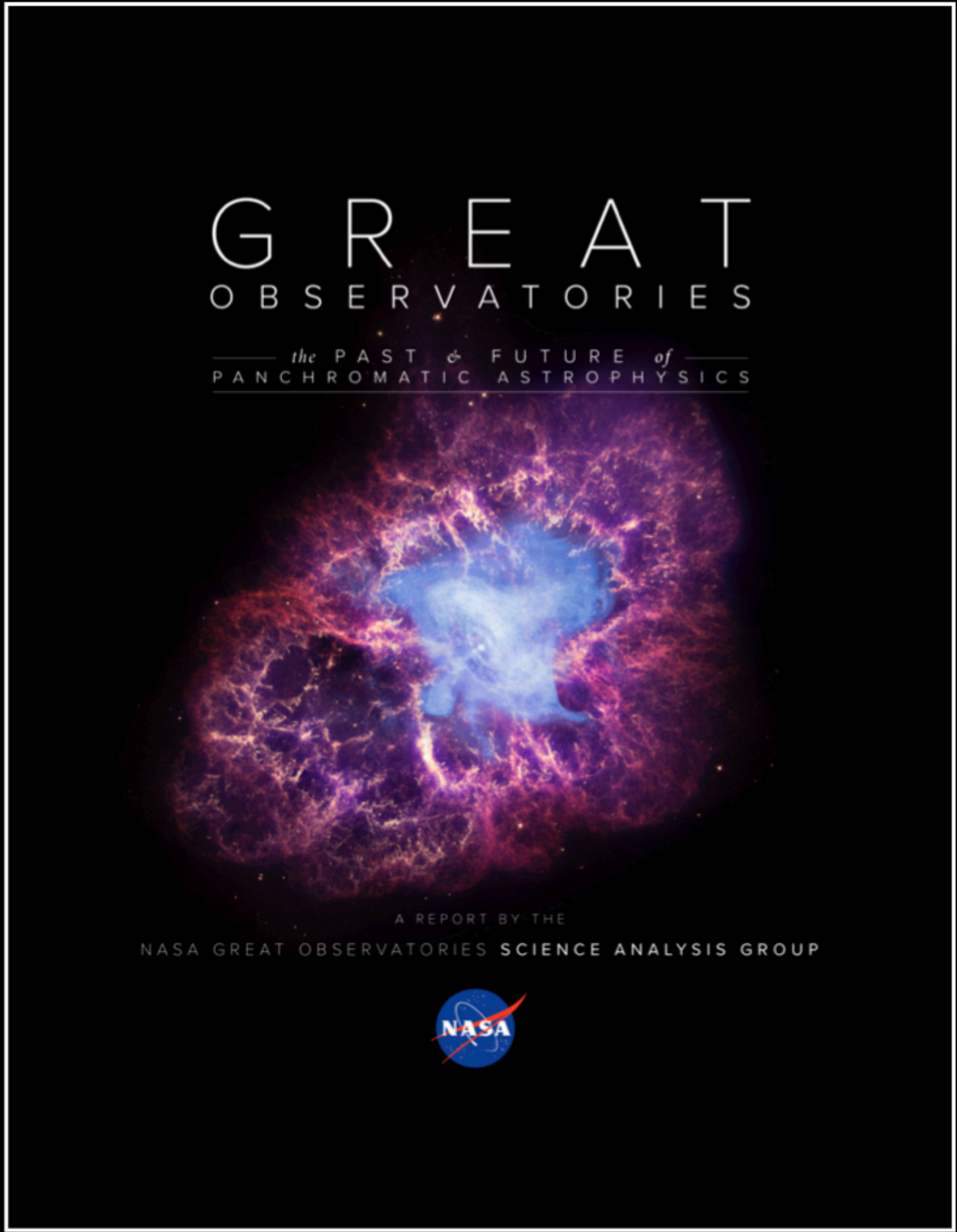
X-Ray SIG AT HEAD 19

A Community discussion on the **future of X-ray astronomy** in the wake of Astro2020

160 people!

Meeting recording available here

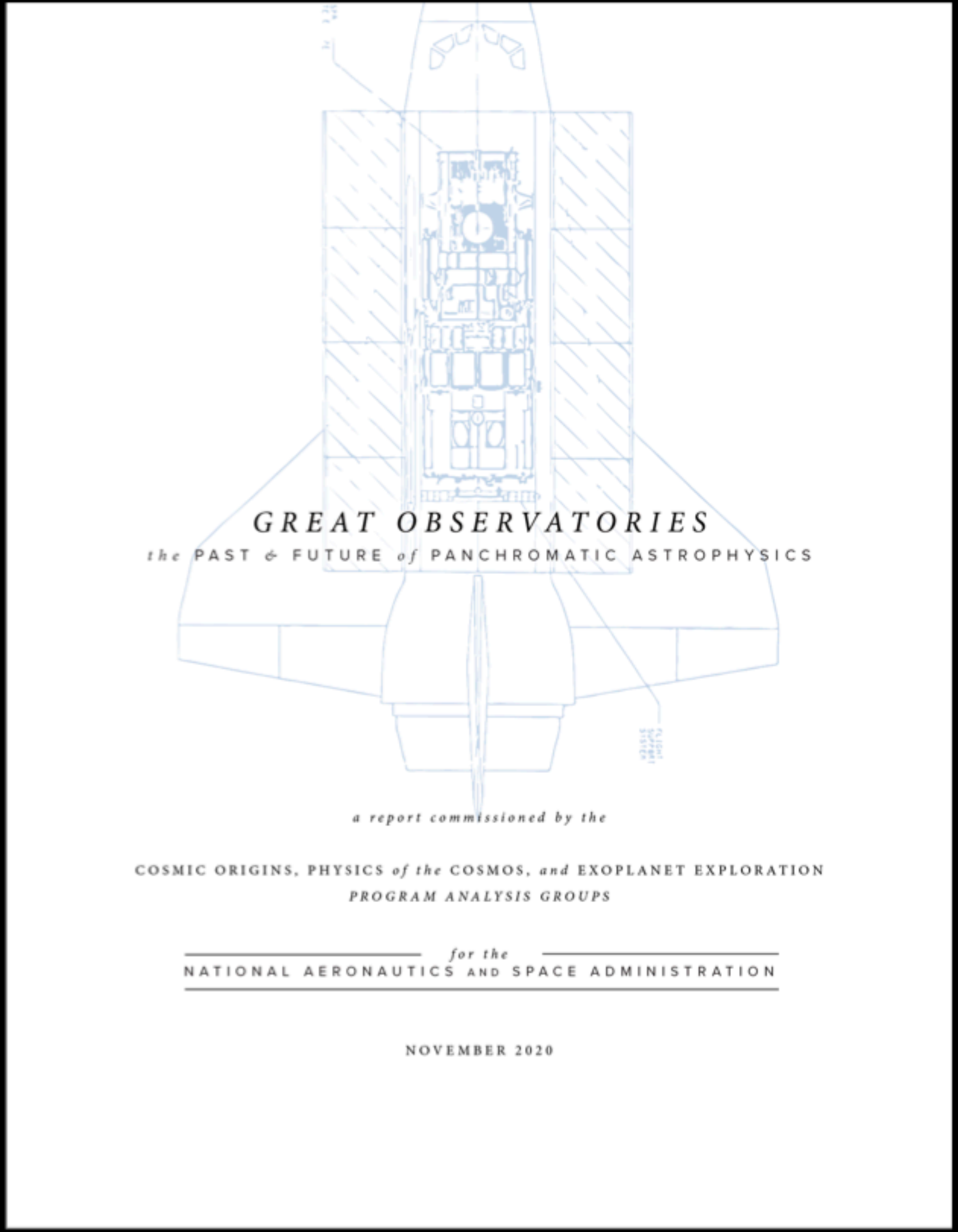
The 2020 Decadal Survey *in* Astronomy & Astrophysics has placed pursuit of a new constellation of *GREAT OBSERVATORIES* as the top national priority for the future of space astrophysics.



The NASA *GREAT OBSERVATORIES* **Science Analysis Group Report**, heavily cited by Astro2020, provides an account of how these four missions changed our country, the world, and our understanding of everything beyond it.

READ THE REPORT NOW AT

www.GREATOBSERVATORIES.org



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INTRODUCTION

NASA's Great Observatories (*Hubble, Compton, Chandra*, and *Spitzer*, Fig. 1-1) have opened up the electromagnetic spectrum from space, providing sustained access to wavelengths not visible, or greatly compromised, from the ground due to Earth's atmosphere. The first, *Hubble*, was launched in 1990, and two of the four (*Hubble* and *Chandra*) are still operating today. Each of these observatories delivered large gains in sensitivity, angular resolution, mapping speed and/or spectral coverage. Together, they have provided the scientific community with a flexible and powerful suite of telescopes capable of addressing broad scientific questions, and reacting to a rapidly changing scientific landscape. Through regular peer-reviewed proposal calls open to the community, this has become a central feature of modern astrophysics, where objects are now routinely observed across the electromagnetic spectrum from the ground and space. It has also become the basis upon which multiple generations of students and post-doctoral scholars have built their careers. However, the concept of the Great Observatories was not an inevitable outcome of a system where communities vied and competed for a share of the limited resources available for new missions.

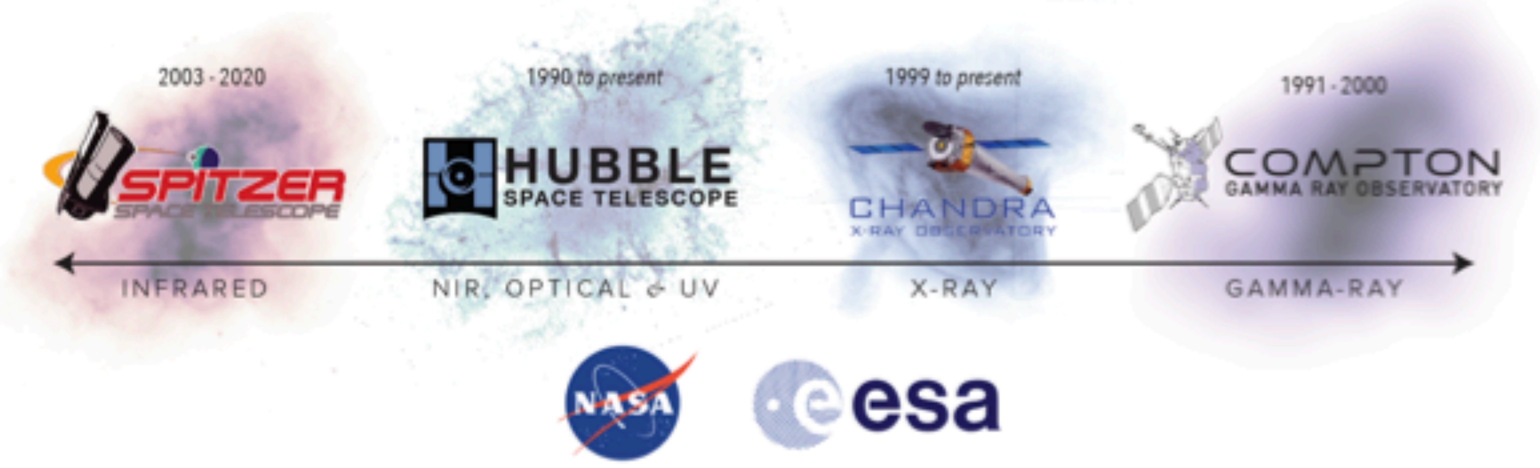


Fig. 1—1. The Great Observatories. *Spitzer, Hubble, Chandra, and Compton, arranged according to the part of the electromagnetic spectrum they observe.*

The concept of the Great Observatories took shape in the late 1970s as scientists and NASA administrators recognized that fundamental strides in astrophysics required access to the entire electromagnetic spectrum, well beyond what could be accessed from the ground, and any single space observatory could deliver. The article "*The Number of Class A Phenomenon Characterizing the Universe*" (Harwit, 1975) served as inspiration first for Frank Martin and later Charlie Pellerin, who succeeded Martin as Astrophysics Division director in 1983 and initiated the study of the Great Observatory concept. By that time, *Hubble* and *Compton* were already approved, and the key issue was how to get support and funding for *AXAF* and *SIRTF* (later *Chandra* and *Spitzer*; both highly ranked by the 1980 Decadal review), which would open up the X-ray and Infrared windows, respectively, so that they could be launched and be operational well before the *HST* and *CGRO* missions were over. The Astrophysics Council, formulated by Pellerin in 1985 and chaired by Harwit, was charged with sketching out a total astrophysics program that would require all four observatories.

read it now at

GREATOBSERVATORIES.ORG

DRAFT | APPROVAL PENDING

A PITCH TO THE APAC

THE NEW GREAT OBSERVATORIES
SCIENCE ANALYSIS GROUP

THE NEW GREAT OBSERVATORIES
SCIENCE ANALYSIS GROUP

A proposed **Joint-PAG SAG** in response to Astro2020

Inclusive and open. We want a broad, diverse subset of the community to participate

In some ways, this is a “sequel” to SAG-10 in the wake of Astro2020’s
Great Observatories Mission & Technology Maturation Program Recommendation

THE NEW GREAT OBSERVATORIES
SCIENCE ANALYSIS GROUP

PROPOSED CHARTER (KEY POINTS)

1. Identify key questions left unanswered by today's space astronomy missions, building on the SAG-10 report

2. Synthesize notional science cases for a future fleet of New Great Observatories, specifically those recommended to enter Astro2020's Maturation Program (i.e. IR/O/UV, X-ray, FIR)

3. Identify important questions not raised by Astro2020 (or the four Large Mission Study Reports) that can be addressed by multi-wavelength observations.

4. Identify science gaps that might be close should these observatories enjoy contemporaneous flight

TIME DOMAIN & MULTI-MESSENGER

SCIENCE ANALYSIS GROUP

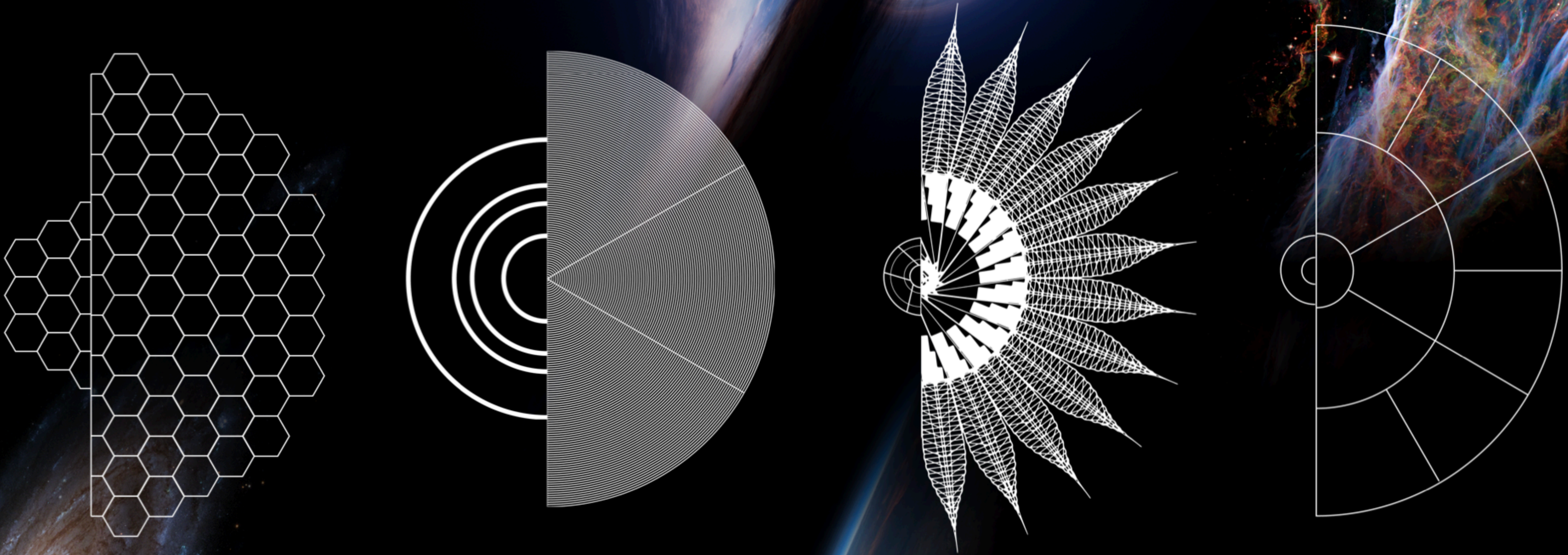
DRAFT LANGUAGE FOR CHARTER

1. Are existing NASA community funding mechanisms meeting the needs of TDAMM science? Are studies quantifying projections for future missions supported through current means? If gaps are identified, what scientific or technical advances are limited by these gaps? **(Abridged)**

2. Are event alert mechanisms being supported and built (by NASA or even NSF w.r.t. Rubin) sufficient for coordination between future ground and space facilities? What gaps exist?

3. What are key space-based wavelengths for multi messenger astronomy? What are the key capabilities necessary across wavelength ranges? What types of mission and mission scales, within Astro2020's recommended funding envelope, could accomplish these science requirements?

YOUR PAGS ARE READY



PhysPAG, ExoPAG, and COPAG are **energized and ready to work** in the wake of Astro2020

We are ready to help with, e.g. **Analyses of Alternatives** that must be commissioned.
We can explore questions like:

How do decadal recommendations differ from input recommendations of large mission concepts?

Have any of the goals or science objectives put forth in the recommended mission's study been modified by the Decadal Survey?

Have any of the technologies or methods in the recommended mission's study been modified by the Decadal Survey?

Are the mission goals separable in a way such that some of the science could be achieved quicker or more cheaply by multiple missions?

Are there mission technologies or concepts of operation that could be simplified or significantly changed with better knowledge of some aspect of astronomy or astrophysics before any mission study were to start?

What alternative methods exist for achieving any of the mission goals?