

The National Academies of SCIENCES • ENGINEERING • MEDICINE

# Pathways to Discovery in Astronomy and Astrophysics for the 2020s

Rachel Osten Astro2020 Executive Officer Steering Committee member

nap.edu/astro2020

### Realizing the Astro2020 Program: **Pathways From Foundations to Frontiers**

#### **Explore the Cosmos**

- Worlds and Suns in Context
- New Messengers and New Physics
  New Windows on the Dynamic
- Cosmic Ecosystems

- · Pathways to Habitable Worlds
- Universe
- · Unveiling the Drivers of Galaxy Growth

#### Forge the Frontiers

- Enable U.S. community participation in ELT program
- Develop and Implement Cosmic microwave Background S4 (joint DOE)
- Begin ngVLA design, technical demonstration, construction
- Upgrade IceCube to Gen2 (NSF/PHY)
- · Begin implementation of an Infrared/Optical/Ultraviolet large strategic mission for exoplanet exploration and general astrophysics after a successful maturation program

#### Enable Future Visions

Develop technology for future gravitational wave upgrades and observatories (NSF/PHY)  Commence Great Observatories Missions and **Technology Maturation Program** 

First entrant: IR/O/UV missions

Second entrants: Far-IR and X-ray missions

Space-Based

#### Sustain and Balance the Science

- Augment mid-scale programs, add strategic competitions
- Implement time domain & multi-messenger program
- · Compete probe missions in strategic areas of Far-IR and X-ray Astrophysics

#### **Build the Foundations**

- · Expand grants to bring science and ideas to fruition
- Develop and diversify the scientific workforce •
- Support data archives and curation
- Bolster theory underpinnings

Ground-Based

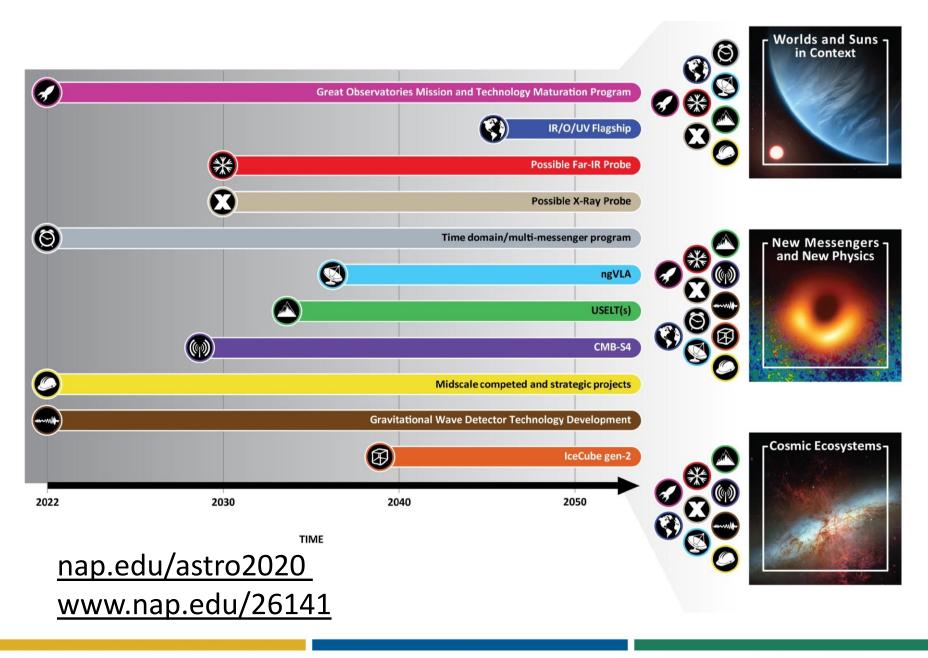
Advance crucial laboratory measurements

· Promote scientific literacy and engage the public

Expand support for early-stage and basic technology development

#### **Guiding Principles**

- · Balance the portfolio
- · Broaden and optimize the science
- Advance diversity and equity
- · Nurture sustainability



The National Academies of SCIENCES • ENGINEERING • MEDICINE

## Important Take-aways of the Pathways report:

- Taking the agencies at their urging to be *inspirational, aspirational, transformational,* but also
  - realistic, responsible, achievable, sustainable
- Interconnected nature of the science
  - Multiwavelength approach to address science questions
  - Synergies of ground & space
- Unprecedented involvement of the community
- Attention to trifecta of minds, measurements, and machines
- There is no one "winner" of the decadal we all win with this approach