

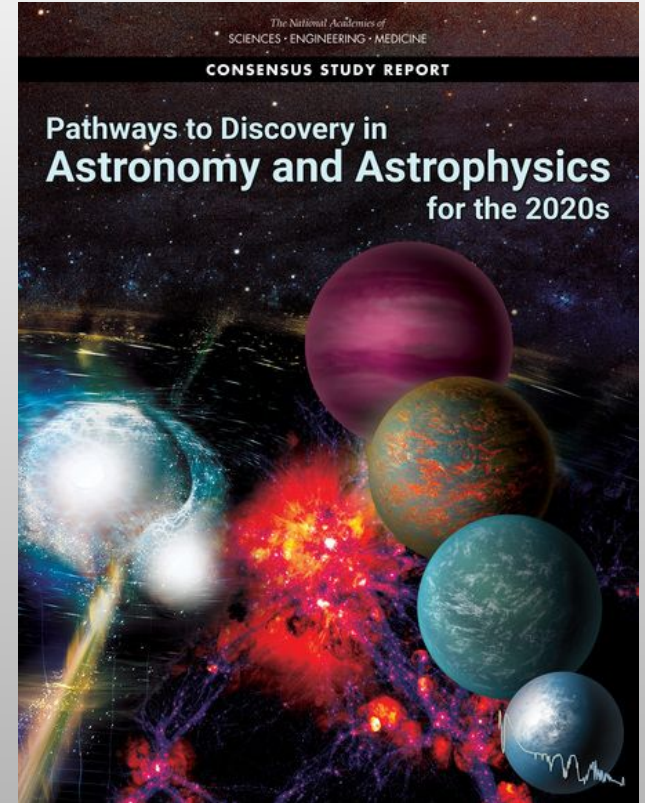
The Multimessenger Science and Facilities Snowmass White Paper

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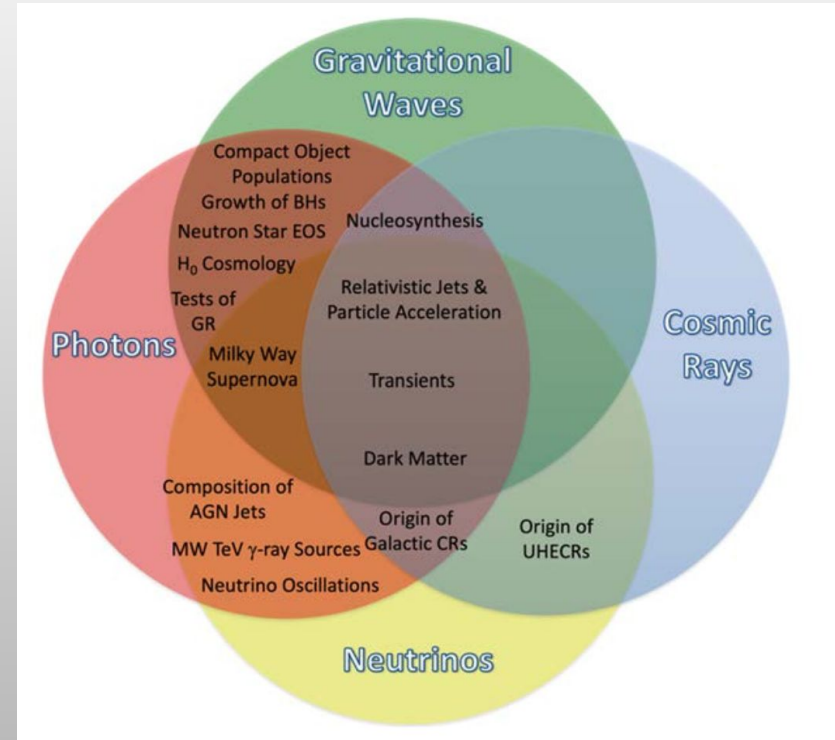
New Messengers and New Physics

- Multimessenger science is revolutionizing our understanding of the Universe.
- Multimessenger science is a central theme of Astro2020.



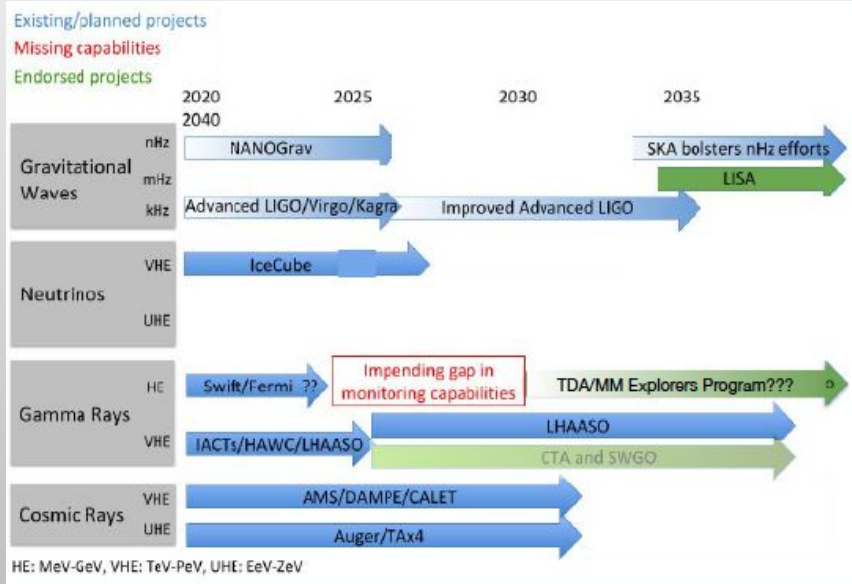
Multimessenger Science *Enables* Fundamental Physics

- MM observations can test or reveal physics in ways that are not possible on Earth.
- Access to 3 of the 4 messengers provided by *physics programs*.

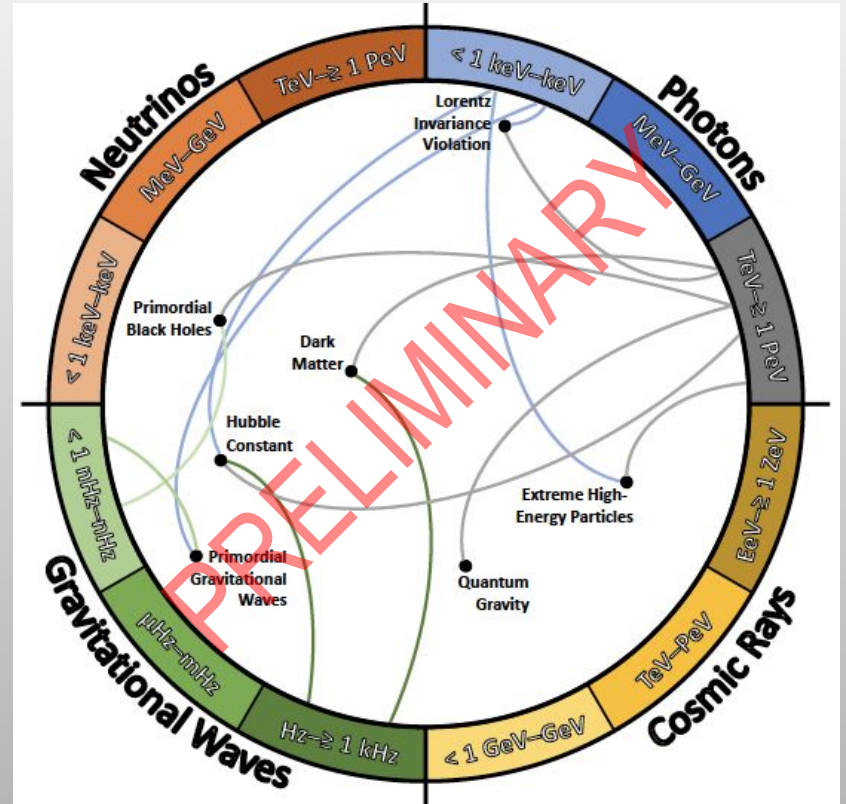


Source: Astro2020 Decadal Survey

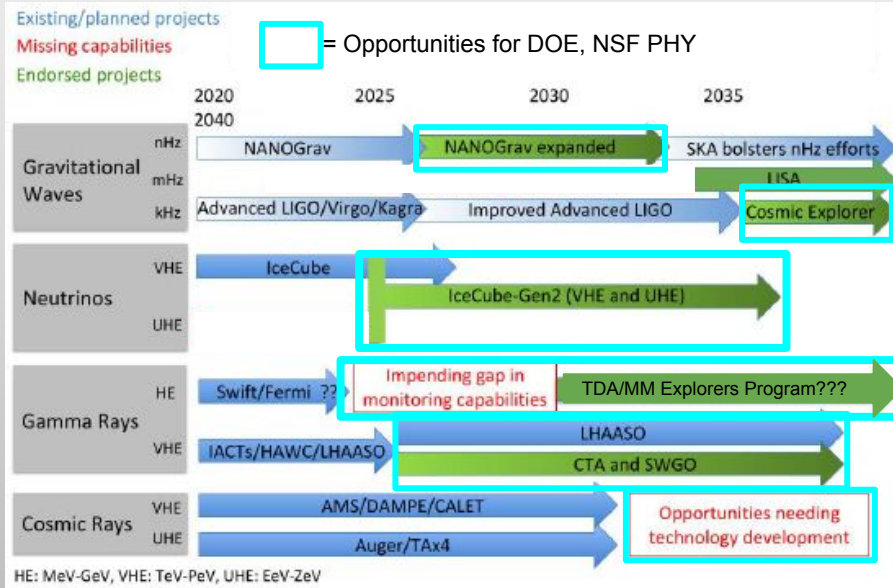
Current Multimessenger Landscape



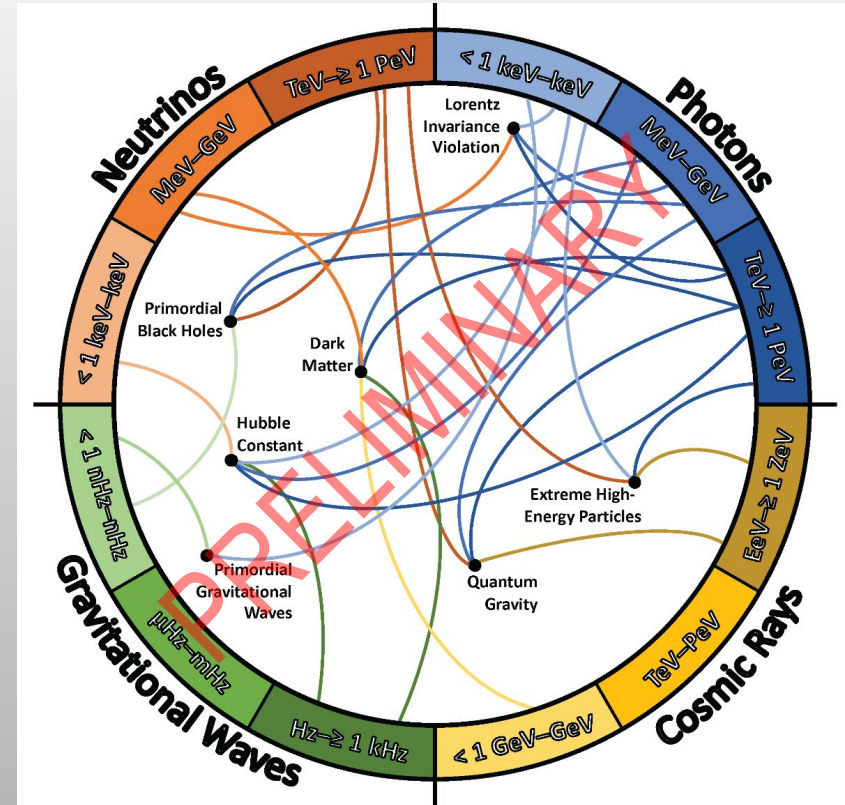
Source: Astro2020 Panel on Particle Astrophysics and Gravitation



Opportunities from Expanded MM Landscape



Source: Astro2020 Panel on Particle Astrophysics and Gravitation



Goals of the white paper

- To identify physics and astrophysics that is uniquely enabled or greatly enhanced by MM observations.
- To provide a blueprint of a portfolio of facilities and experiments that will collectively realize the 20-year vision of MM science.

A note about scope:

- Each messenger has at least one solicited Snowmass white paper; our focus is on science that is enabled by observations and detections in more than one messenger

White Paper Outline

Executive Summary

1. Introduction
2. Tests of Fundamental Physics
 - 2.1. Cosmology
 - 2.2. Dark Matter
 - 2.3. Lorentz Invariance Violation and Spacetime Structure
 - 2.4. Extremely High-energy Particles
 - 2.5. Primordial Black Holes
3. Multimessenger Synergies in Particle Astrophysics
 - 3.1. Stellar Mass Compact Object Binaries
 - 3.2. Massive Compact Object Binaries
 - 3.3. Active Galactic Nuclei
 - 3.4. Tidal Disruption Events
 - 3.5. Other Transients
 - 3.6. Diffuse Backgrounds
4. The Current and Future MM Network
 - 4.1. The Current Landscape
 - 4.2. The Multimessenger Vision
 - 4.3. Enabling Technologies
 - 4.4. Real-time Alert Network Coordination
 - 4.5. MM Facilities
5. Data Management
 - 5.1. Data Archiving
 - 5.2. Data Access
 - 5.3. Software
6. Conclusions

Timeline

1. Create outline and inform the community: Nov. 5
2. Solicit contributions: Nov. – Jan. (36 confirmed contributors; *Thank You!*)
3. Deadline for contributions: Feb. 4 – 11
4. Editing period: Feb. – early Mar.
5. Coordinators draft Introduction and Conclusion: end of Feb.
6. Circulate among contributors: end of Feb. – early Mar.
7. Submit to CF7 (post on arXiv): Mar. 15
8. Solicit feedback from wider community: Mar. 15 – Jun.
9. Final version on arXiv: Jun.

Additional Information

- Read only link to WP: <https://www.overleaf.com/read/kzyjhmbjkytf>
- Public Slack channel: #wp-cf07-multi-messenger
- Sign-up sheet:
<https://docs.google.com/spreadsheets/d/1k9zC3OuBC1FBnzlohNpHdjc8mQDn1AyAml3i7Wop3Zc/edit?usp=sharing>

Backup Slides

WP Philosophy

Key questions to be addressed:

1. What is the current status of the field?
2. What facilities and capabilities will we have or develop in the next decade and what kinds of MM science will be achievable with these capabilities?
3. What are the big questions that will require a new generation (~20+ years) of MM facilities?

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