

Cosmic Explorer Progress and Plans



Matthew Evans, on behalf of the Cosmic Explorer Team



A Horizon Study for

Cosmic Explorer

Science, Observatories, and Community

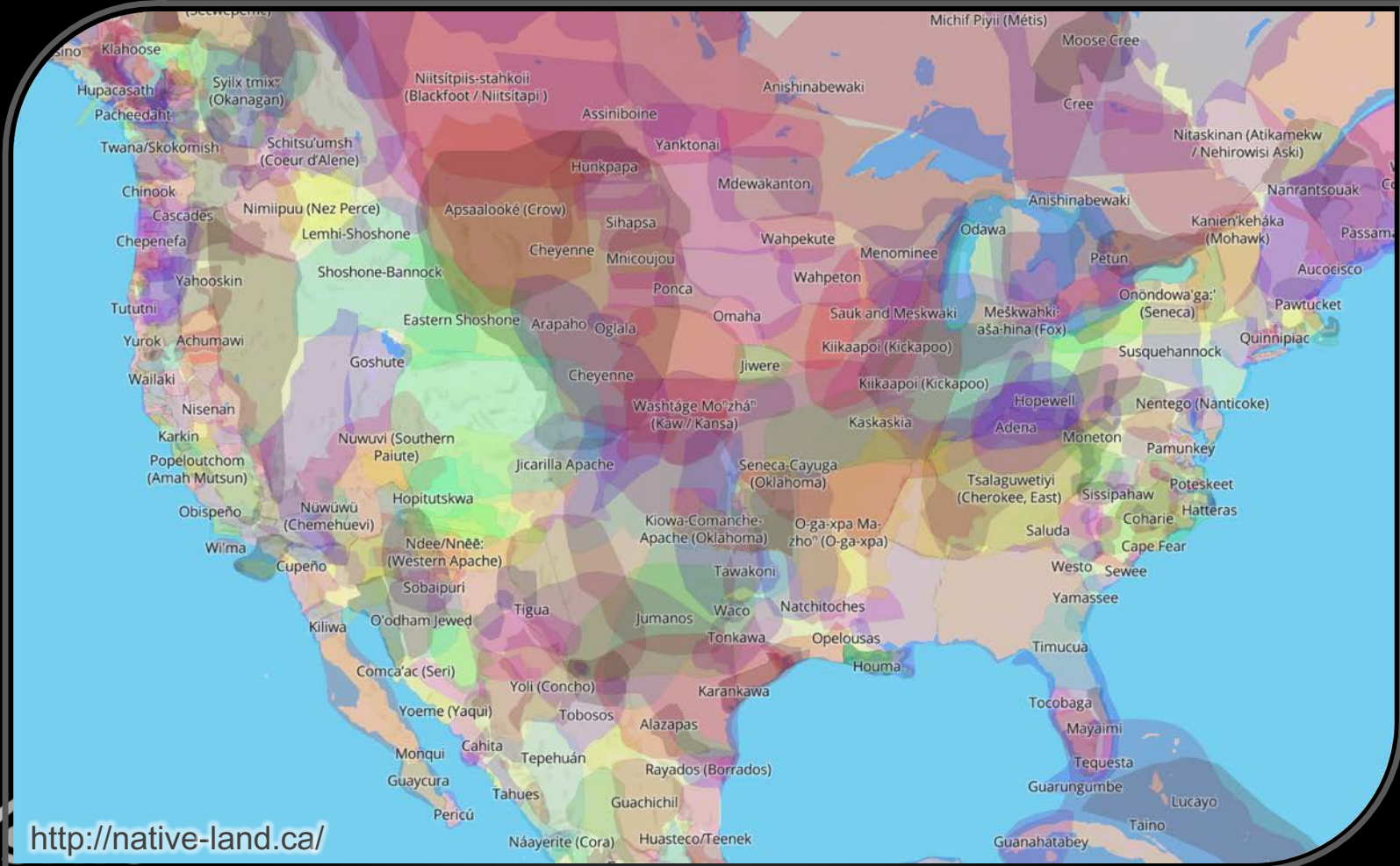




Getting Started

- Your input and involvement is important to CE:
 - **CE Horizon Study available at cosmicexplorer.org**
 - dcc.cosmicexplorer.org/CE-P2100003/public
 - **And your feedback is much appreciated!**
 - cosmicexplorer.org/horizon-study-feedback
 - **CE will be built by this community.**
Please join the CE consortium
 - cosmicexplorer.org/consortium.htm
- EDI play a central role in our thinking about CE. I'll start with a few words about one EDI aspect of the CE project...

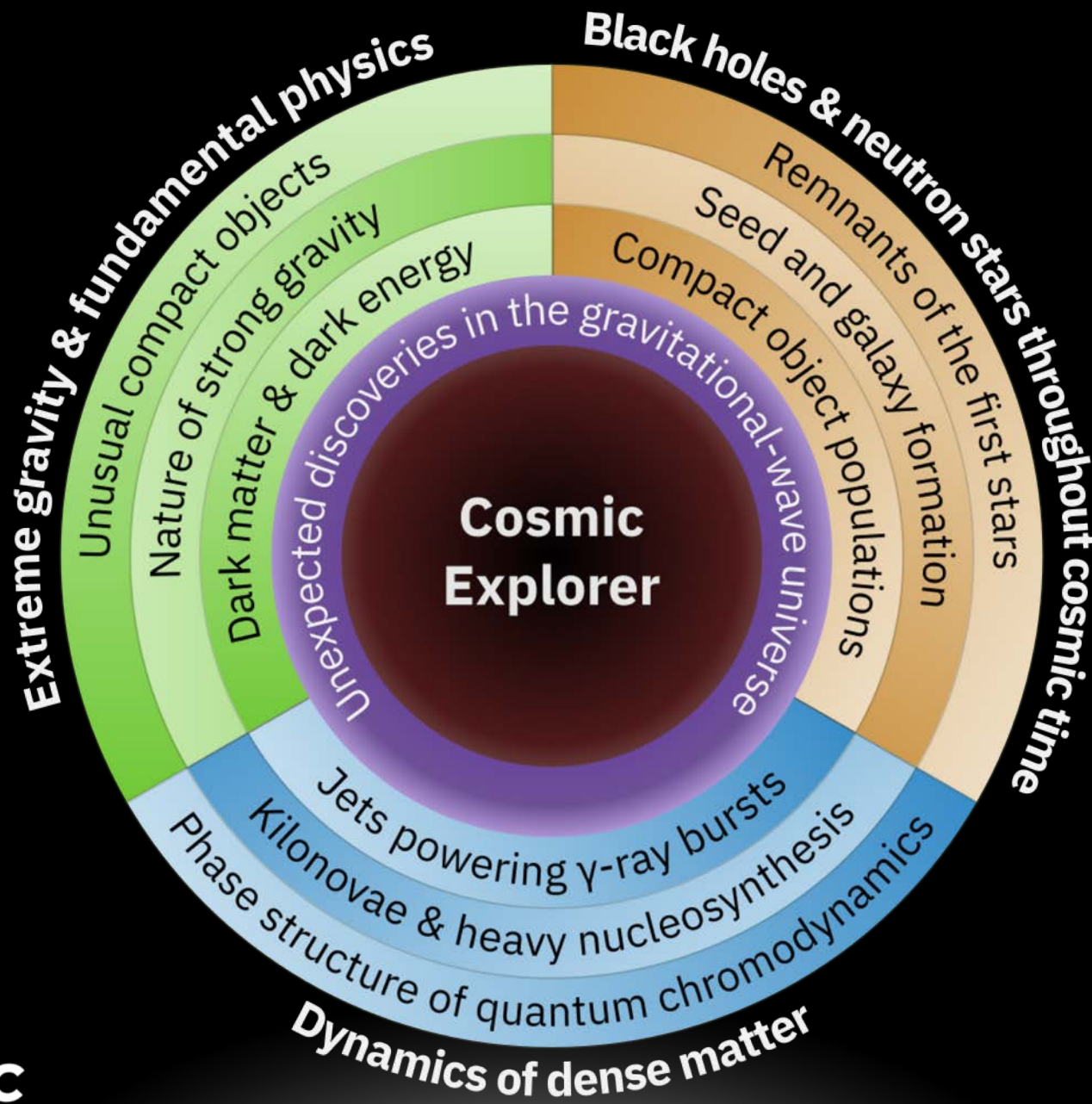
No matter where we build Cosmic Explorer, the history of the land will play a **pivotal** role in this project. We will have the **opportunity**, and obligation, to work with Indigenous Peoples to build synergistic relationships and to ensure that we respect their land, their culture and their sovereignty.



<http://native-land.ca/>

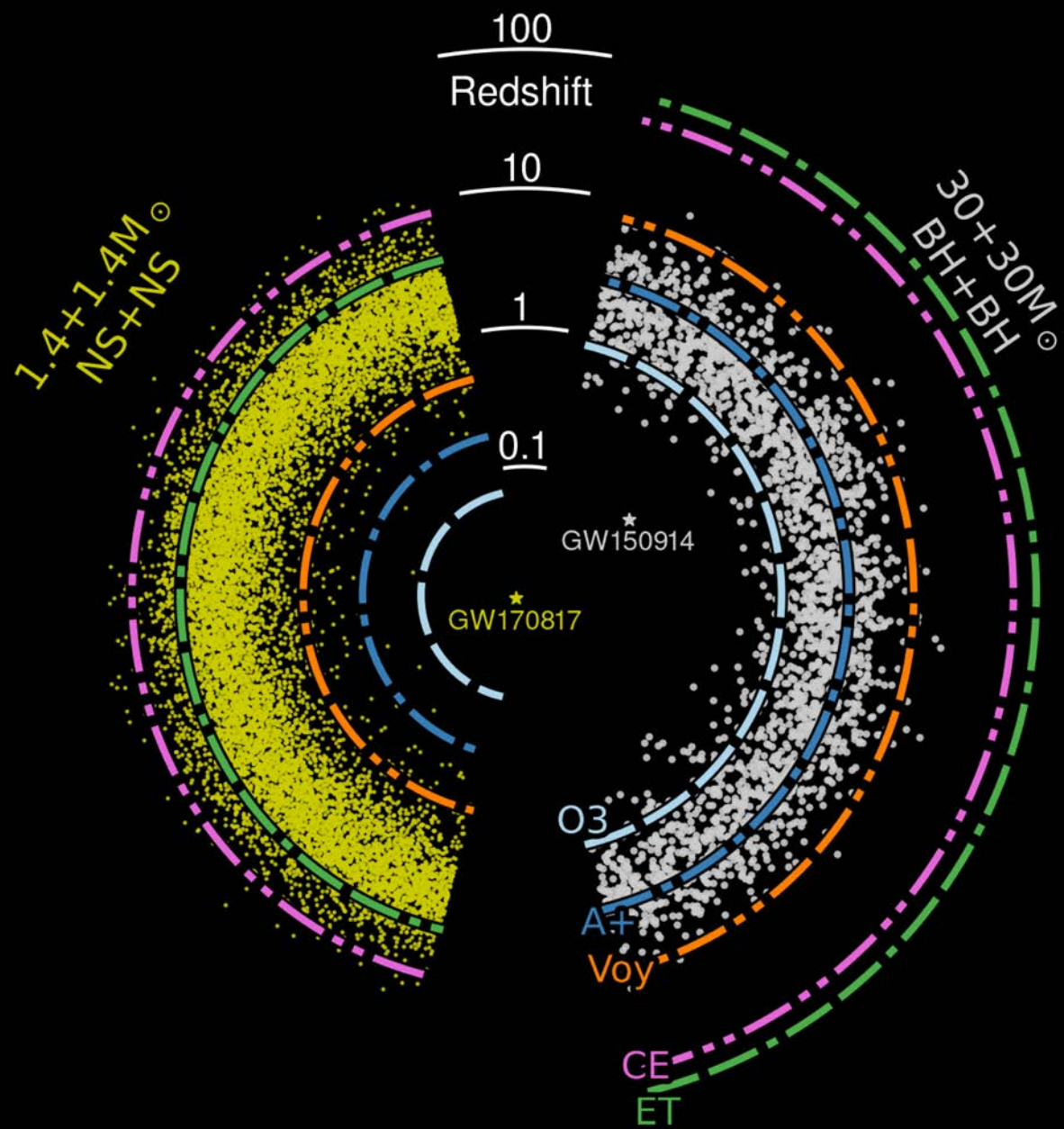


If you are not aware of issues surrounding TMT, please read [arXiv:2001.00970](https://arxiv.org/abs/2001.00970) .





Black Holes & Neutron Stars
Throughout Cosmic Time

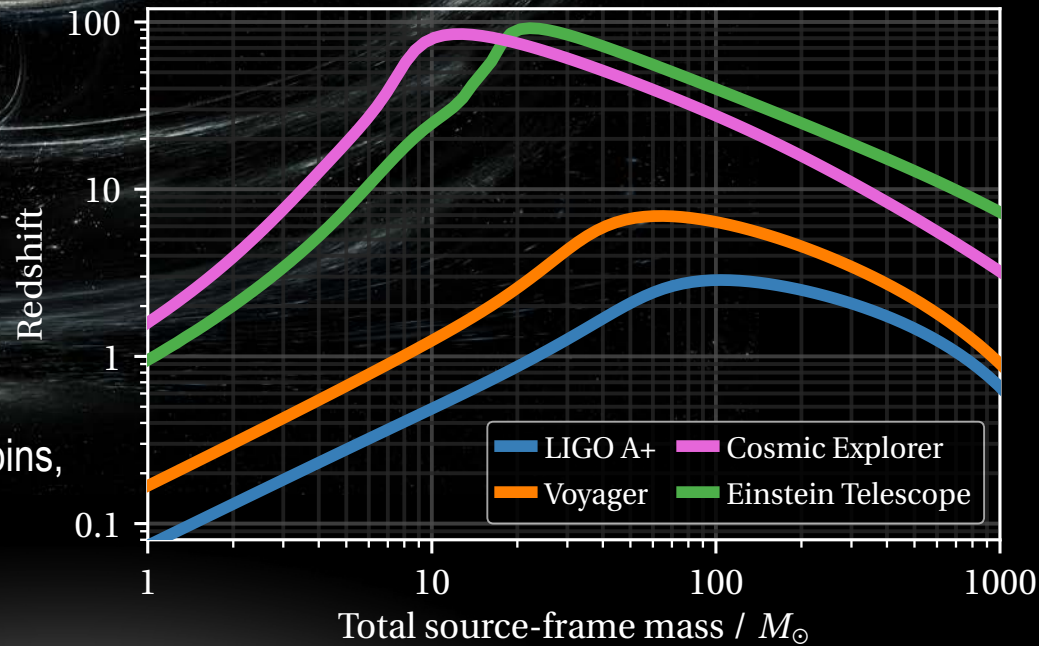


Precision tests will be enabled by black hole mergers like those seen now (~ 30 solar mass, at $z \sim 0.3$), which will have an SNR ~ 1000 in CE.



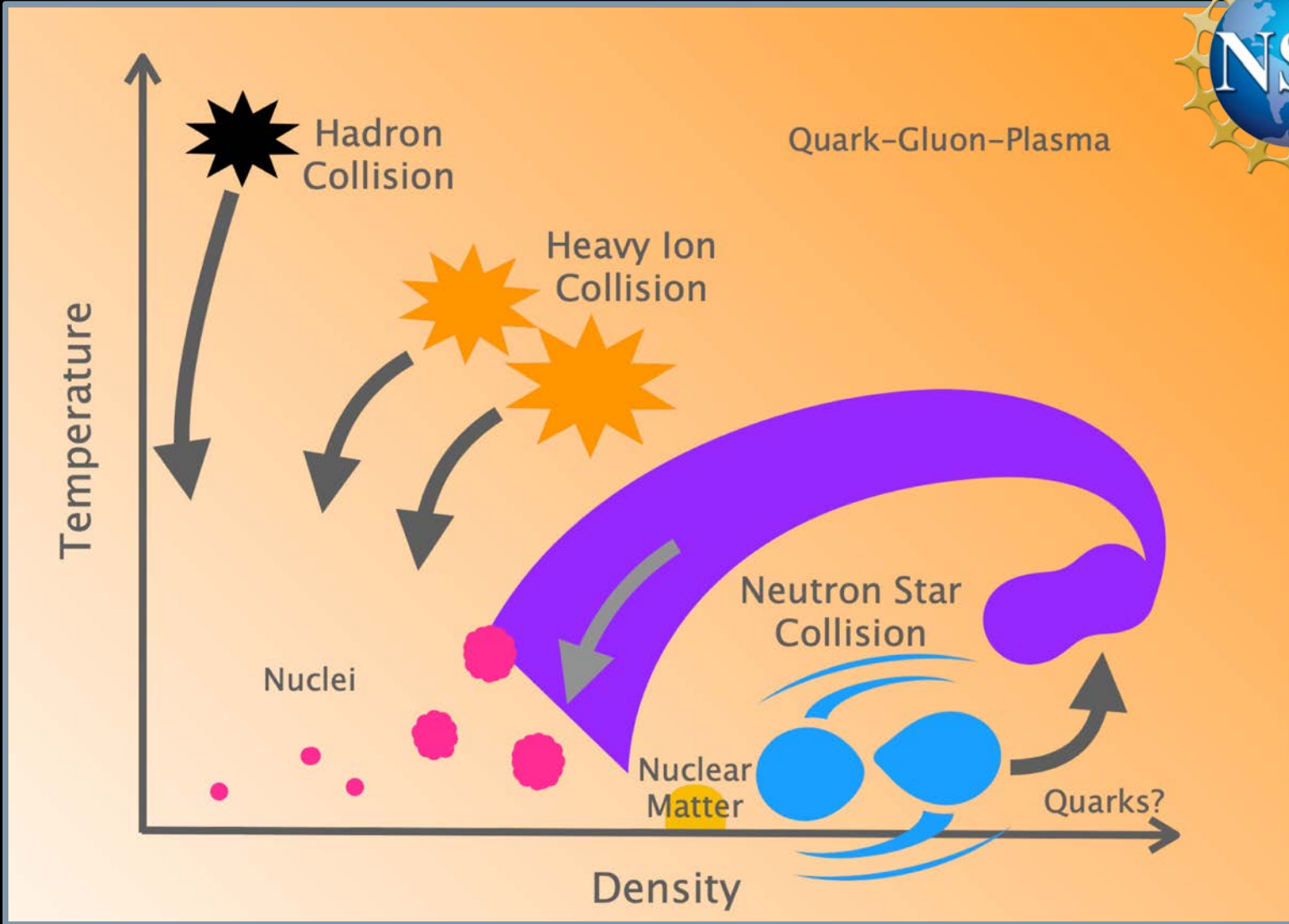
Extreme Gravity
& Fundamental Physics

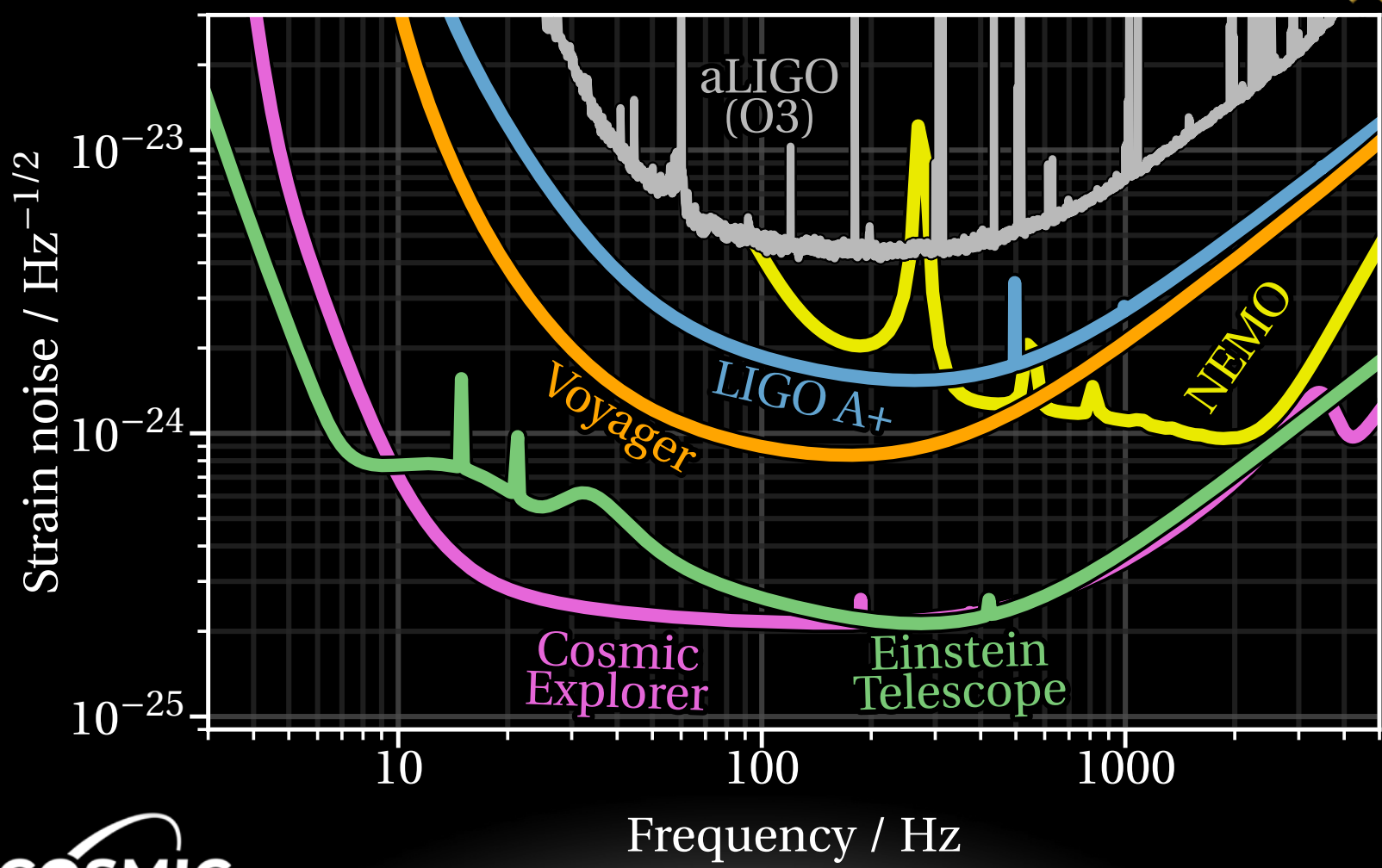
With thousands of BBH events per day, we will be able to cherry pick the most telling events (high spins, large kicks, edge-on, high ellipticity, etc.).

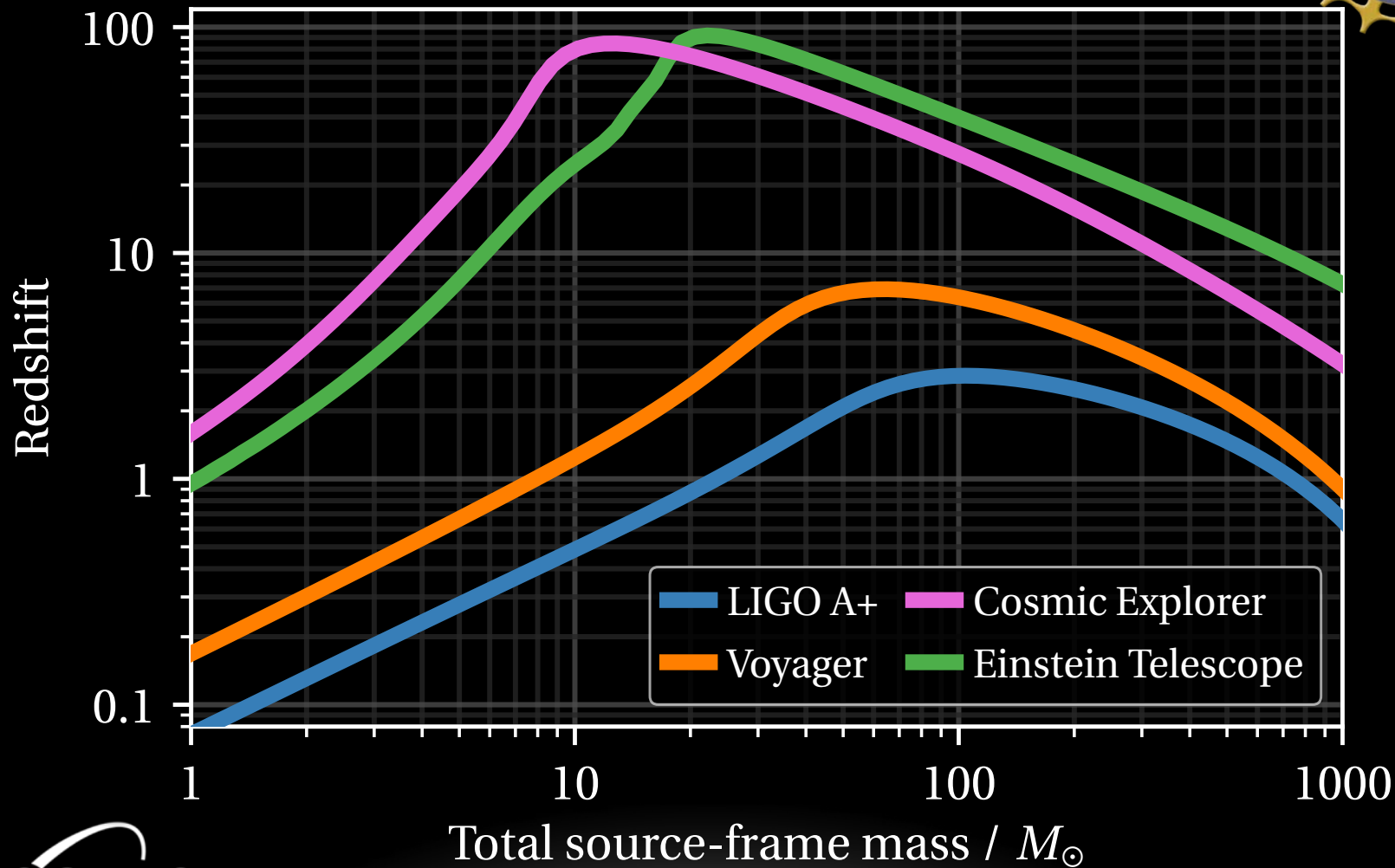




Dynamics of Dense Matter & Extreme Environments





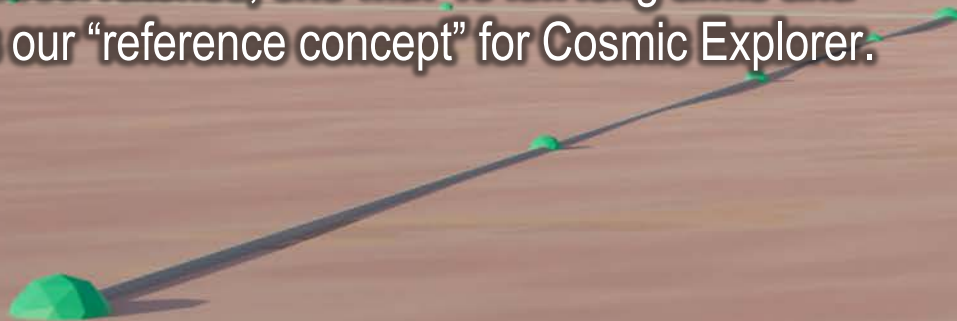


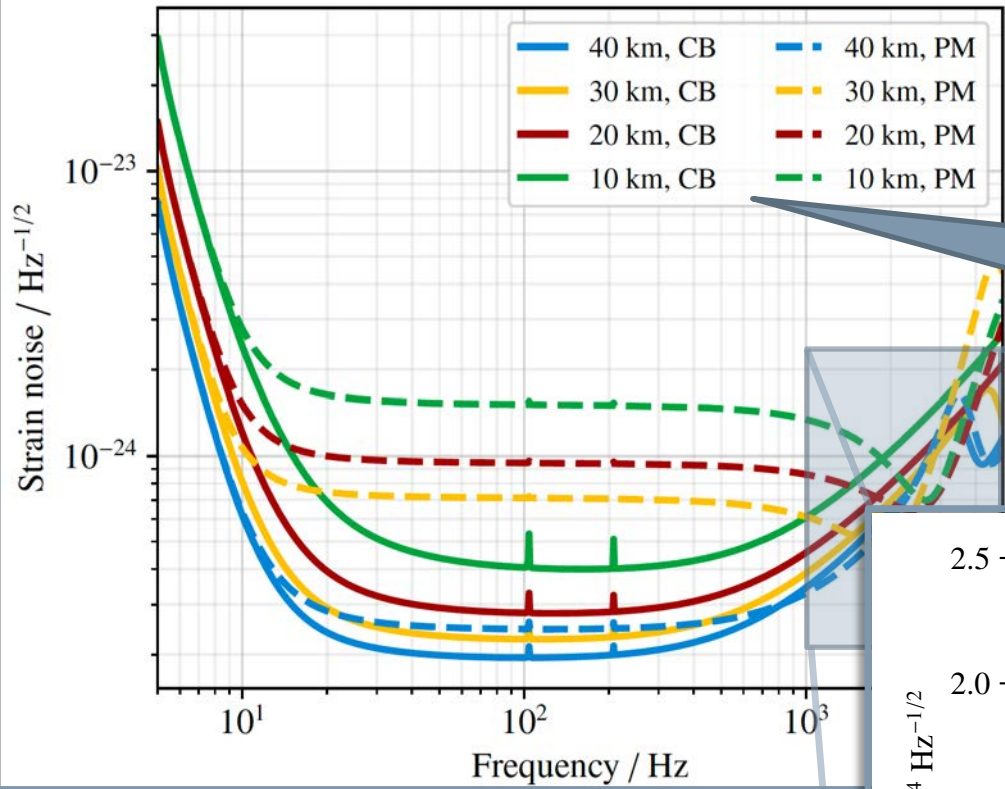


A Science-Driven Design for CE

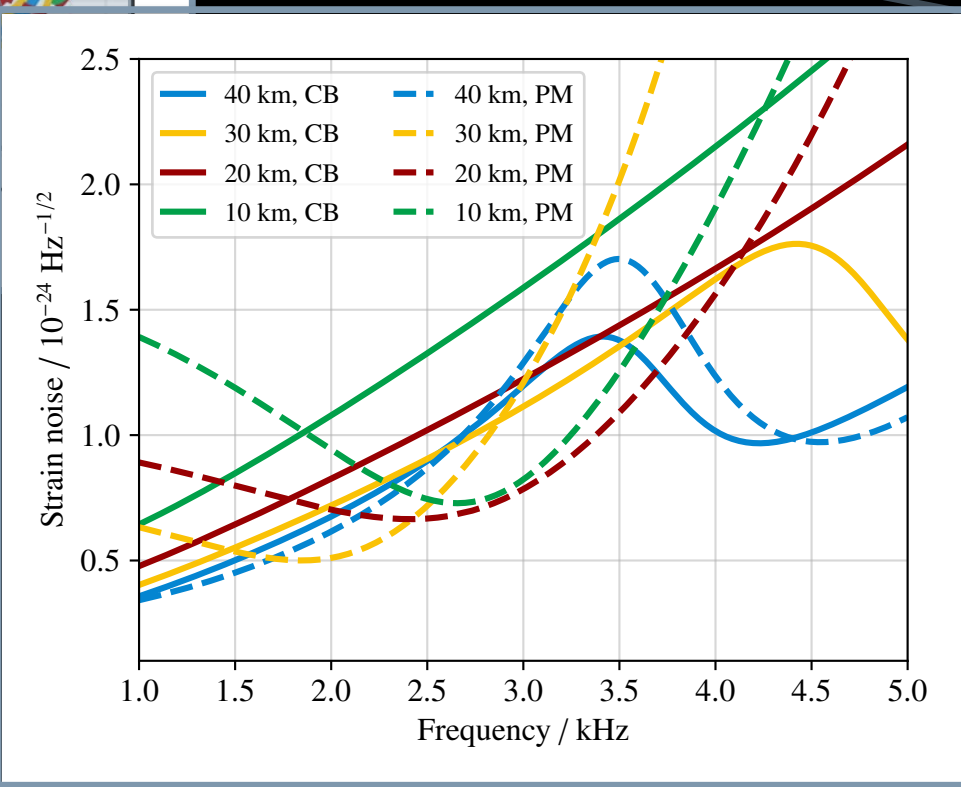
- In the Horizon Study we explore a variety of potential CE designs, and address questions such as:
 - Why is ground-based laser interferometry the best way to achieve our science goals?
 - Why are we considering large L-shaped above-ground facilities?
 - What are the advantages of 1 vs. 2 or more facilities?
- The CE approach — seek to optimize detector length and design for maximum science while minimizing technical risk and complexity

We identify a combination of two observatories, one with 40 km long arms and the other with 20km long arms, as our “reference concept” for Cosmic Explorer.



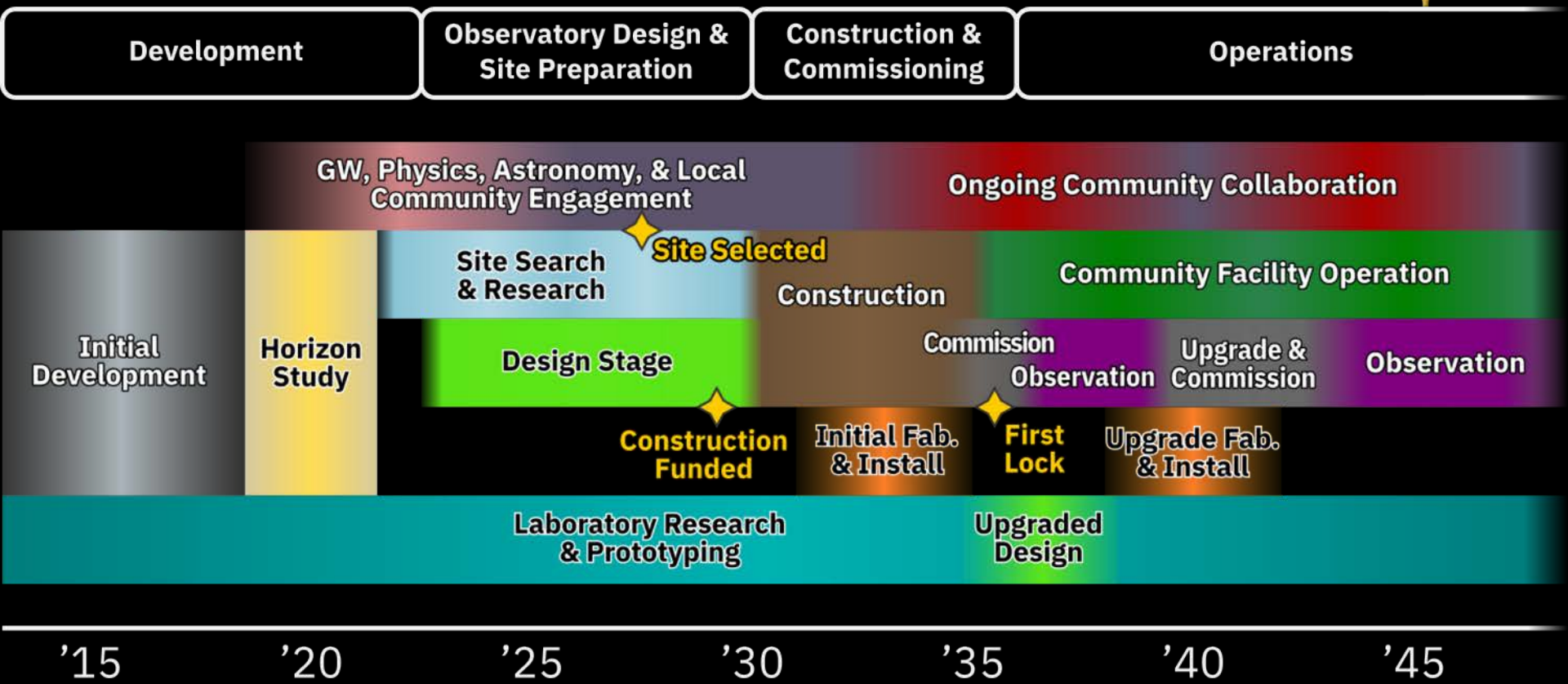


PM = post-merger optimized
CB = compact binary optimized





Cosmic Explorer Timeline





The Message

- Next-Generation Observatories have great potential!
 - Cosmic Explorer and ET are moving forward
 - We are guided by researchers like you!
- Your input and involvement is important to CE:
 - **CE Horizon Study available at cosmicexplorer.org**
 - cosmicexplorer.org/horizon-study-feedback
 - **CE will be built by this community.**

cosmicexplorer.org/consortium.html



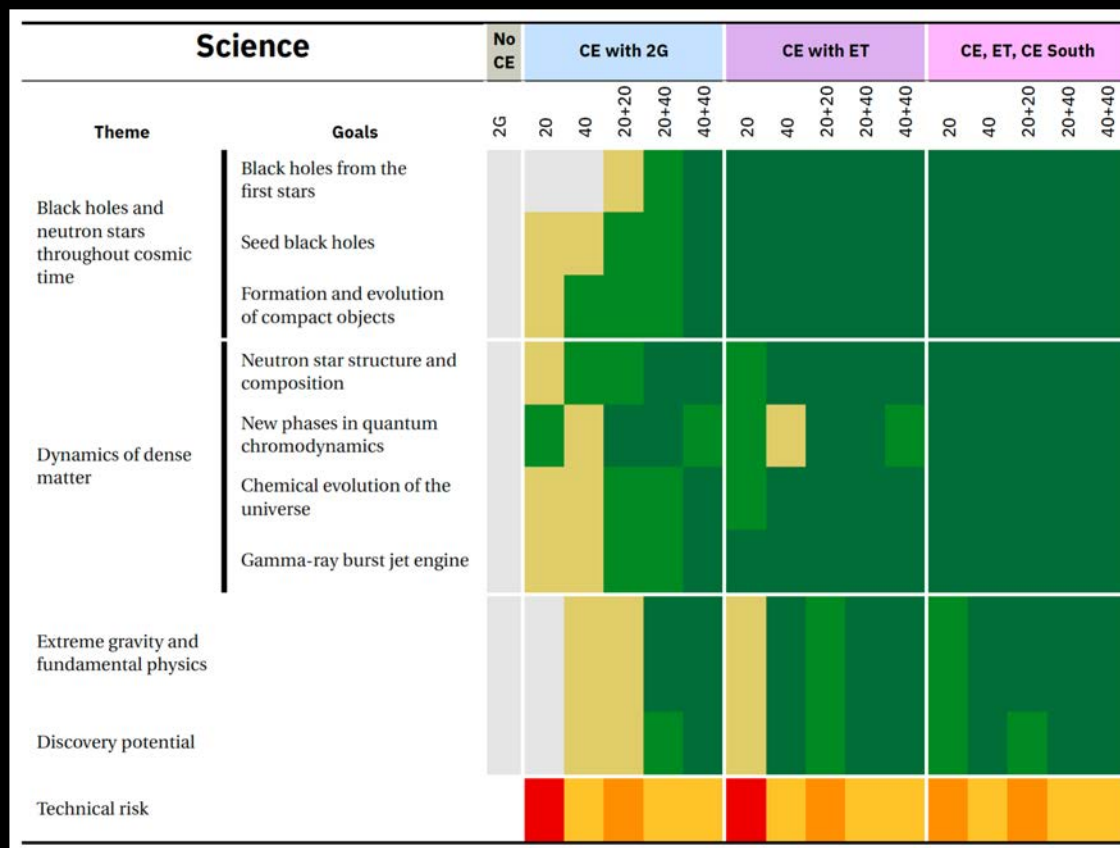


Extra material



7) Optimizing Design Performance

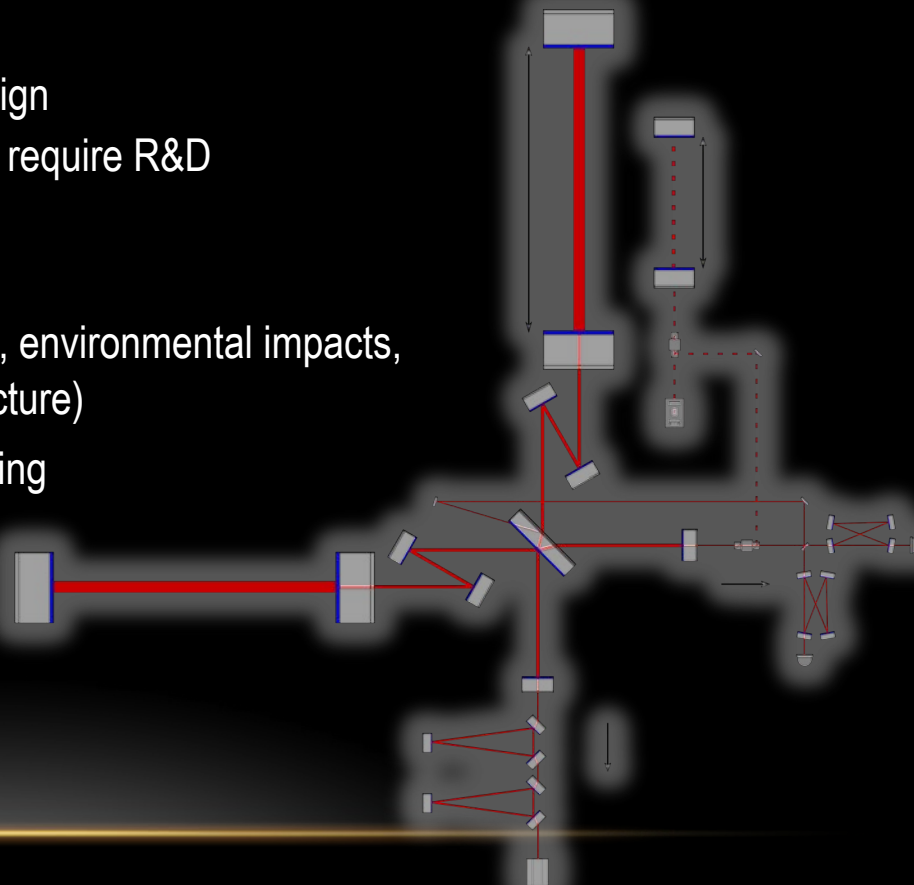
A study of how design choices impact the key science goals, in the context of a global network with ET and CE South





8) Technical Overview and Design Choices

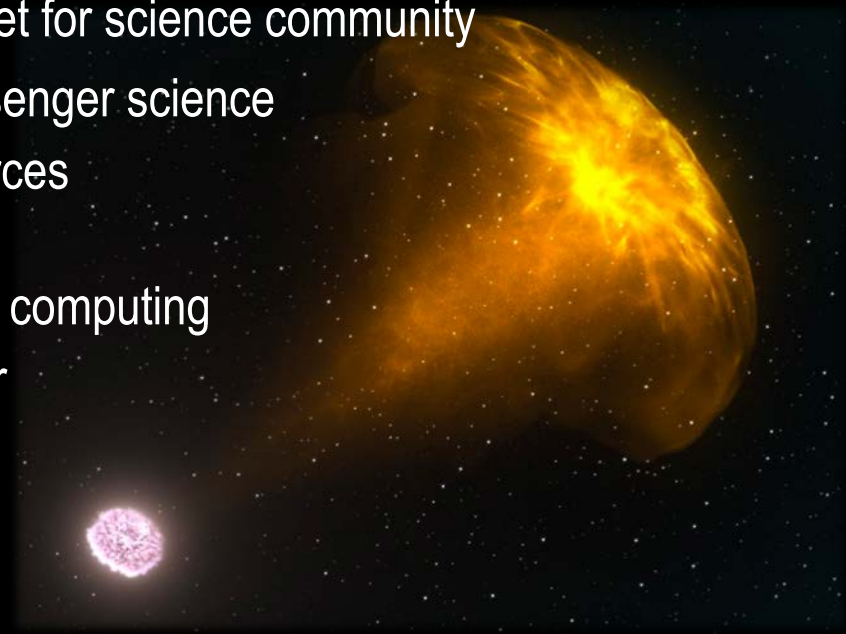
- This section provides a technical overview of the Cosmic Explorer Observatory including
 - technical siting considerations (seismicity, infrasound, etc.)
 - required infrastructure
 - vacuum system requirements and design
- It also outlines the key technologies that will require R&D to enable the CE science goals.
- Finally, other key considerations including
 - Choice of site (esp. local stakeholders, environmental impacts, natural hazards, surrounding infrastructure)
 - Cost vs. Arm length – not a linear scaling
 - Beamtube material and diameter





9) Data Management, Analysis, and Computing

- Here we present a vision for providing CE data to the scientific community
- Describe plans for Open Data and dissemination of
 - Production of clean, calibrated data set for science community
 - Dissemination of alerts for multi-messenger science
- Estimate the computing and human resources needed to deliver these goals
- Discuss needs for operations analysis and computing
- Discuss areas where support is needed for community's analysis and computing





10) Cosmic Explorer at the Local and Global Scales

The Cosmic Explorer project will develop observatory designs with a **multi-dimensional approach that creates synergy with its respective local, scientific, and global communities**. This includes designing the physical and virtual infrastructure to serve Cosmic Explorer's broad community integration and engagement goals, and developing interpersonal relationships among members of these communities. **Early and ongoing engagement with communities connected with Cosmic Explorer, from local to global, will be crucial to the project's success.**



The logo for Cosmic Explorer features the words "COSMIC" and "EXPLORER" in a bold, white, sans-serif font with a black outline. The text is set against a background of a lunar surface with a large, stylized white arc above and below the word "EXPLORER".

COSMIC EXPLORER



CE: 40 and 20km L, surface, 1 interferometer per observatory

