

## COSMIC EXPLORER

#### CE-G2000044 / LIGO-G2001761

Stefan Ballmer

on behalf of the Cosmic Explorer Team

Oct 7, 2020

Snowmass 2021







- Advanced LIGO worked spectacularly
  - But antenna size << wavelength/4</li>
  - And limited by mirror displacement noise (mostly thermal noise)
  - $\rightarrow$  Scale up! (up to x10 arm length)\_\_\_\_\_\_

Observation Range ∝ strain sensitivity

Enables access to Gravitational Waves throughout Cosmic Time







Accessible Science

Highlights:

- Observing Stellar Mass / Primordial Black Holes Throughout Cosmic Time
- Access to Nuclear Matter at Neutron Star & Post-merger Densities
- Probing Extreme Gravity and Searching for New Physics
- Much more: see other sessions









E. Hall, MIT

# **EXPLORER** Technology R&D



- Improved squeezed light and other quantum metrology techniques
- Large (hundreds of kg), low-loss fused silica optics for test masses
- Large (hundreds of kg) single crystal silicon as a test mass material
- Optical coatings for the larger test masses that have low optical loss and low thermal noise
- Cryogenics with low vibrational noise
- Improved active vibration isolation
- 2 um wavelength technology: high power, low noise lasers, and high quantum efficiency photodiodes
- Low cost UHV vacuum tubes, as the total construction cost of a 40km gravitational wave observatory is driven by the cost of the vacuum system.

Significant technology overlap with particle physics.



- Open to experts inside and outside the LIGO Scientific Collaboration
- Join if interested!
- Upcoming
  CE meeting:
  Oct 26-30 (zoom)

### **EXPLORER** CE Consortium



Cosmic Explorer Home Overview Science News For researchers Join Consortium https://cosmicexplorer.org **Cosmic Explorer** a next generation gravitational wave detector PennState FIRST COSMIC EXPLORER MEETING October 26-30, 2020 Home **Organizing Committee** Schedule Registration REFERENCES **First Cosmic Explorer Meeting** October 26-30, 2020, Online via Zoom

https://sites.psu.edu/cosmicexplorermeeting



### Thank you!



• Questions?

Example location: Bonneville Salt Flats, Utah, USA