Cosmic Explorer

Current Plans and GWADW Impact

Matthew Evans on behalf of the US3G Team
Context, What is Cosmic Explorer (CE)?

- 40km long
- L-shaped
- Single interferometer
Context, What is Cosmic Explorer (CE)?

• 40km long
• L-shaped
• Single interferometer... yes, there are places for that
What can CE do?

[Graphs showing redshift vs. total source-frame mass, and ASD of strain vs. frequency for different detectors: aLIGO, ET, Voyager, CE.]

Horizon 10% detected
50% detected

Redshift

100
10
1
0.1

10
1
1

Total source-frame mass [$M_\odot$]

1 10 100 1000

ASD of strain [1/Hz$^2$]

10$^{-22}$
10$^{-23}$
10$^{-24}$
10$^{-25}$

10 100 1000

Frequency [Hz]

Median source
Best 10% of sources
Optimal source

arXiv:1902.09485
What can CE do?

[Graph showing redshift against total source-frame mass]
Current Plans

• The need to write a white paper for the Astro2020 decadal caused a bit of soul-searching about the CE timeline
• We have a number of Nobel Laureates who think that we stand a good chance of getting CE funded soon if we are ready
• By soon, I mean in less than a decade, and while that may sound like a long time it really isn’t
Current Plans – A CE Centric View

**Cosmic Explorer Stage 1**
- Construction & Commissioning

**Cosmic Explorer Stage 2**
- Installation & Commissioning
- Observations & Operations

**Stage 1 R&D**
- Seismic isolation improvements
- Larger test masses & suspensions
- Squeezing improvements

**Stage 2 R&D**
- Interferometer prototype testing
- Large silicon test masses & coatings
- Cryogenics
- High-power laser
- High-efficiency photodetectors
- Coatings for new wavelength

Timeline:
- 2020
- 2022
- 2024
- 2026
- 2028
- 2030
- 2032
- 2034
- 2036
- 2038
- 2040
- 2042
- 2044
- 2046

Date: 5/23/19
GWADW 2019
A few words about Voyager

“Det er vanskeligt at spaa, især naar det gælder Fremtiden.”
-- Karl Kristian Steincke

“It is difficult to make predictions, especially about the future.”
Impact of GWADW

• What did we learn here?

• A few things that struck me...
Impact of GWADW

• Early warning could be a big driver for 3G low-frequency (talk by Vitale)
  • This needs more study, both in terms of what we can do and what is needed in order to do the best science
  • Is 100 sqdg 1 hour before coalescence good enough?
  • What about 3 sqdg 20 minutes before?
Impact of GWADW

• Engineering a facility, and the surrounding geology, may be critical to Newtonian Noise mitigation

• Both atmospheric and seismic NN must be considered very early in the process (i.e., site selection)

(talks by Badaracco, Fiorucci and Kamai)
Impact of GWADW

• HoQI sensors may be the key to better suspensions and isolation platforms (talk by Cooper)
Impact of GWADW

• There is a lot to learn from the past (talks by Driggers)
  • Alignment control is difficult
  • Low-frequency sensitivity improvement is hard and slow
  • Always assume that absorption is non-uniform
  • Don’t let potential scattering surfaces move
  • We need more sensors, and better grounds
  • ...
Impact of GWAWD

• 2μm is coming (talks by Adya, Veitch and others)

• ... but there is still a lot of work to do!

5/23/19

GWADW 2019
Impact of GWADW

Is the Universe boring?

• We have a chance to make sure that the Universe is not cosmically boring!

What could be more important than that?

(talk by Palmese)
Impact of GWADW

• And much more!

... though I was sometimes defeated in my attempt to see all the talks by parallel sessions and jetlag. My apologies if I missed yours!