Cosmic Explorer

The US Vision for Gravitational-Wave Astrophysics

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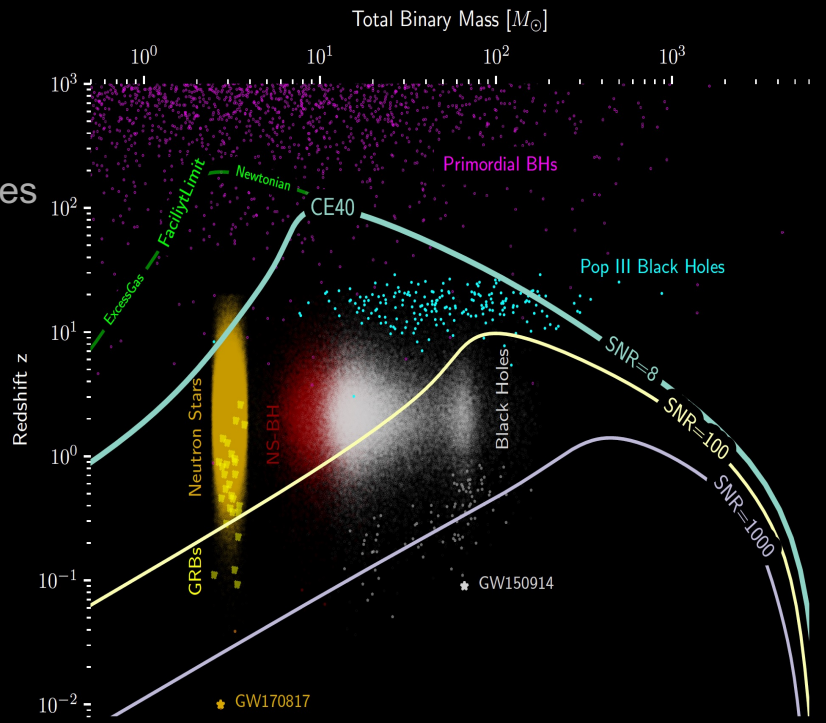
CE-G2300028

- Next-Generation Gravitational-Wave Observatory
  - 40 km and 20 km L-shaped surface observatories
  - 10x sensitivity of today's observatories
  - Global network together with European Einstein Telescope
- Enables access to
  - Stellar to intermediate mass mergers throughout Cosmic Time
  - Dynamics of Dense Matter
  - Extreme Gravity



https://cosmicexplorer.org (preliminary)

Credit: Alex Nitz

Configuration changes compared to Advanced LIGO

- Longer arm cavities (4km→40km)
- Larger test masses (m=40kg, ø=34cm →m=320kg, ø=70cm)
- 2nd input mode cleaner for frequency stabilization (arXiv:2107.14349)
- Beam reduction telescopes on arm-side of beam splitter
- Lower-loss signal recycling cavity (e.g. BS orientation)
- Scaled filter cavity (compared to A+)
- Homodyne readout (same as A+)
- Larger vacuum system (cost-critical)

Other Lessons from Advanced LIGO

- Design the sides flexible – detector upgrades will be installed
- 2 Sites is good, not just for observations:
  - Synergies: construction, Installation, commissioning and operation
  - But no downtime due to dependencies (remember H1 and H2?)

Cosmic Explorer Challenges

- Find a site
- Vacuum system

- Large Optics
- Coatings
- Squeezing (application)
- Suspensions and seismic isolation systems

Overview of CE Research Activities

- Observational Science (consortium driven) ♀
- Site evaluation and Indigenous Partnership Program *
- Vacuum system ♀
- Stray-light control *
- Newtonian Noise reduction *
- Optical design *
- Mode sensing and control *
- Suspension design (A#) ♀

♀: (Partially) funded activities
*: Design funding pending

10 year ago…

- This week….
- On May 24…
- On Elba…

Lavender team

Constitutional meeting:
Isola d'Elba
May 24, 2013
midnight – 3am CEST

GWADW
La Biodola,
Isola d'Elba, Italy

May 2013
Lisa Barsotti,
Matt Evans,
Nergis Malvalvala,
Stefan Ballmer

Long is good

- Coating noise
  - Gain: $L^{1.5}$
  - Cryogenic/Crystal: no need
- Displacement noise
  - Gain: L

Long Uncomplicated Next-Generation Gravitational-Wave Observatory LUNGO

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