LISA and its possible successors

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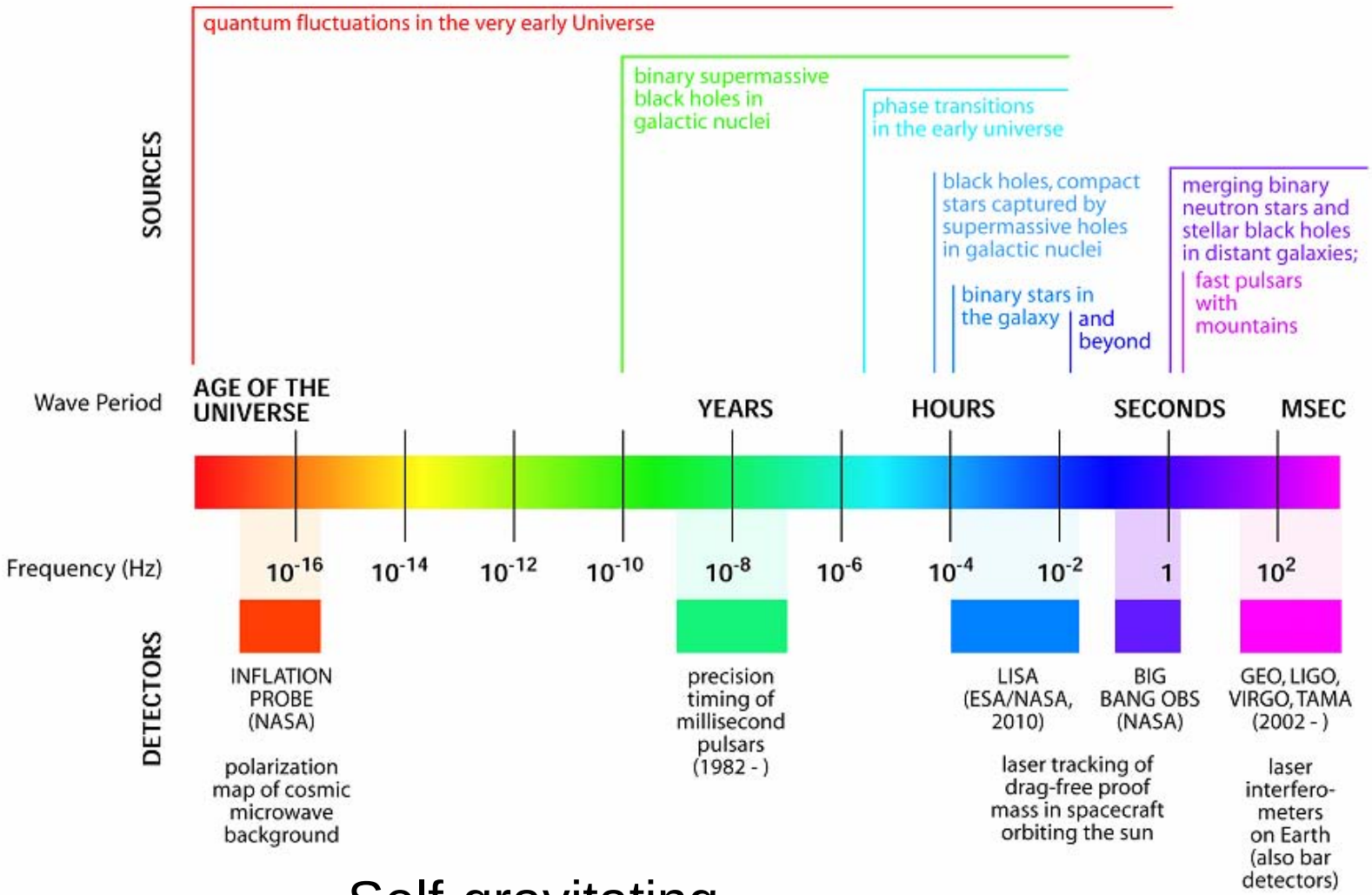
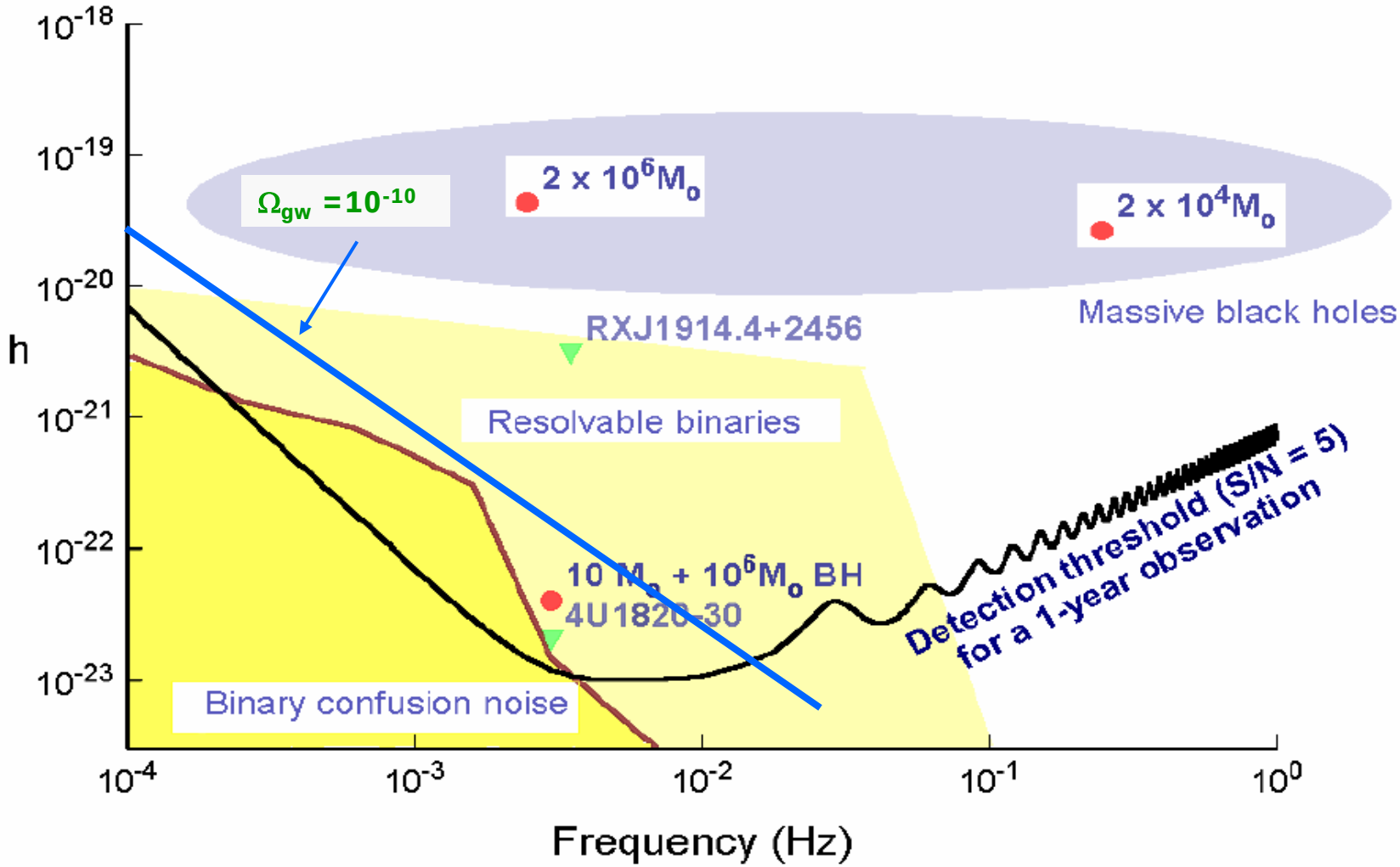
Gravitational Wave Spectrum



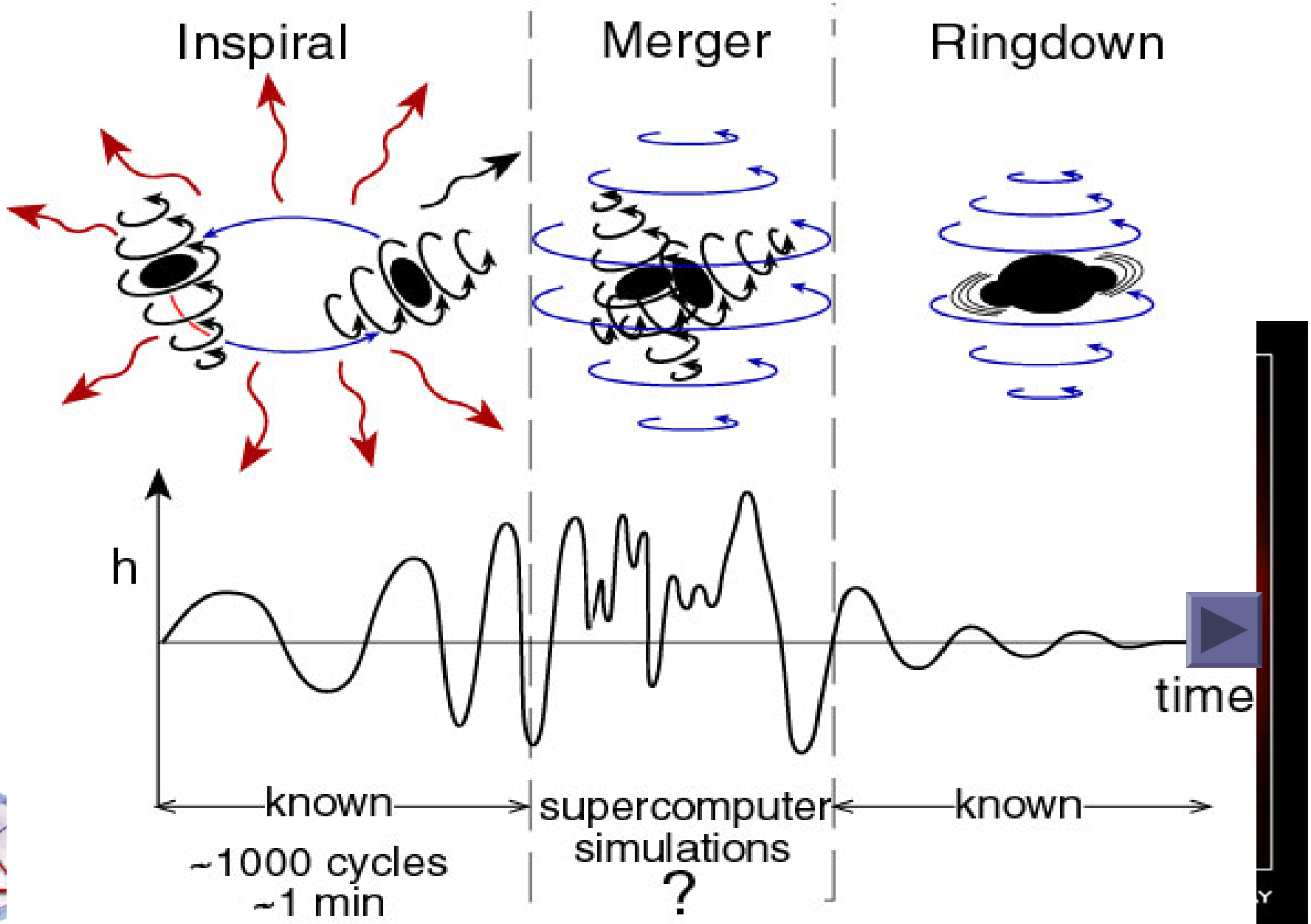
Self-gravitating system:

$$f_{\text{rest}} \sim \left(4\pi GM / R^3\right)^{1/2}$$

Listening to the universe at low-*f*

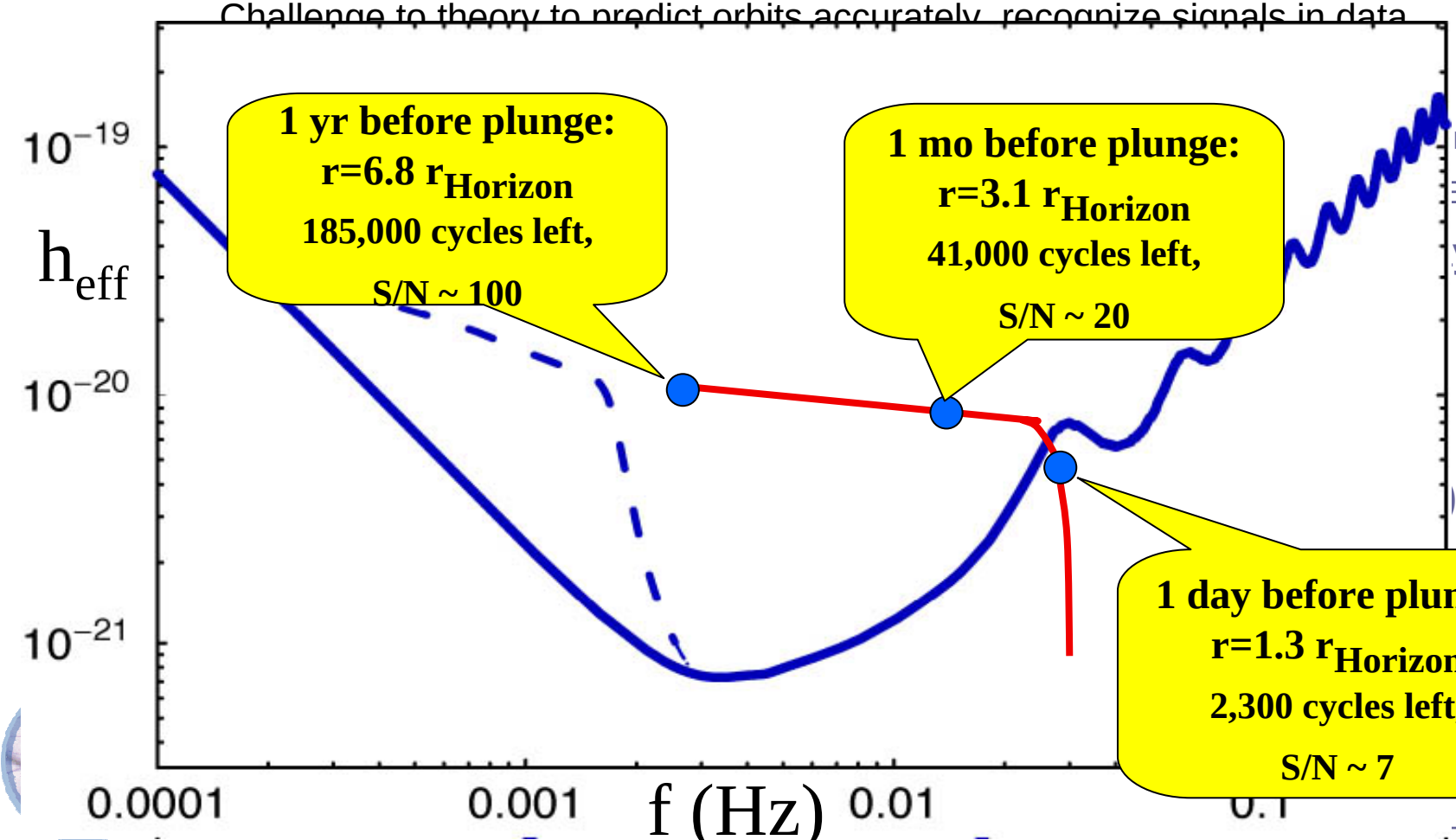


LISA and massive black hole mergers



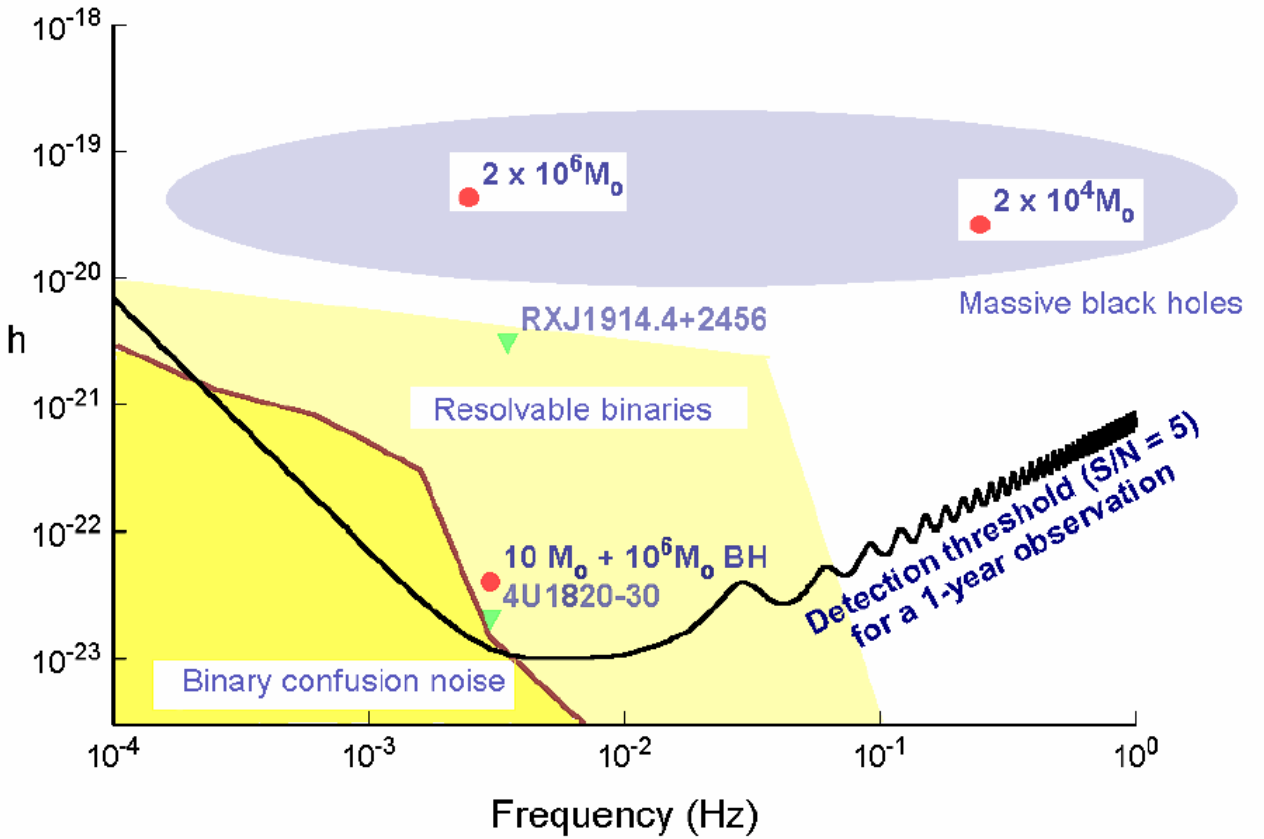
LISA and captures

- **LISA will hear stellar black holes and neutron stars falling into massive holes, observing 10^5 or more orbits (EMRI events).**
  - Objects captured into orbit by hole on first highly eccentric encounter.
  - Challenge to theory to predict orbits accurately, recognize signals in data

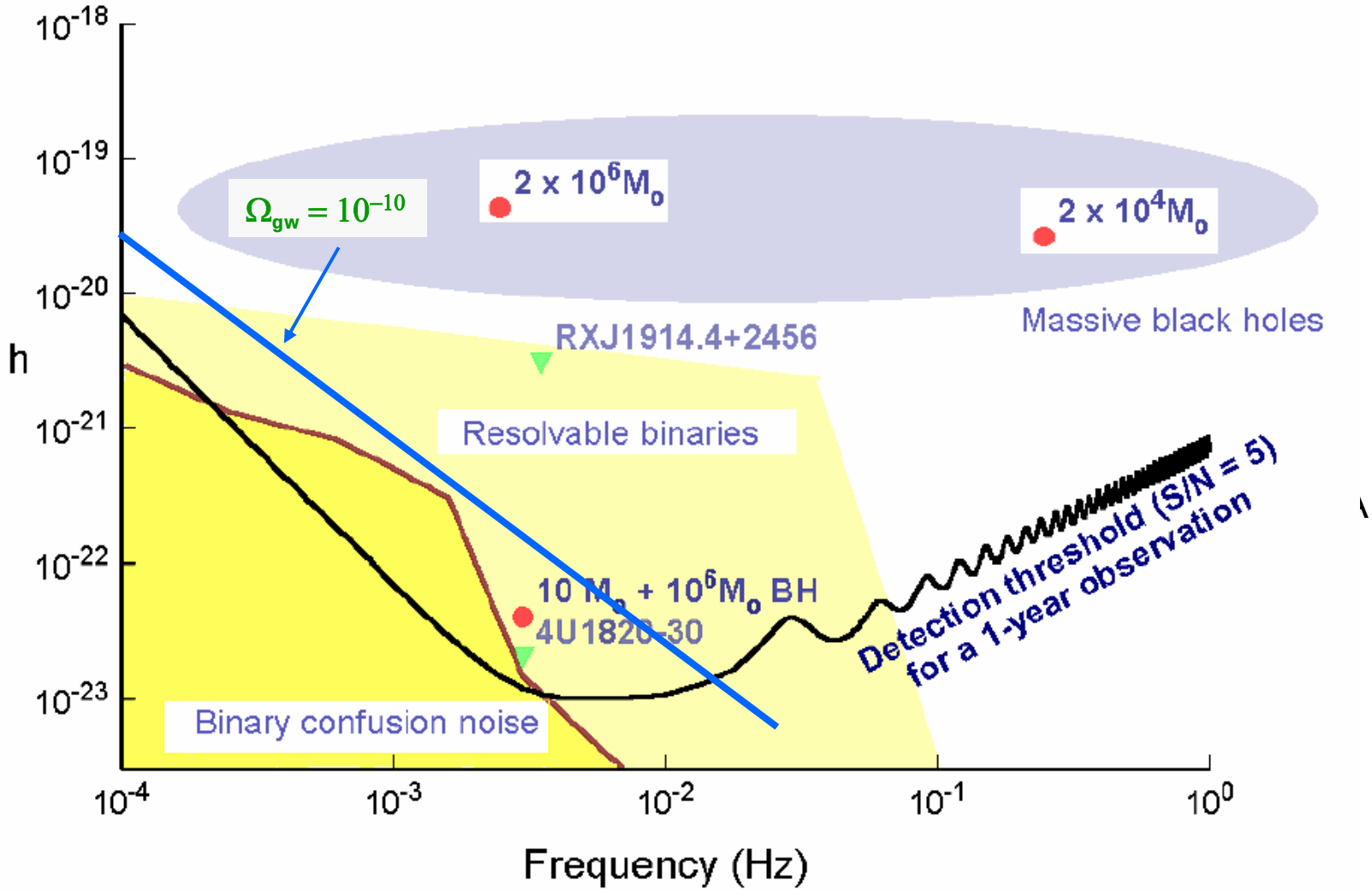


LISA and binary systems

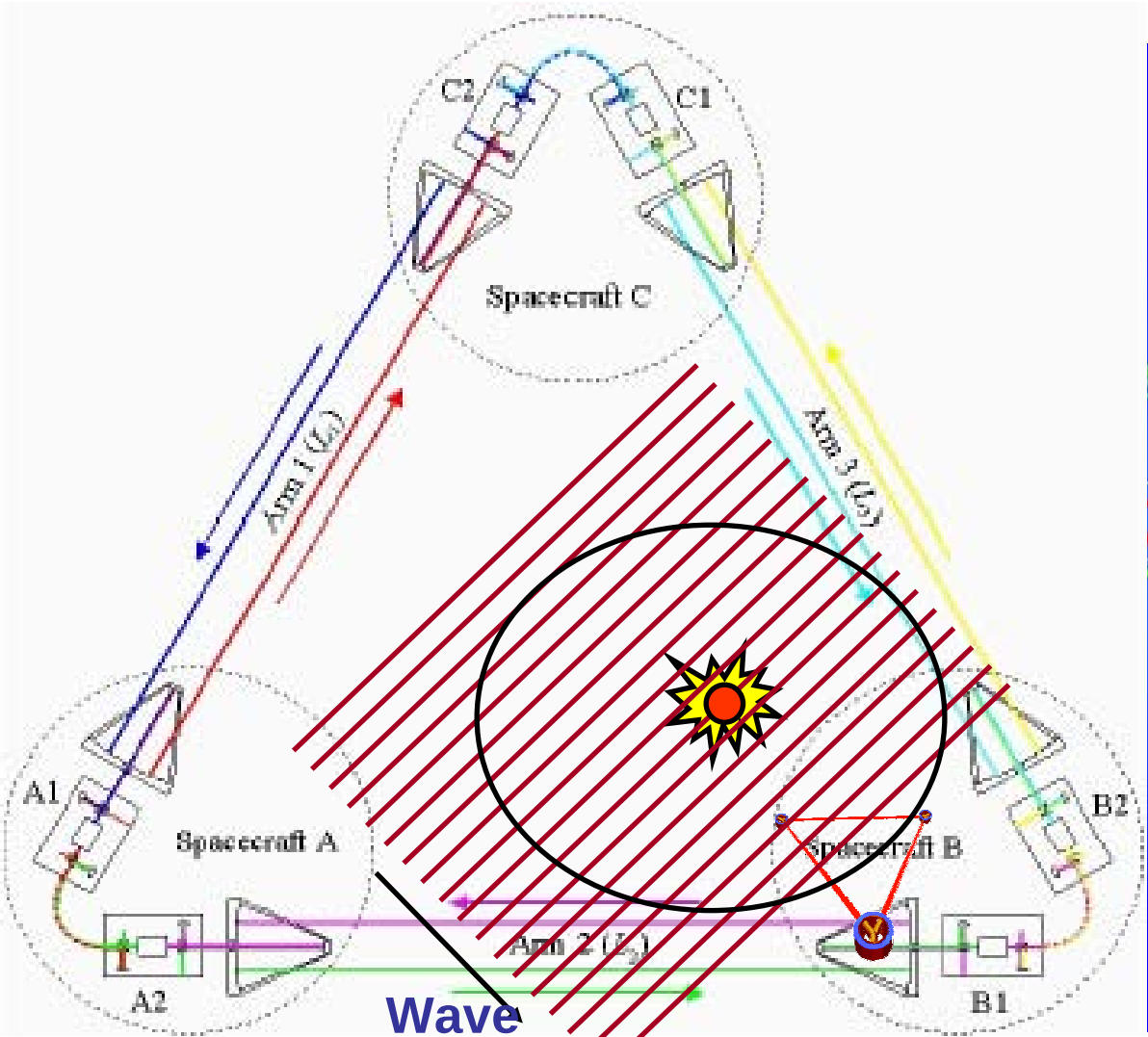
- **LISA will hear every binary system in the Galaxy that has a period < 2 hr, but at periods > 0.5 hr only nearby systems can be resolved.**
- **Kn … l verify tha … ng, so the … ir sig …**
- **Fir … .**
- **Sy …**
  - … tal plane
  - … binaries … helping to



LISA and a primordial background

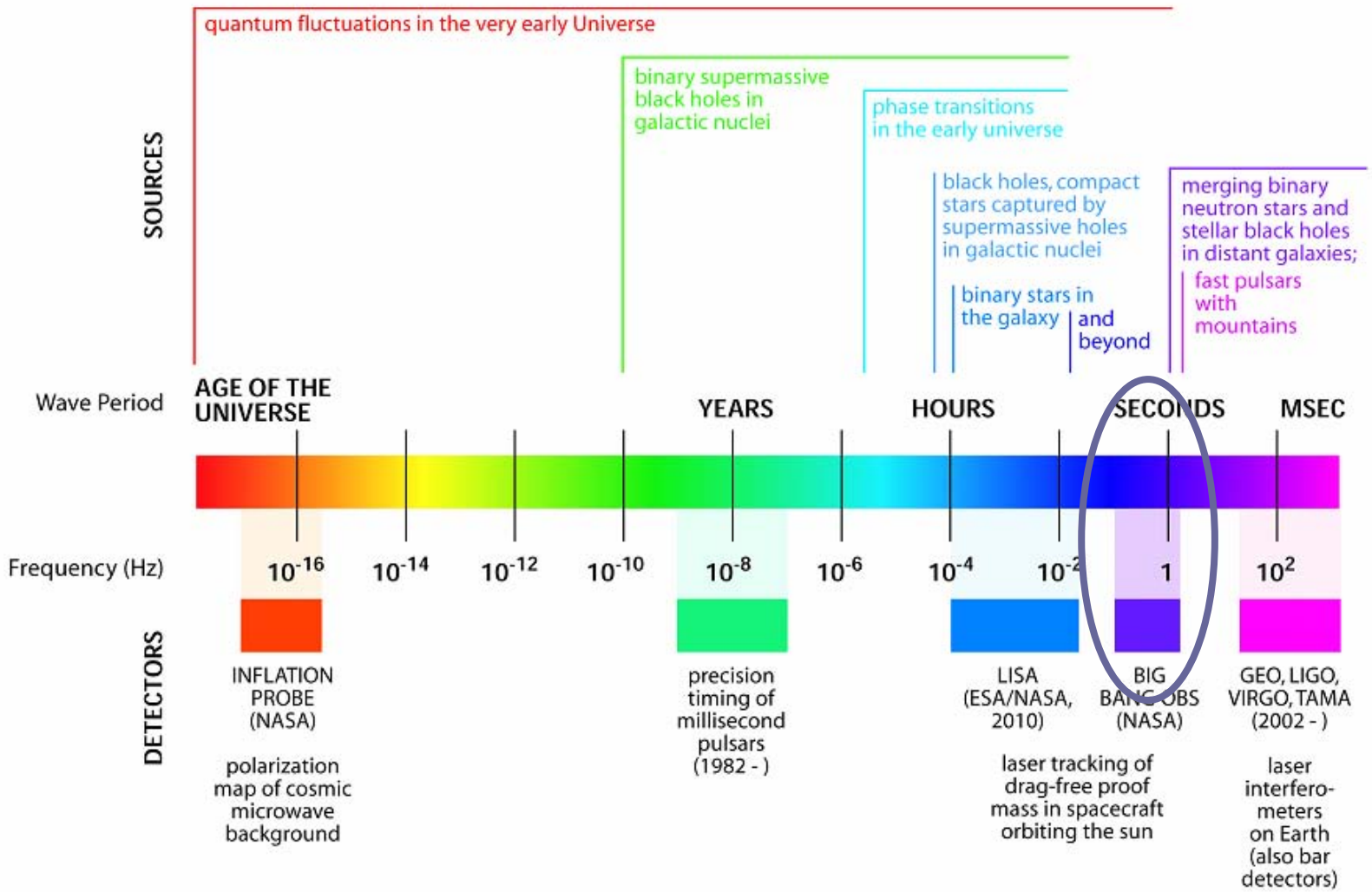


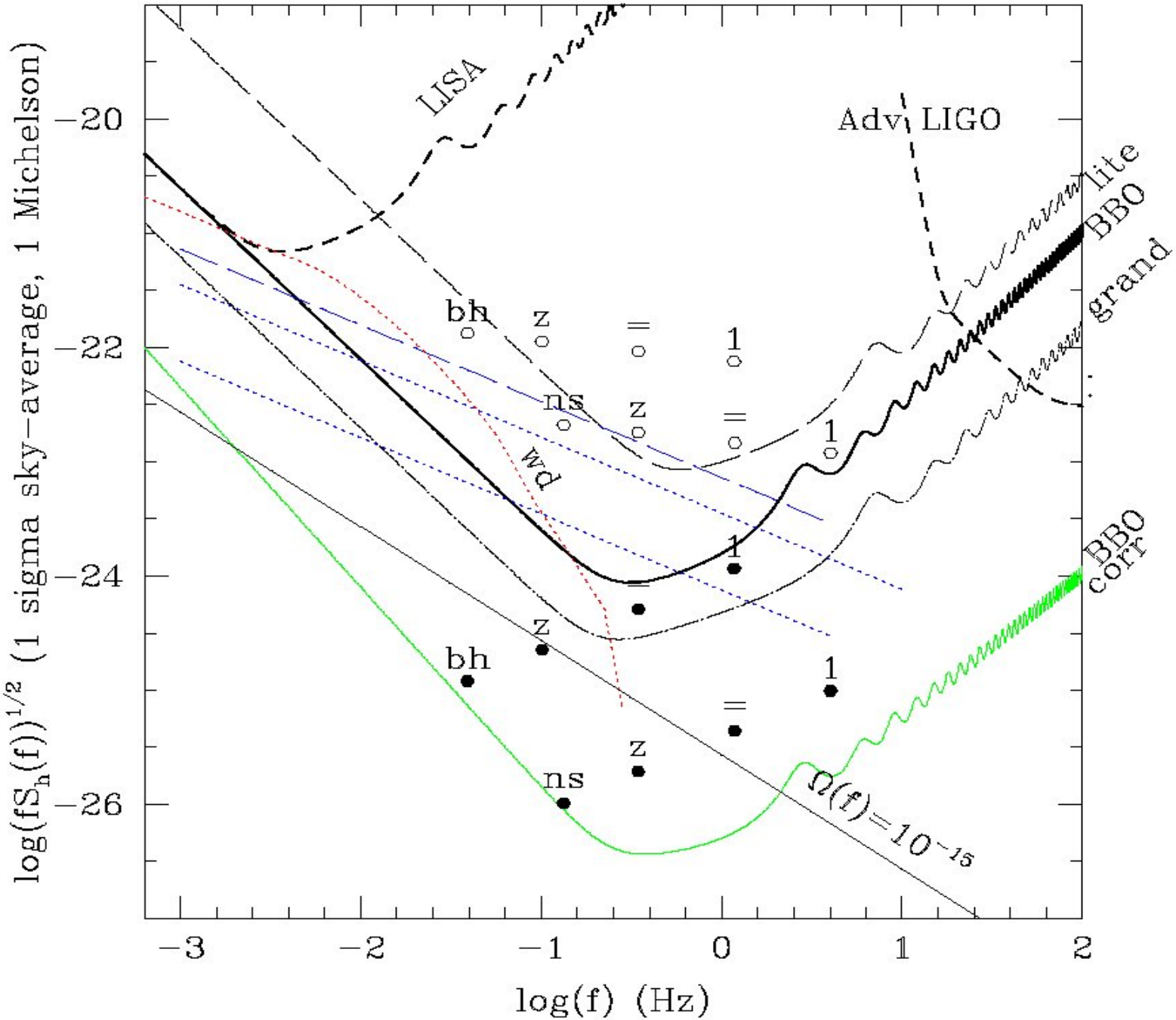
LISA data challenge



Wave
(*f* = 16 mHz)

1 Hz window into the early universe




LISA
Adv. LIGO
BBO
grand
BBO
corr
bh
z
=
1
ns
z
=
1
wd
1
bh
z
1
=
ns
z
$\Omega(f)=10^{-15}$
$\log(fS_h(f))^{1/2}$ (1 sigma sky−average, 1 Michelson)
log(f) (Hz)
−20
−22
−24
−26
−3
−2
−1
0
1
2

Next steps

- BBO was conceived when LISA launch was 2012. Today it looks less helpful as a future goal than it did then.
- European GW community may put in a more modest proposal to Cosmic Vision: develop technology, explore 1 Hz band for astrophysics.
- Goal of detecting CGWB is just as interesting as ever, but we learn *least* if the background is as small as $\Omega_{gw} = 10^{-15}$. We should ensure capability of detecting background at ~10^{-12}.
- New technological approaches could have a major impact on this next step.