Stochastic GW Background in the Dawn of GW Astrophysics

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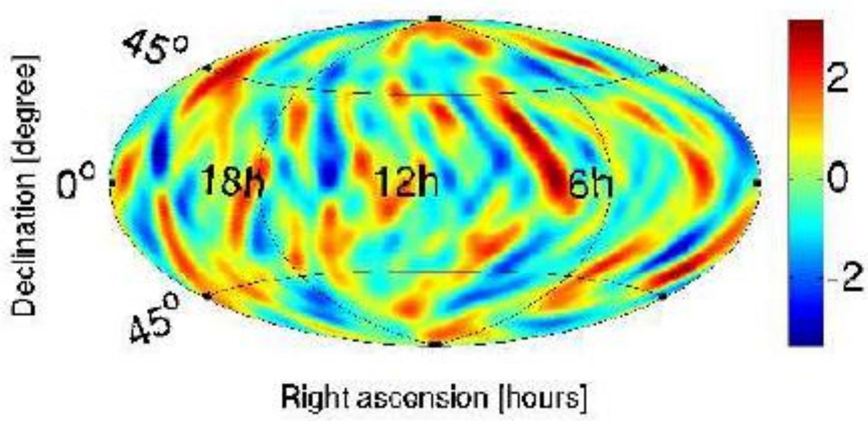
Measuring the GW Energy Density

- Incoherent superposition of sources.
  - Everything contributes, astrophysical and cosmological.
  - Need not be continuous in time.
- Cross correlate detectors.
  - Isotropic
  - Anisotropic: radiometer and spherical harmonic
  - Polarization-sensitive

$$\Omega_{GW}(f) = \frac{1}{\rho_c} \frac{d\rho_{GW}(f)}{d\ln f}$$

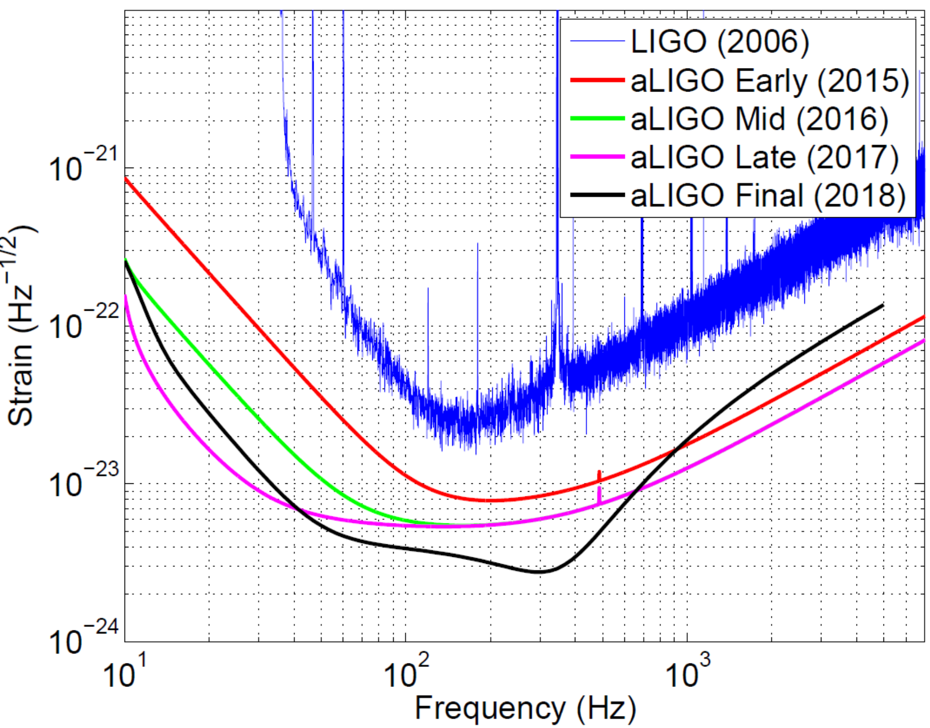
$$Y = \int_{-T/2}^{+T/2} dt_1 \int_{-T/2}^{+T/2} dt_2 \; s_1(t_1)\; s_2(t_2)\; Q(t_2 - t_1)$$

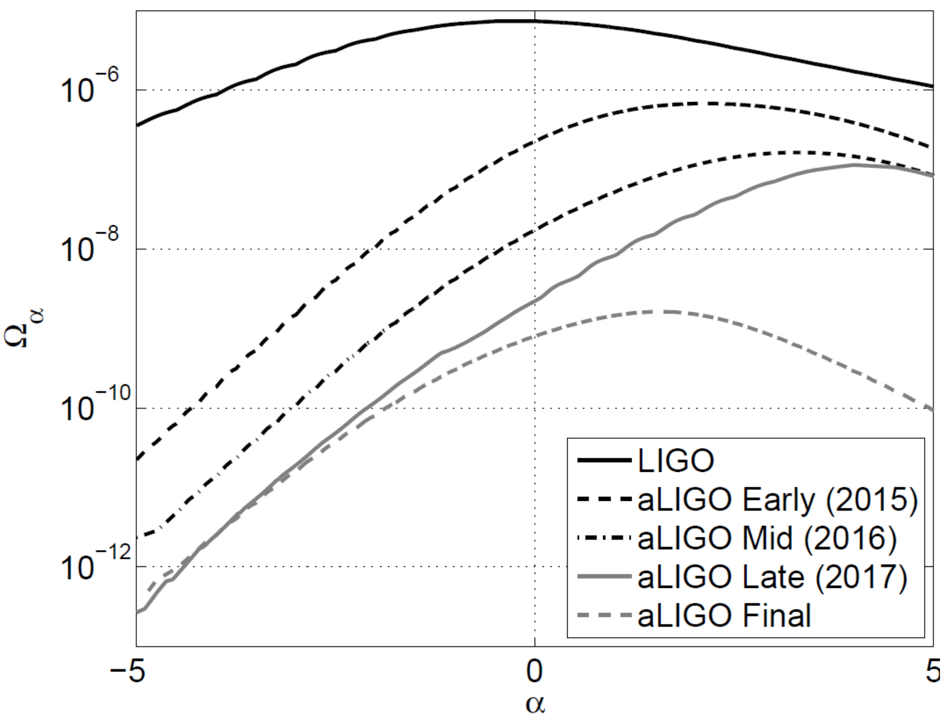
$$Y = \int_{-\infty}^{+\infty} df \; \tilde{s}_1^*(f)\; \tilde{s}_2(f)\; \tilde{Q}(f)$$



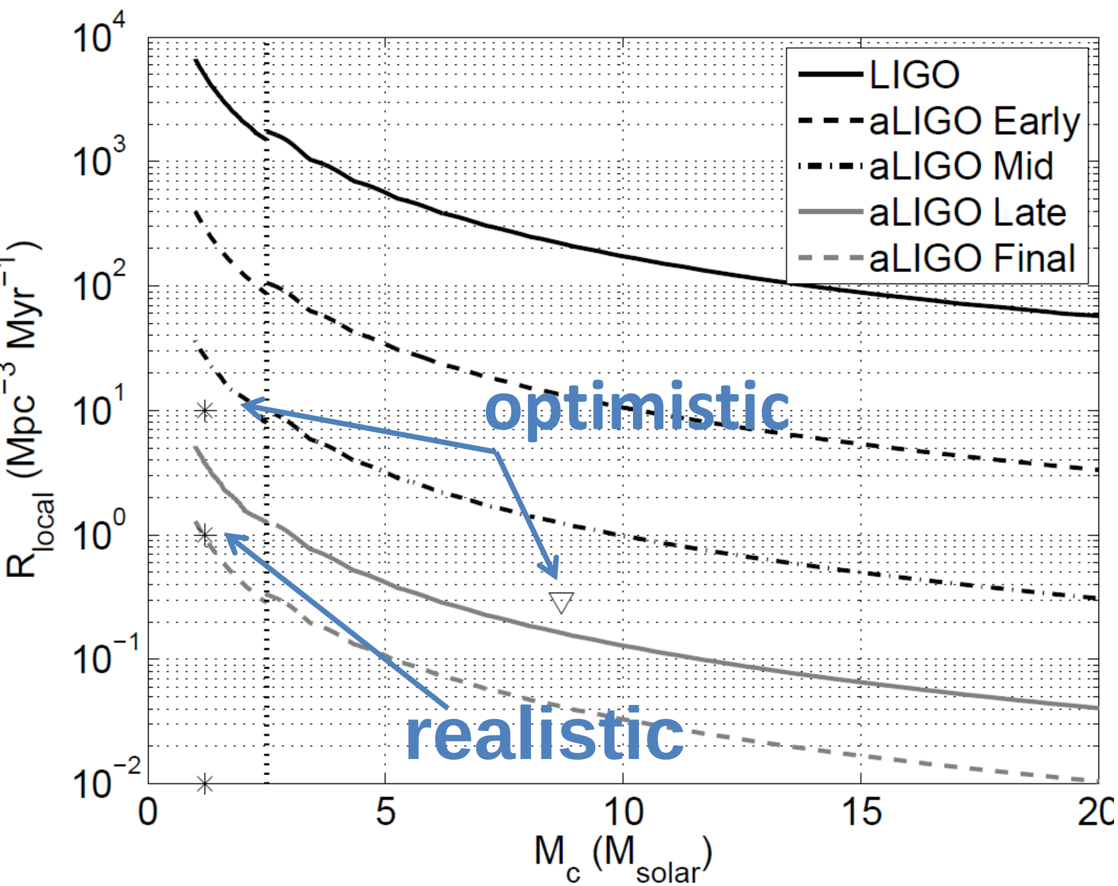
aLIGO Sensitivity Progression

$$\Omega_t(f) = \Omega_\alpha (f/100\ \mathrm{Hz})^\alpha$$



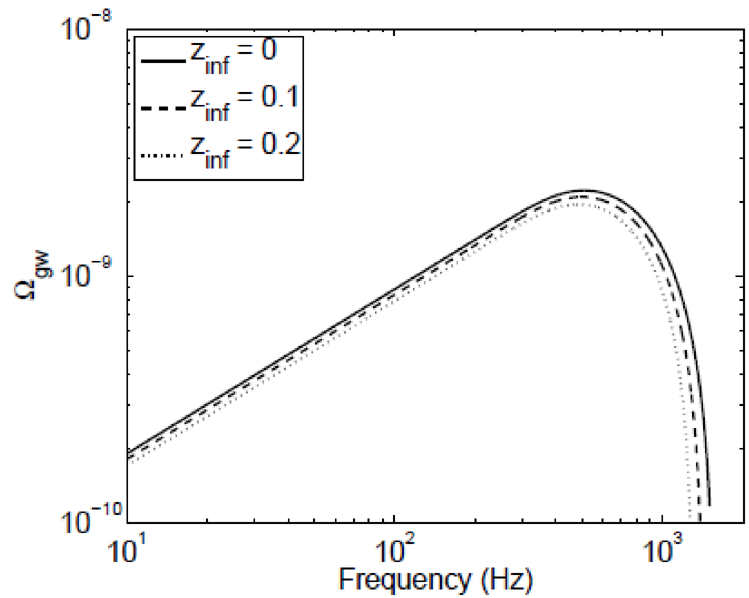


CBC Background



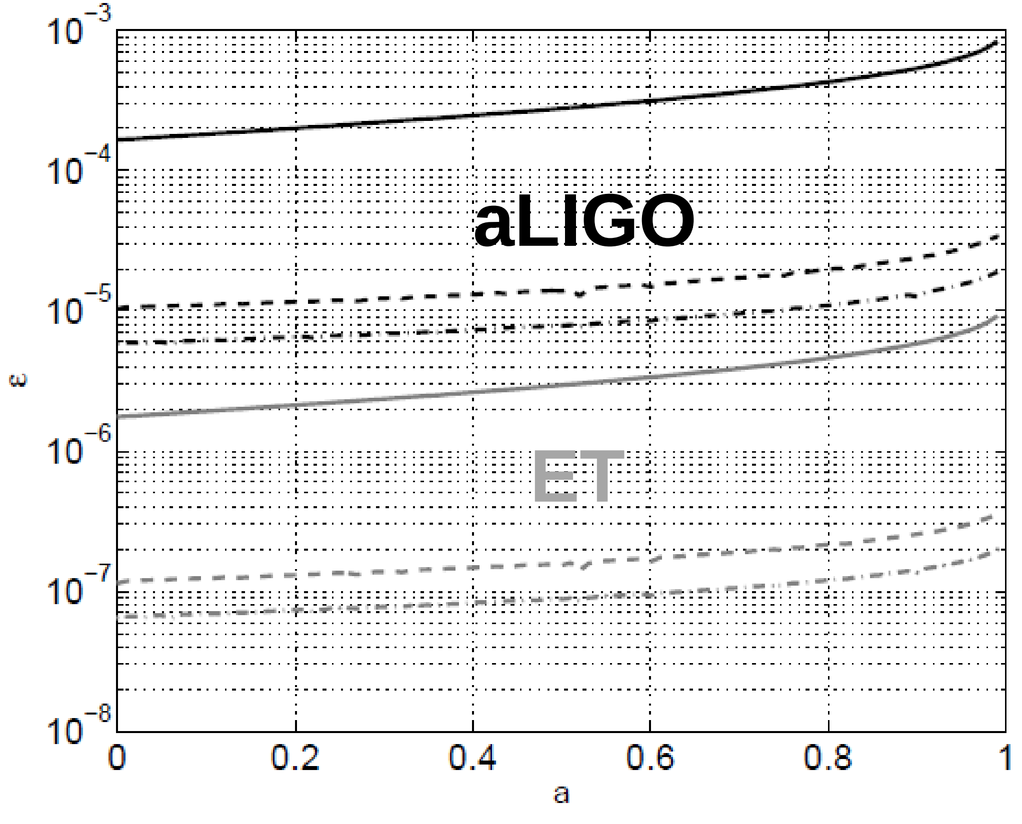
Wu et al, **Phys. Rev. D** 85, 2012, 104024.

- Not continuous.
- Rate modelled off of the star formation rate.
- Dominated by z~1-2.



Stellar Core Collapse

- Many mechanisms contributing, difficult to model.
- Consider only the BH ring-down contribution.
- Could probe the extreme efficiencies (ε ~10^{-4}-10^{-2}).
- Could be more interesting depending on the mass distribution of progenitors.

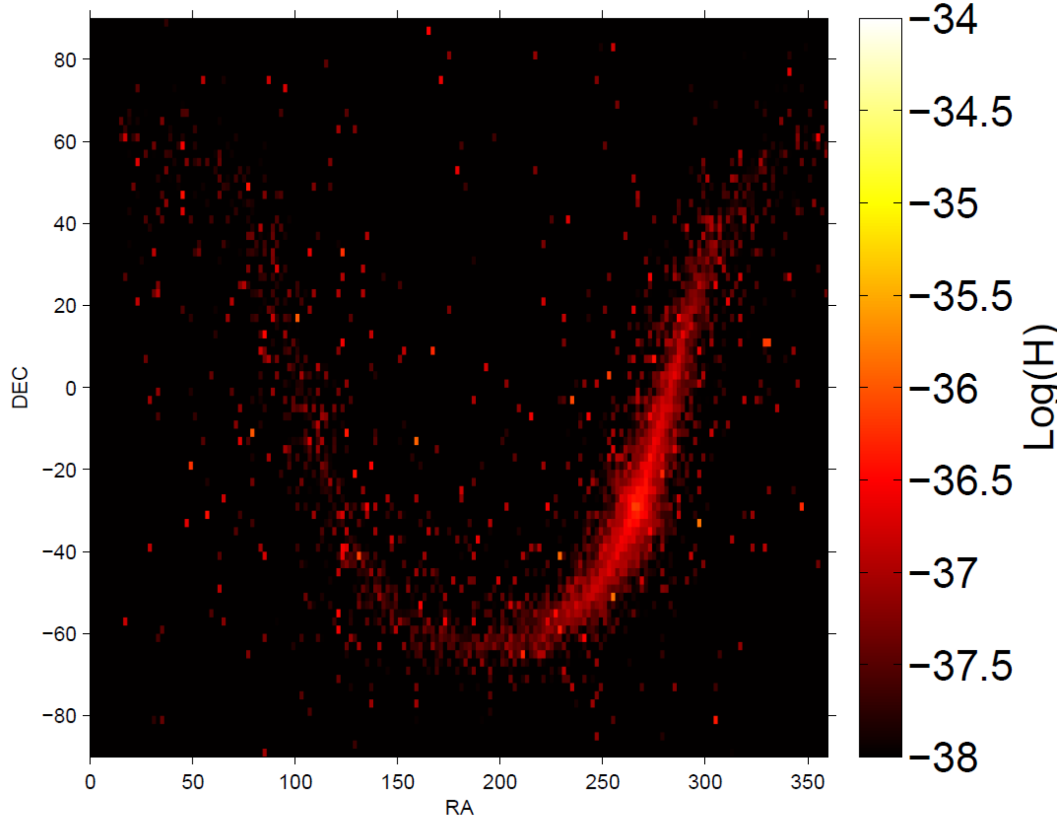


Crocker et al, in preparation

Directional Searches

- Radiometer:
  - After point sources, complementary to CW searches.
- Spherical harmonic decomposition:
  - More appropriate for extended sources such as the Milky Way.

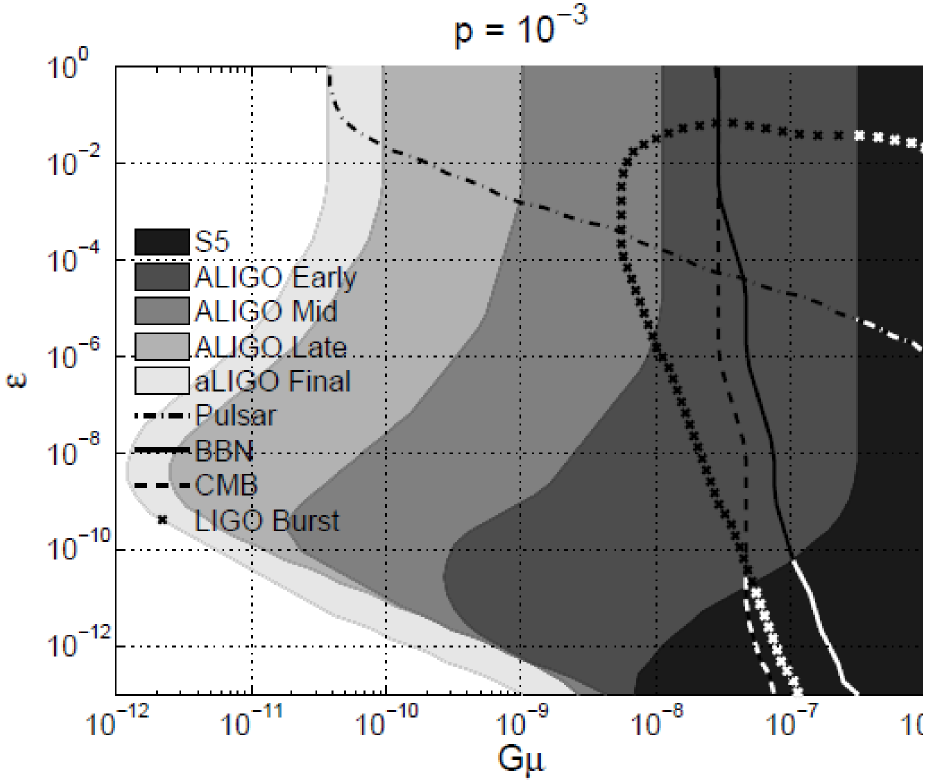
MW Simulation

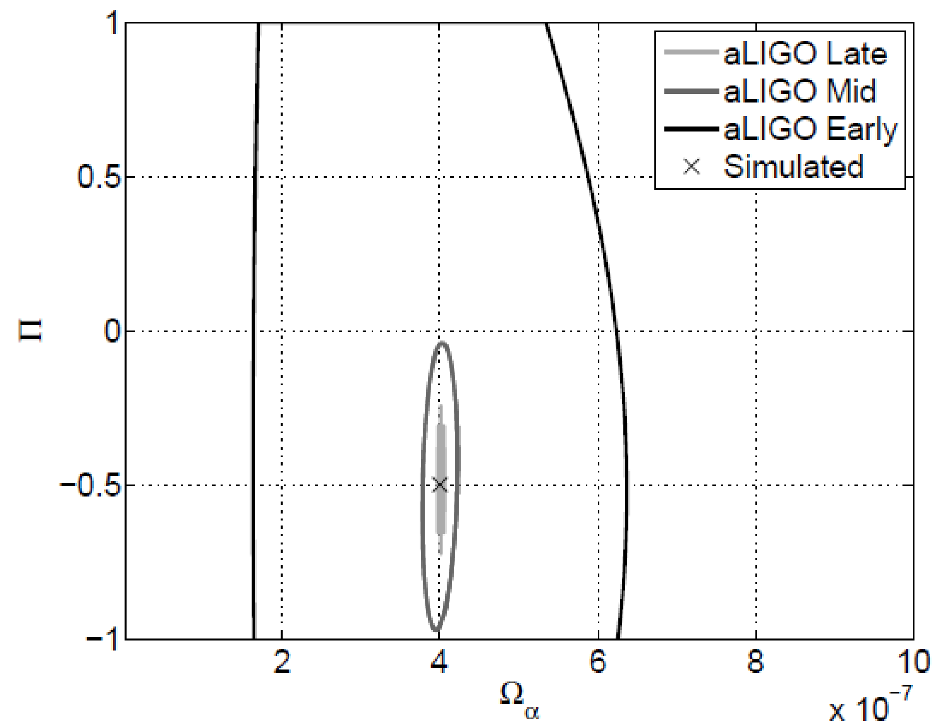


Cosmology

- Cosmic (super)string model
  - Expect to explore a large part of the parameter space.

Could search for parity violation in the Early Universe, by measuring polarization of the GW background.





Many other models: Landscape