GW Sensitivity Measures

Tom Krokotsch

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Measures of GW signals

- The dimensionless strain h_0 from $h(t) = \mathrm{Re}\, h_0 e^{i\omega_g t}$
  Only defined for a (quasi) monochromatic GW
- The fourier transform $h(f)$
  Unit: Hz^{-1}
- The PSD $S_h(f)\delta(f - f') = \langle h(f)h(f')\rangle$
  Only (well) defined for stochastic signals, unit Hz^{-1}
- The characteristic strain h_c (dimensionless)
  - $h_c(f) := f\, h(f)$ for coherent sources
    For monochromatic: $f\, h(f) \approx \sqrt{N_{\mathrm{cyc}}} h_0 \Rightarrow$ depends on T_{int}
  - $h_c(f) := \sqrt{f\, S_h(f)}$ for stochastic sources
- $\Omega_g(f) \propto f^3 S_h(f)$ (not relevant now)

Measures of detector noise

- The PSD $S_n(f) = \frac{S_{\text{noise power}}(f)}{\mathcal{T}_{sig}(f)}$ Unit Hz^{-1}
- The characteristic strain h_n (dimensionless)
  $h_n(f) := \sqrt{f\, S_n(f)}$

$\Rightarrow$ combination of multiple detectors and sources in one plot is best done using the PSDs S_n, S_h or the characteristic strains h_c, h_n.

h_0 vs h_c sensitivity

$S_{sig}(f) = \mathcal{T}(f) S_h(f)$, for monochromatic wave $P_{sig} = \mathcal{T} h_0^2$ and
$P_n(f) \gtrsim \Delta f\, S_{\text{noise power}}(f)$
$\Rightarrow$ Detector Sensitivity $h_0 \approx \sqrt{\Delta f_{\text{min}}\, S_n(f)}$
c.f. with characteristic $h_n = \sqrt{f\, S_n(f)}$.
$\Rightarrow$ h_c sensitivity typically much worse than h_0

Sensitivities I'm unsure about

- IAXO Sensitivity in Fig. 6 (2409.06462, GWs with MADMAX)
- y-axis in Fig. 11 (2112.11465, GRAVNET)
- LSD & ADMX/SQMS sensitivity in Fig. 7 (2203.00621) and just about anywhere else. (2112.11465 reports h_0 sensitivity including integration time etc. but is mostly used as h_c sensitivity like in 2205.02153)