Characteristic strain

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Consider the formula for then optimal power SNR

$$\rho^2 = 4 \int_0^{+\infty} \frac{|\tilde{h}(f)|^2}{S_n(f)} df \tag{1}$$

and note that

$$d(\ln f) = \frac{df}{f}. \tag{2}$$

Then, we can write

$$\rho^2 = \int_{-\infty}^{+\infty} \frac{|2f\ \tilde{h}(f)|^2}{f S_n(f)} d(\ln f) \tag{3}$$

or also,

$$\rho^2 = \int_{-\infty}^{+\infty} \frac{h_c^2(f)}{h_n^2(f)} d(\ln f) \tag{4}$$

using the *characteristic strain* and the *characteristic noise strain*

$$h_c^2(f) = 4f^2 |\tilde{h}(f)|^2, \quad h_n^2(f) = f S_n(f)$$

An example of application of the characteristic strain is shown in figure 1, which is drawn with a log-log scale. In such cases, it is possible to give a rough evaluation of the SNR from the figure, because

$$\ln \frac{h_c^2(f)}{h_n^2(f)} = 2(\ln h_c(f) - \ln h_n(f))$$

so that the power SNR is equal to twice the area between the characteristic strain and the characteristic noise strain.

References

[1] Christopher J Moore, Robert H Cole, and Christopher PL Berry. Gravitational-wave sensitivity curves. *Classical and Quantum Gravity*, 32(1):015014, 2014.

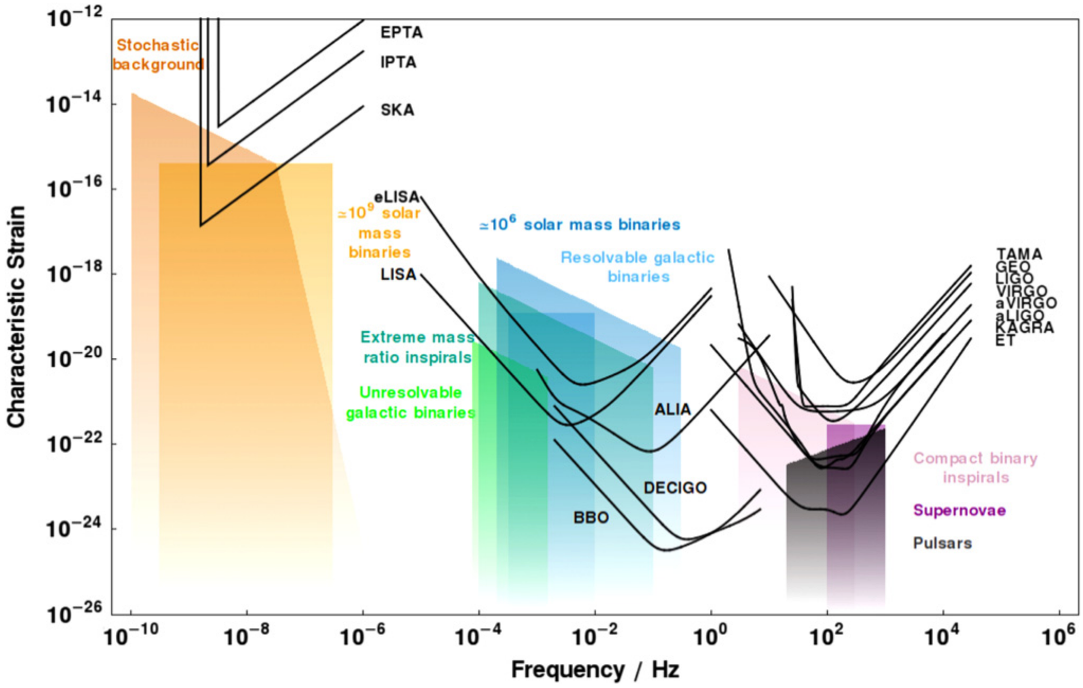

Figure 1: A plot of characteristic strain against frequency for a variety of detectors and sources. From [1].