

Gravitational Wave Buttons Guide

Reference Parameters

"Reference Parameters" takes you to the parameters published on GWOSC for the selected waveform. Each parameter includes an associated uncertainty, which can be visualized on the slider as the range of values that yield a reasonable fit to the waveform.

Use Real Data

Checking "Use Real Data" lets you choose from several real gravitational wave detections. The displayed signals include:

- ▶ Fit (green): Model waveform corresponding to the selected parameter values.
- ▶ Data (grey): Real signal data for comparison.

Unchecking "Use Real Data" returns you to the simulated waveform.

Detectors (L1, H1)

Displays the gravitational wave signals recorded by the LIGO detectors in Hanford, Washington (H1) and Livingston, Louisiana (L1). The signals from the two detectors may differ because:

- ▶ Their orientations on Earth are slightly different, causing each detector to respond differently to the same gravitational wave.
- ▶ Each site has a unique noise environment, which affects the clarity and signal-to-noise ratio (SNR) of the waveform.

This button allows the user to compare the signals from each detector.

Residuals

The "Residuals" button plots the noise remaining after subtracting the fit from the data. Residuals help evaluate how well the model fits: when the parameters are close to the reference values, the residual noise should appear smaller. For simulated data, this means that less noise remains overall.

- ▶ Equation:

$$Residuals = [Data - Fit] \quad (1)$$

Simulated Data

The simulated data is what the slider defaults to if you are not using real data. This is an idealized, noise-free waveform that allows users to explore the waveform shape and the effect of changing parameters without the complications of detector noise.