

## ANITA 2023 SCHOOL: DETECTING GRAVITATIONAL WAVES

You have been given two data streams: one from the LIGO Livingston detector (/DATA/challenge\_timeseries\_L1.txt) and one from the LIGO Hanford detector (/DATA/challenge\_timeseries\_H1.txt).

In these data streams are hidden a number of simulated signals generated by the merger of binary black holes – these are located anywhere from 300 to 3000 Mpc away.

The component masses of the black holes are uniformly distributed between 20 and 100 solar masses. Not all, or possibly not any, of these have equal masses. The spins of the black holes are in the z direction only, and were randomly chosen. There are no eccentric black holes or anything fancy – just plain, vanilla black hole binaries! Also, none of the signals in the data stream overlap.

Your challenge is to create an algorithm that uses a **template bank** to find these signals. You can use all the tools given in the demo notebook, and any more you come up with. The goal is to identify merger time of the signals and the chirp mass of the binary as closely as possible.

You should also try to optimize your search – it should ideally execute with the push of a single button. To speed things up, you can use python functions and classes.

To test your algorithm, I have also provided two sets of shorter data streams that contain one signal each. One is at a high SNR, the other at a much lower SNR. You can test out your search on these shorter data streams to see how it works.