Possible topics for master or bachelor thesis

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Bachelor Thesis (that do not require GR course):

- Understanding the astrophysical formation channel of the detected binary black hole events
- Machine learning and gravitational waves searches
- Optimal time-frequency representation of gravitational waves strain data (signal processing topic)

Master Thesis (that require some GR knowledge):

- Breaking the degeneracy between inclination angle and distance of the binary neutron star events with its post merger signature
- Fundamental bias in determining the astrophysical channel from detected events with LIGO-Virgo-KAGRA detectors
- Reliably extending IMR consistency checks to precessing binaries

  When two black holes orbiting each other coalesce to form a single black hole the properties (mass and spin) of the final black hole can be predicted (assuming General Relativity to be correct) from the properties of the black holes in the original binary. By measuring the gravitational waves emitted from both the binary and the final black hole we can measure the properties of the respective black holes. Comparing the measured properties with their predicted values can allow us to perform tests of General Relativity. Such tests are well developed in the case where the initial black holes are non-spinning but need improving for the case where one or more of the initial black holes is spinning.

- Possibilities for detecting amplitude birefringence with gravitational waves

  Amplitude birefringence is a feature of several beyond-GR theories which may produce a detectable signature in gravitational waves. The detection of amplitude birefringence would be a clear indication of deviations from GR but even its non-detection will allow us to place limits on the magnitude of these deviations. We wish to study the circumstances under which current and future gravitational wave detectors are likely to detect signals which will allow us to place meaningful limits on these deviations.