

Project Title:

Modelling and studying gravitational waves from black-hole-binary mergers

Supervisor(s):

Prof Mark Hannam

Dr Steve Fairhurst

Project Description:

Accurate models of the gravitational-wave signal emitted by generic configurations of black-hole binaries as they inspiral and collide, are essential to make gravitational-wave detections and perform astrophysics with the Advanced LIGO and Virgo detectors. One of the most pressing problems is the modelling of generic binaries, where the black-hole spins introduce wild dynamics that generate complicated waveforms. The advanced LIGO detectors began taking science in late 2015, making this a timely project. One of the most pressing problems is the modelling of generic binaries, where the black-hole spins introduce wild dynamics that generate complicated waveforms.

We currently have a preliminary waveform model, but this does not take into account the subtle precession effects at the black holes approach merger, or their effect on the waveform as the final black hole rings down. It is also important, for both gravitational-wave searches and measurements of physical parameters, to determine those physical parameters that have the dominant effects on the waveform structure, and are therefore the parameters that can be most precisely measured. This has an impact both on how we construct waveform models, and on the astrophysical questions that can be answered with gravitational-wave observations.

Several research directions are possible, including modelling the late-inspiral waveforms of generic systems, using these models to estimate the physics that can be measured from GW observations, and devising strategies to use these models to search for GWs and to measure source parameters.

To discuss this project further, please contact:

Supervisor: Prof Mark Hannam

Email: Mark.Hannam@astro.cf.ac.uk