

Constraining gravitational wave amplitude birefringence with GWTC-3

Thomas C. K. Ng

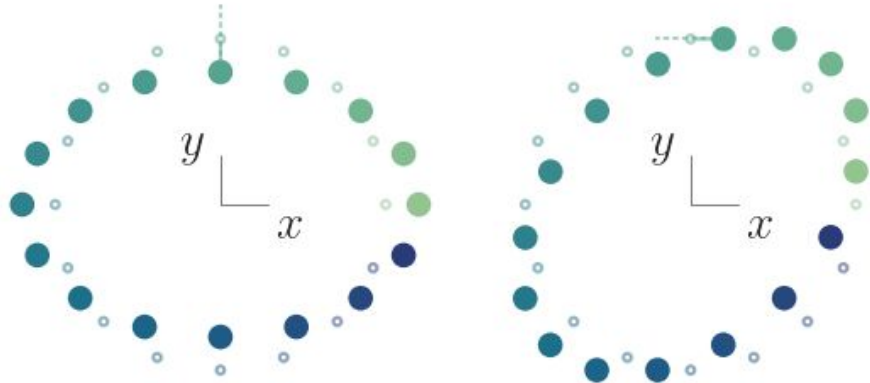
Motivation

- Verify beyond-GR theories
 - GR break down at some length scale
 - look for beyond-GR theories
- GW amplitude birefringence
 - suggested by some beyond-GR theories (e.g. Chern–Simons gravity)

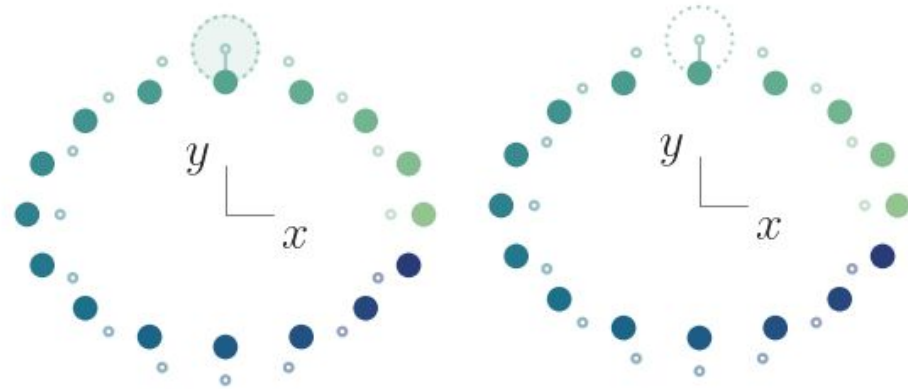
Background

- Gravitational waves
 - 2 polarization (e.g. left and right-handed)

+ & ×



L & R



GW Amplitude birefringence

- Property of space-time
 - enhance one polarization
 - suppress another

Objective

- Constraining GW amplitude birefringence
 - how large this effect could be?

Parameter Estimation with Bilby

1. randomly pick a set of parameter (e.g. masses, spin, RA, dec,)
2. simulate a waveform based on a waveform model
3. calculate likelihood by comparing the simulated waveform with the interferometer data
4. calculate posterior probability with Bayesian Inference
5. pick another set of parameter which is slightly different from the original
6. do step 2-5 again and again

Method

- Modify the waveform

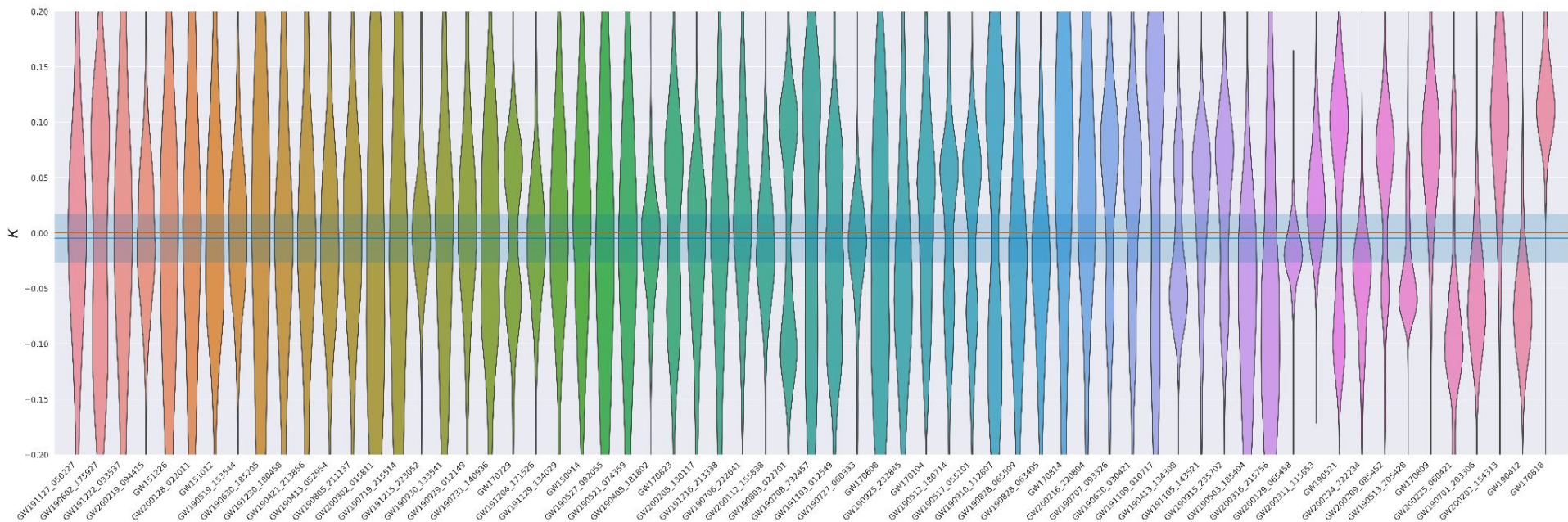
$$h_{L/R}^{\text{br}} = h_{L/R}^{\text{GR}} \times \exp\left(\pm \kappa \frac{d_C}{1\text{Gpc}} \frac{f}{100\text{Hz}}\right)$$

- Assumption
 - GW are generated as GR predicts
- Constrain κ

What is new?

- More accurate modification on the waveform
- More data (GWTC-3)

Preliminary Result



show your work!

Welcome to **showyourwork!**, a workflow management tool for open source scientific articles. If you want to make your research article **reproducible**, **extensible**, **transparent**, or just downright **awesome**, you've found the right tool. **showyourwork!** automates your entire workflow, packaging it into a self-contained recipe that anyone can follow and—at the click of a button—use to reproduce your results.