Formation of merging black holes through isolated binary evolution via the common envelope phase
It’s easy, right?
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It’s easy, right?
Fundamental theorem of GW astrophysics

It’s challenging to bring compact objects to merge within the age of the Universe!

Mandel & Farmer, in prep.
Merging binary black holes

Mandel & Farmer, 2017
Belczynski et al., 2016

Stella

Estelle
Stella

Estelle
Common envelope
Stella
<table>
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<tr>
<th>Time (Myr)</th>
<th>$M_1$ (M$_\odot$)</th>
<th>ST$_1$</th>
<th>ST$_2$</th>
<th>$M_2$ (M$_\odot$)</th>
<th>a ($R_\odot$)</th>
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</table>

Figure 3 | Formation of GW151226. Typical formation of GW151226 at 10% solar metallicity in our model, as described in the Results. The columns...
Could all observed events come from this channel?

Stevenson et al., 2017
Population Synthesis

Vigna Gomez et al., in prep., 2018
Model interpolation

Barrett et al., 2017
Predictions

Barrett et al., 2018
SFR and metallicity

Neijssel et al., in prep.
Learning from detections

Vigna Gomez et al., in prep., 2018
Learning from detections

Farr+, 2017
Multiple populations

Stevenson, Berry, Mandel, 2017
Hierarchical modeling
The future

• Bring together observations, modelling and astrostatistics

• Figure out what questions we can realistically answer... and answer them!

• Use full observation set — concordance binary evolution?