

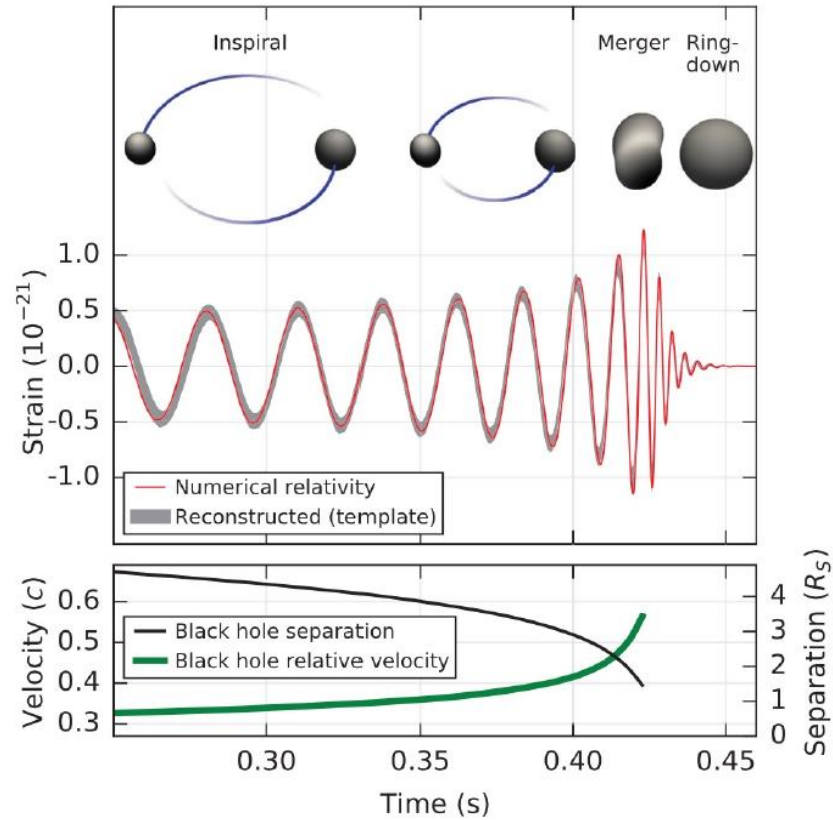
Astrophysics of gravitational wave sources

Lecture 9: Merger & subsequent evolution of the remnant

Ondřej Pejcha

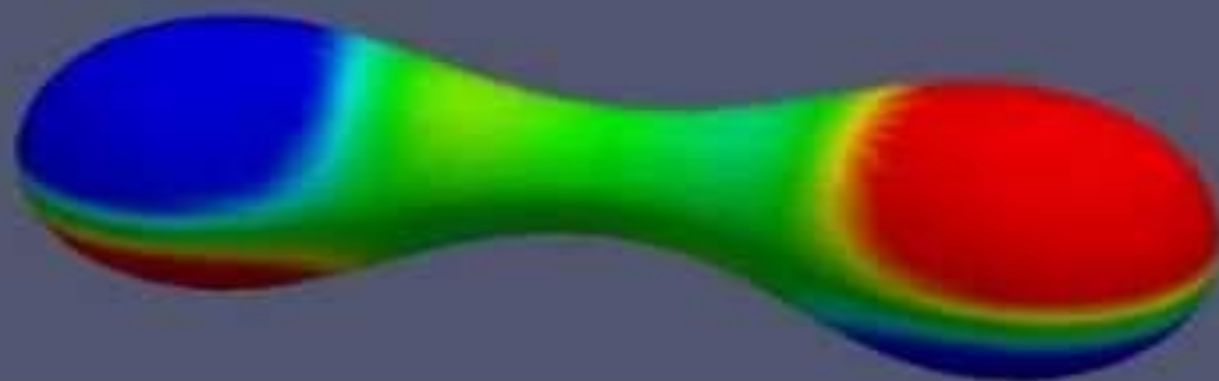
ÚTF MFF UK

Binary black hole mergers



Abbott et al. (2016)

Black hole collision



Time: 82.0

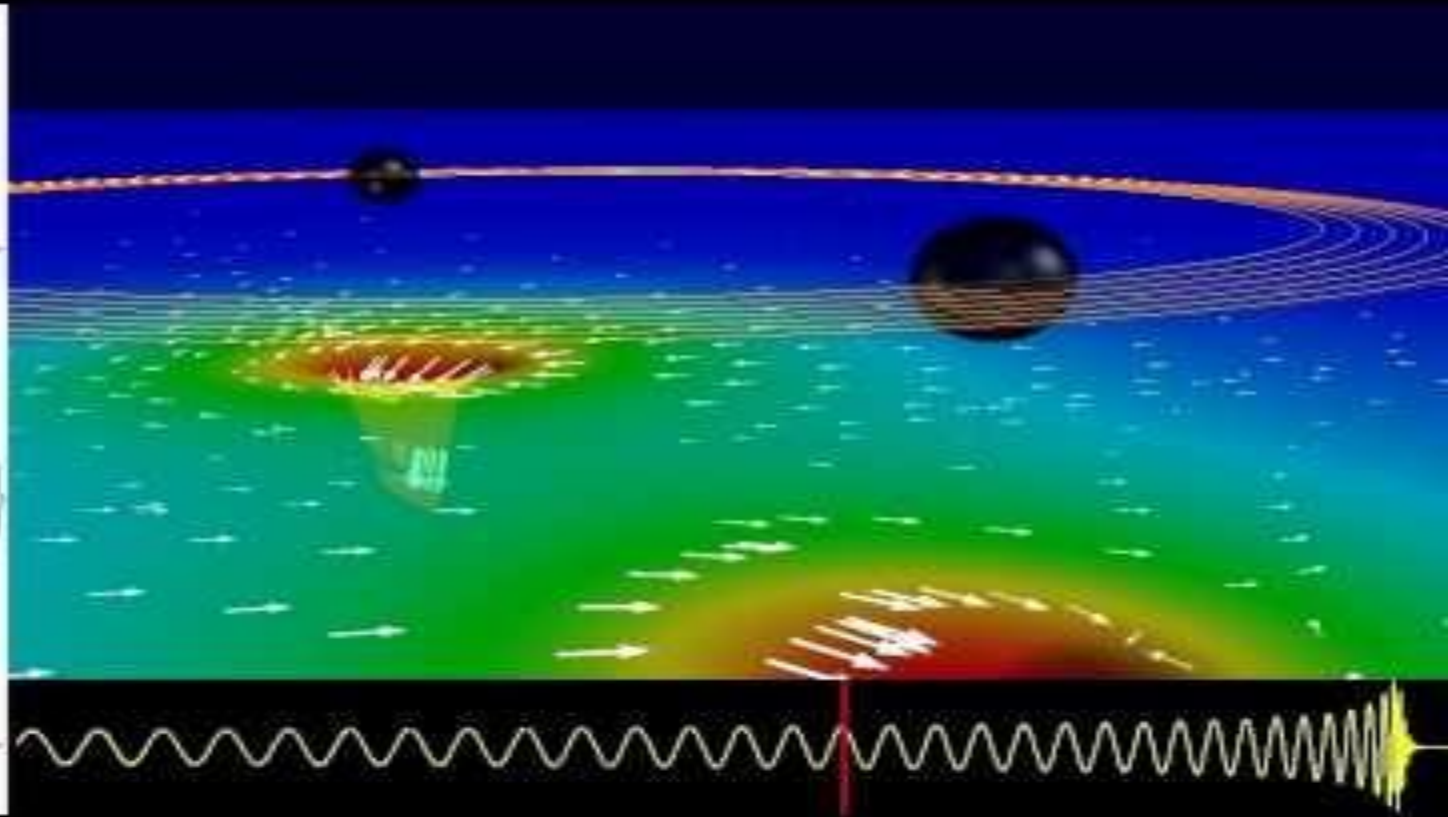
B_NN
0.02
0.01
0
-0.01
-0.02

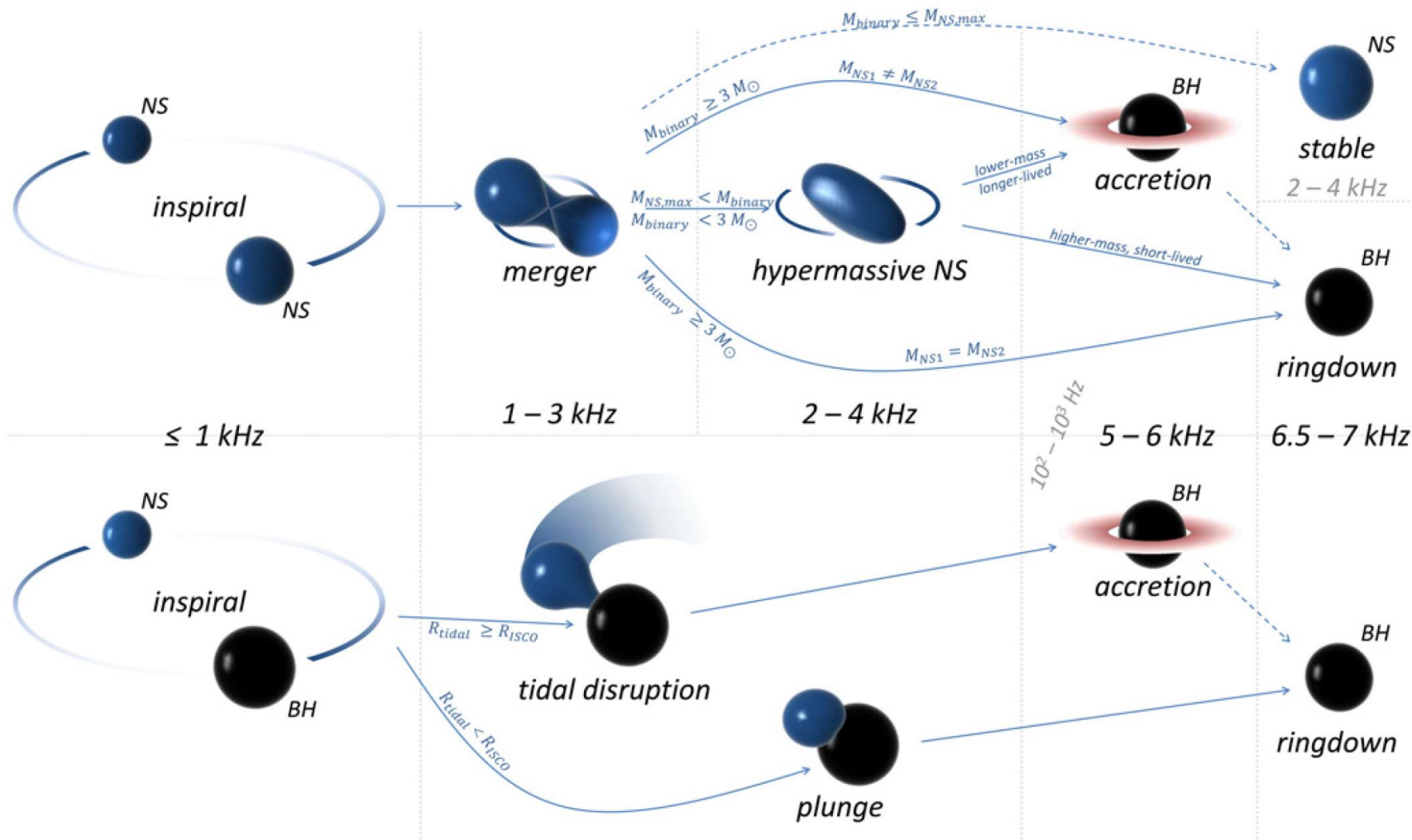
Binary Black Hole Evolution:
Gabetti/Gornall Computer Simulation

Top: 3D view of Black Holes
and Orbital Trajectory

Middle: Spacetime curvature:
Depth: Curvature of space
Colors: Rate of flow of time
Arrows: Velocity of flow of space

Bottom: Waveform
(red line shows current time)

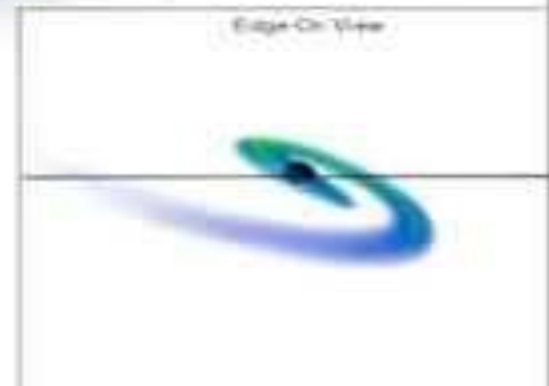




Density

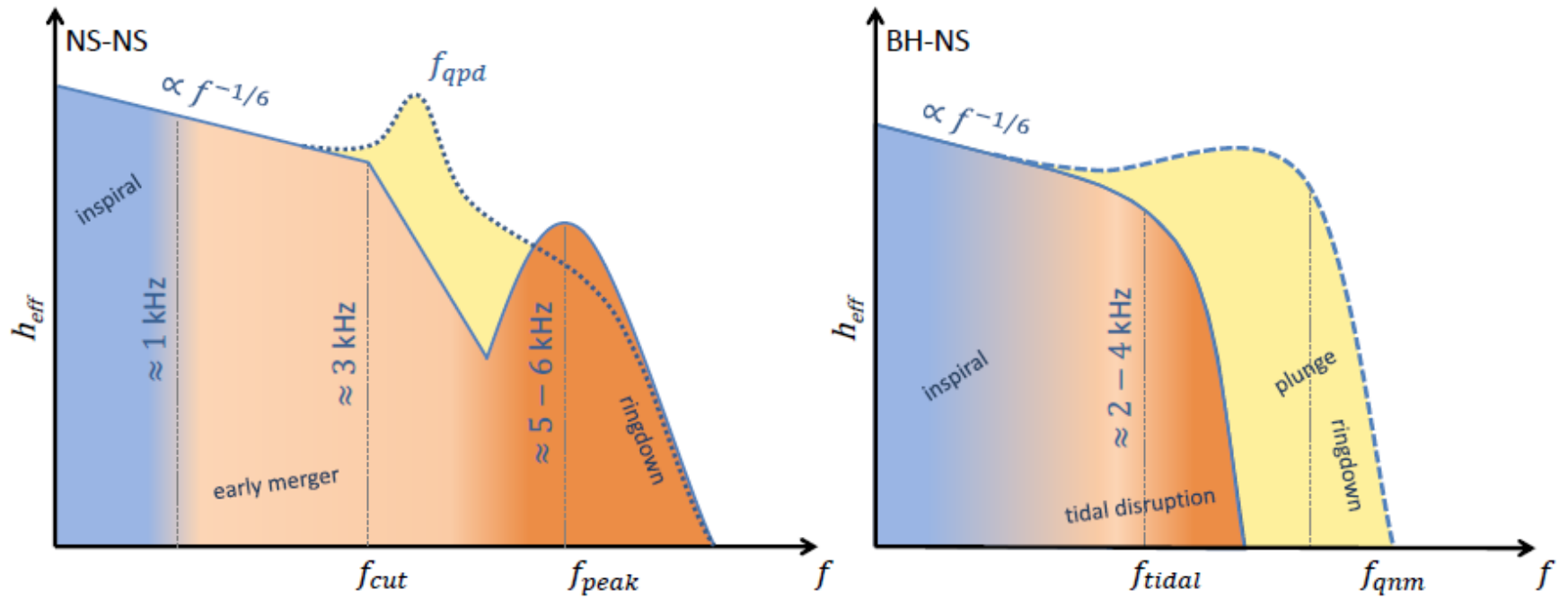


Time=598



Binary neutron star merger





Subsequent evolution of the (rotating) remnant

$$\beta \equiv T_{\text{rot}}/|W|$$

- Dynamical instability (non-axisymmetric shape with same angular momentum is energetically favorable)
 - Uniformly rotating body $\beta \gtrsim 0.27$
 - Differentially rotating body $\beta \lesssim 0.09$
- Secular instability (redistribution of angular momentum)
 - Dissipation due to GW or viscosity $\beta \gtrsim 0.14$

