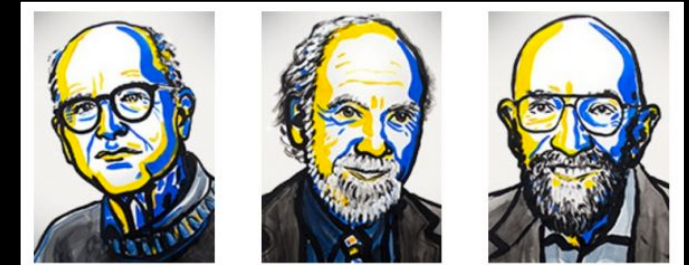
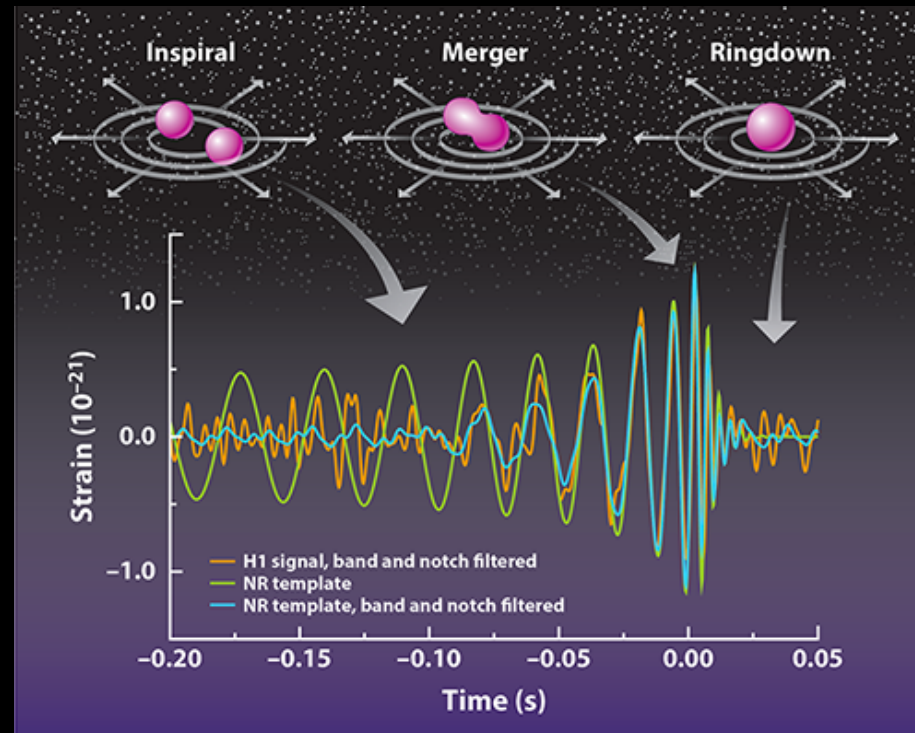
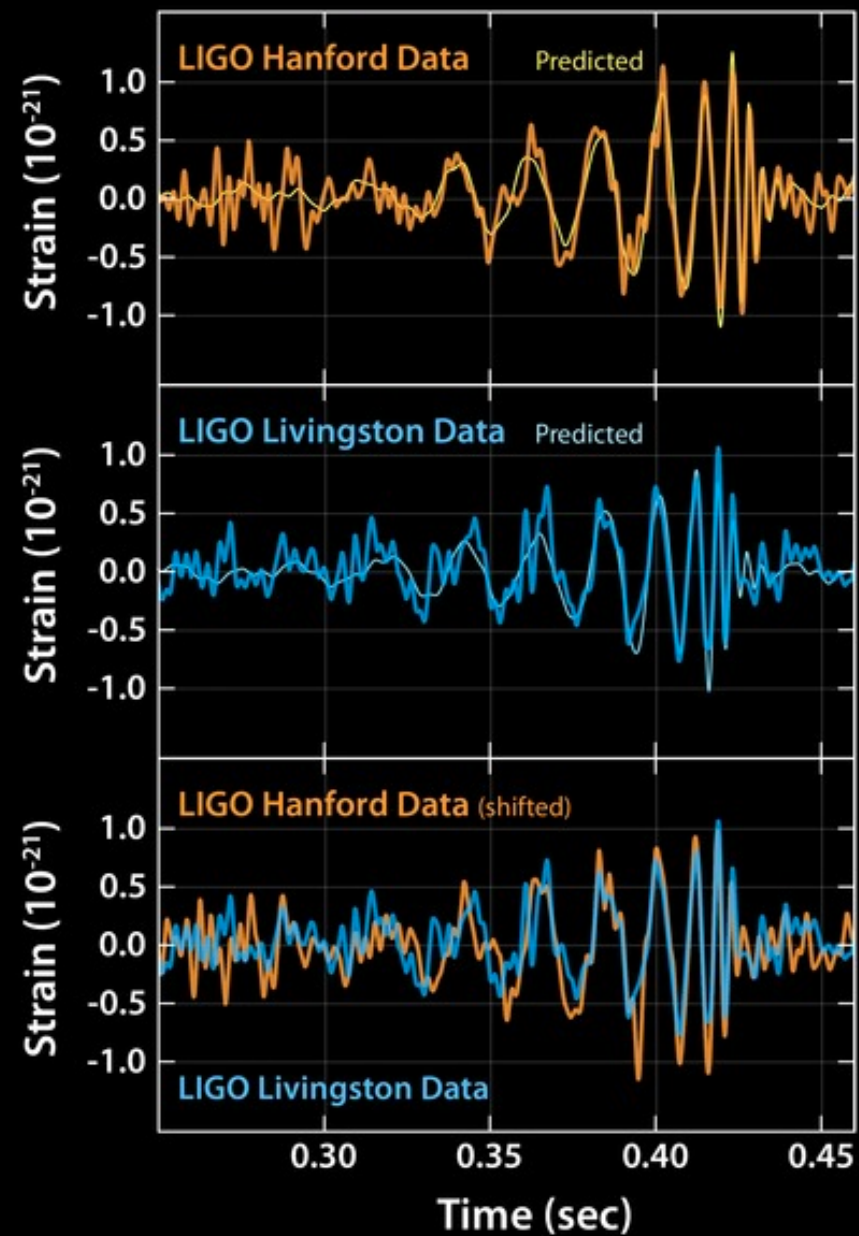


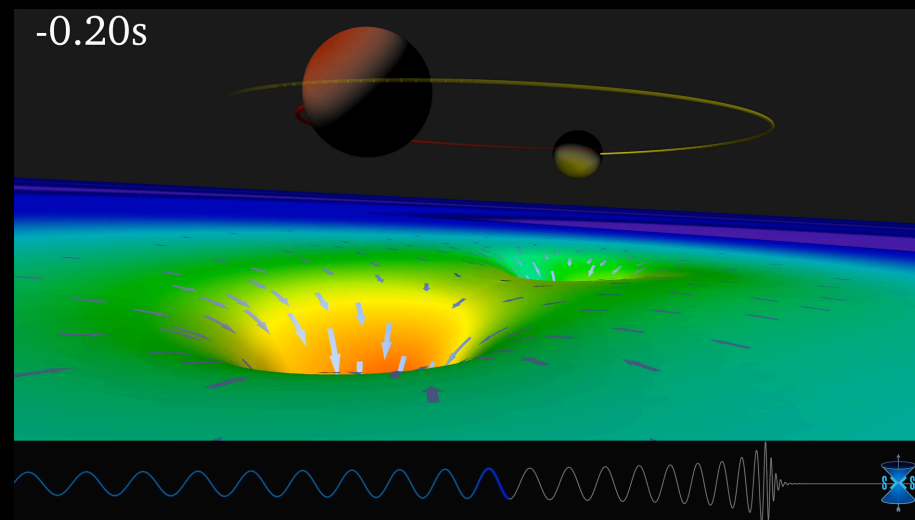
GRAVITATIONAL WAVE ASTROPHYSICS

Real Signal:

Theory and Simulation:



Nobel Prize: 2017



THE GRAVITATIONAL WAVE SPECTRUM

The Gravitational Wave Spectrum

Sources

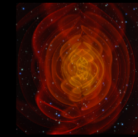
Detectors



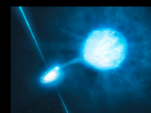
Big Bang



Supermassive Black Hole Binary Merger



Compact Binary Inspiral & Merger



Extreme Mass-Ratio Inspirals



Pulsars, Supernovae



age of the universe

Wave Period

years

hours

seconds

milliseconds

10^{-16}

10^{-14}

10^{-12}

10^{-10}

10^{-8}

10^{-6}

10^{-4}

10^{-2}

1

10^2

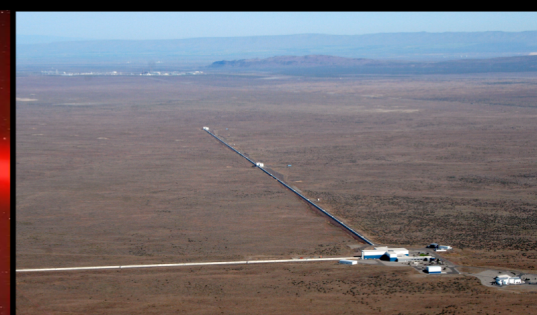
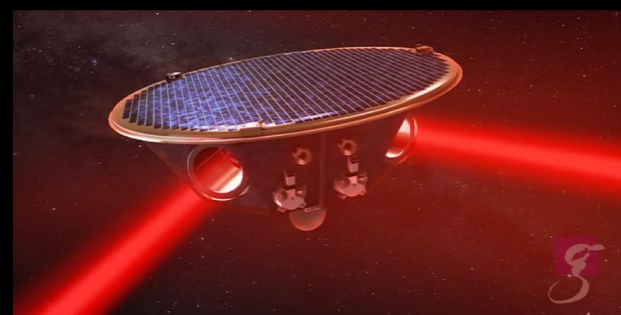
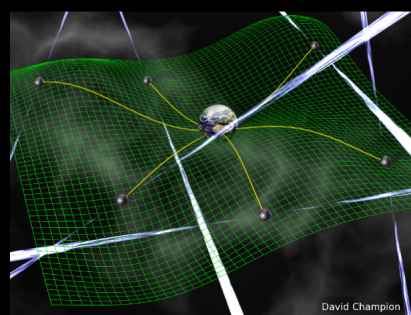
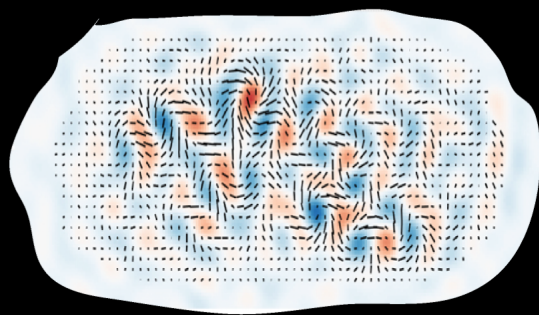
Wave Frequency

CMB Polarization

Radio Pulsar Timing Arrays

Space-based interferometers

Terrestrial interferometers



David Champion

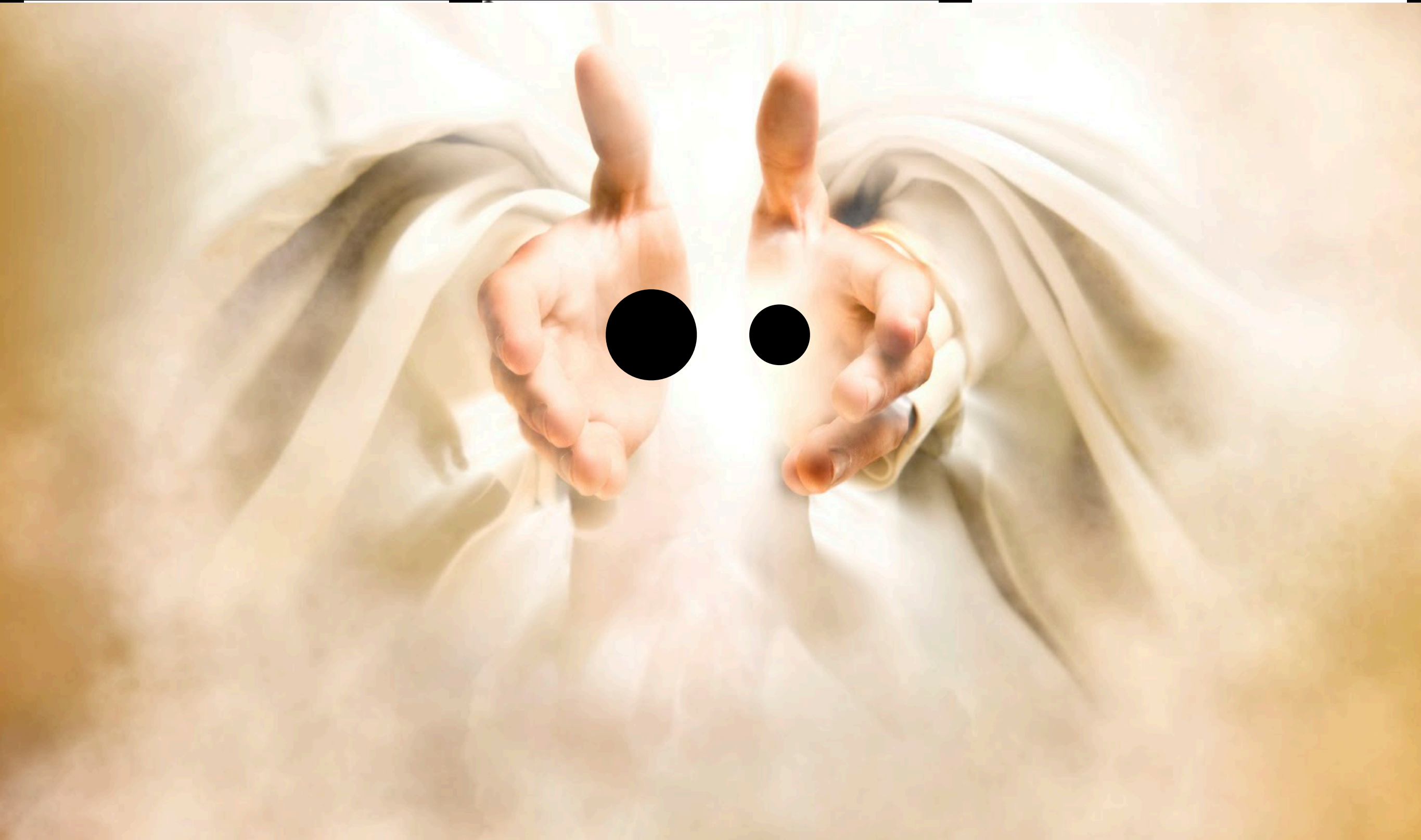
g

STELLAR MASS BINARIES: HOW DID THEY FORM?

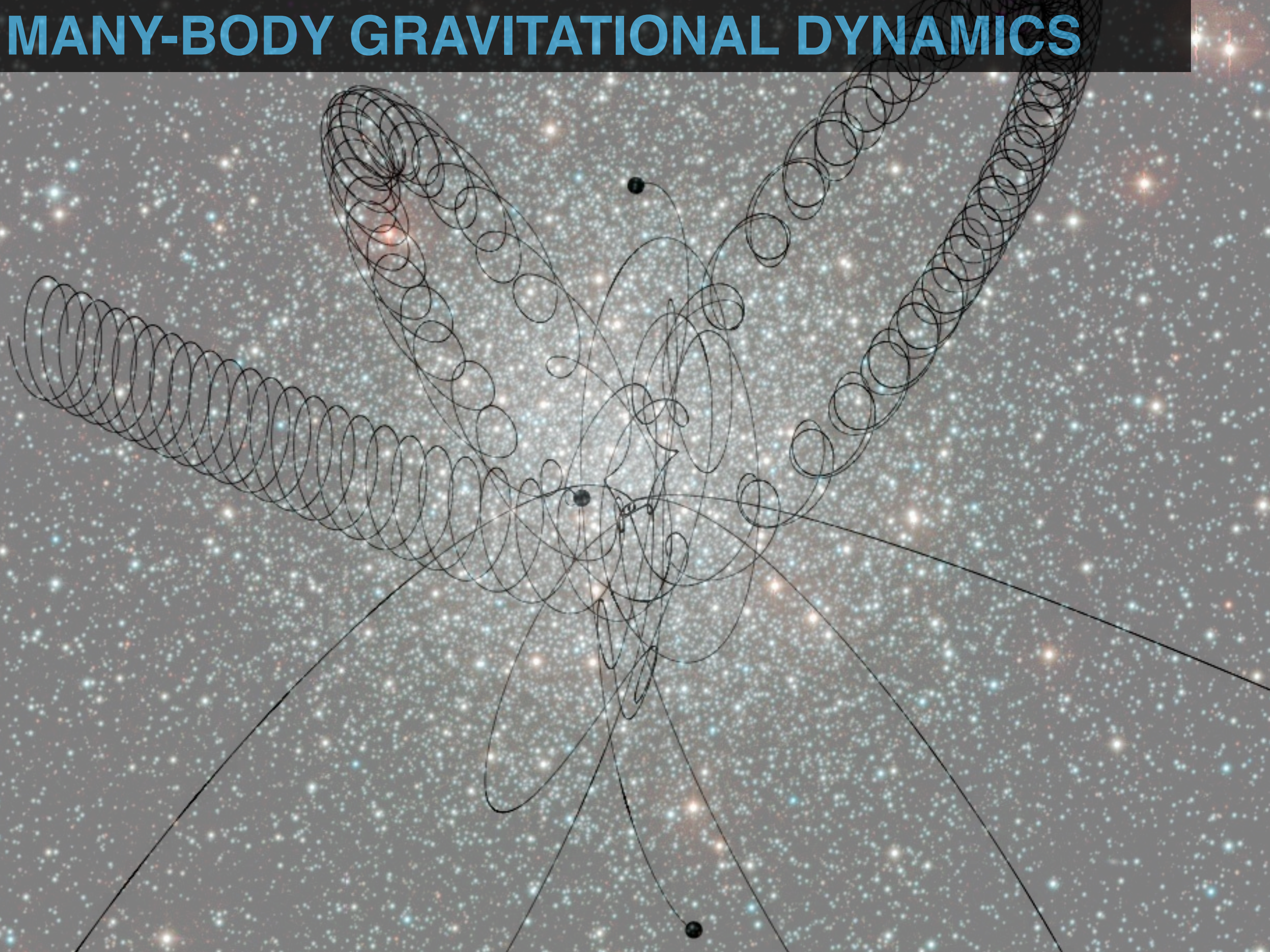
'Field'?

'Dynamically'?

'Other'?



MANY-BODY GRAVITATIONAL DYNAMICS

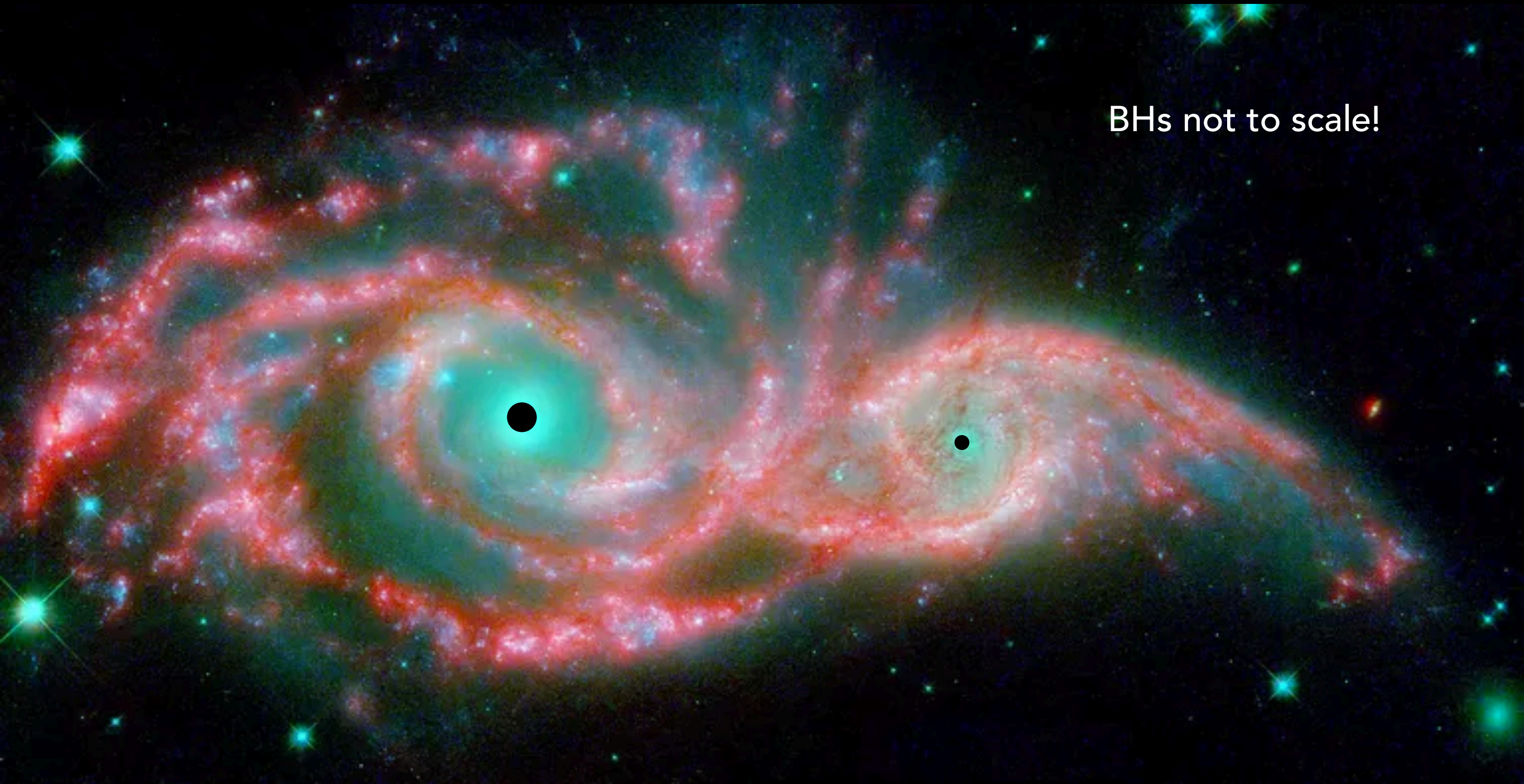


SUPERMASSIVE BLACK HOLE BINARIES - DO THEY MERGE?

- *Gas Dynamics (Broad Lines)
- *Stellar Dynamics
- *AGN power source
- *Pictures from the EHT

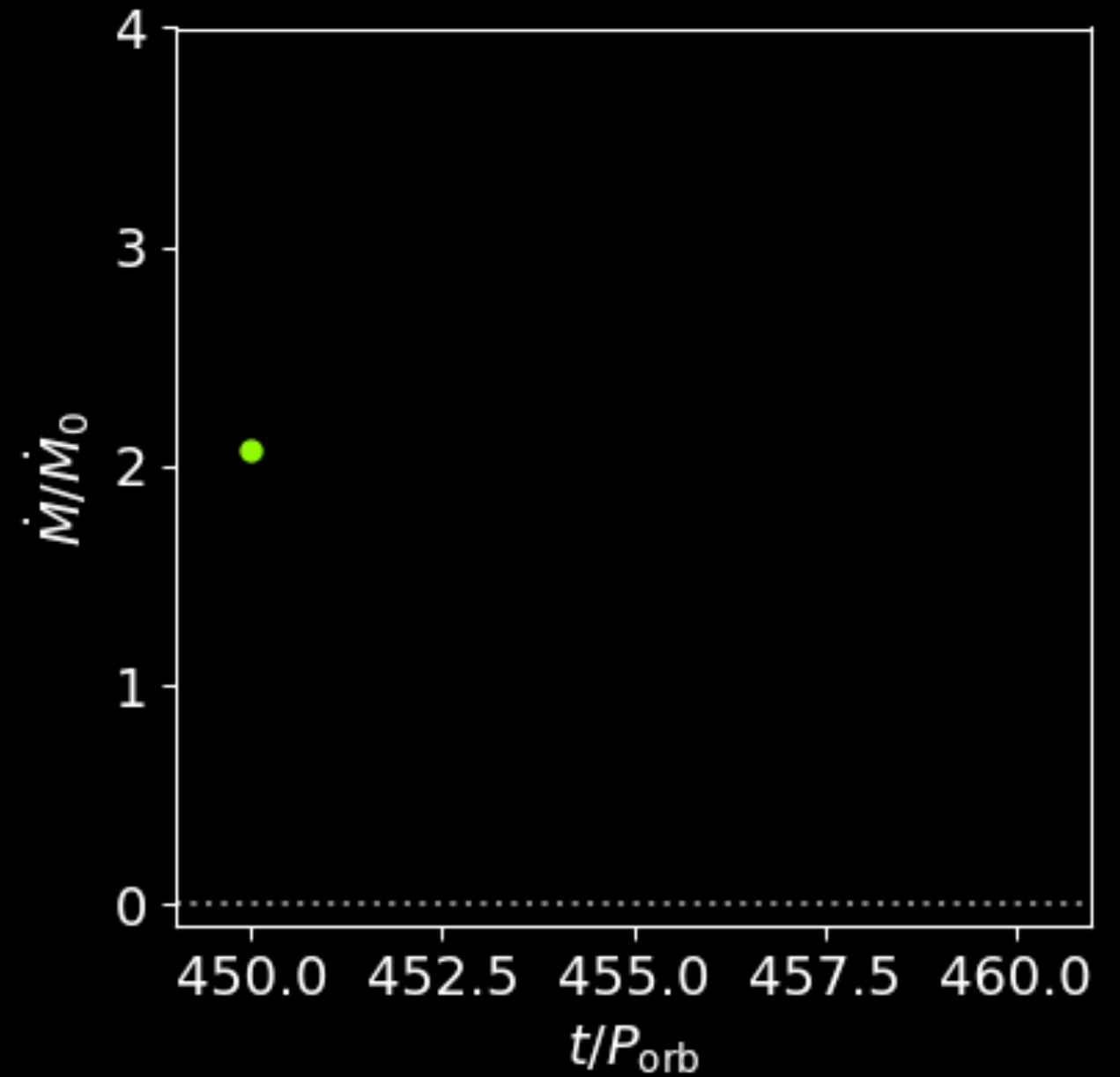
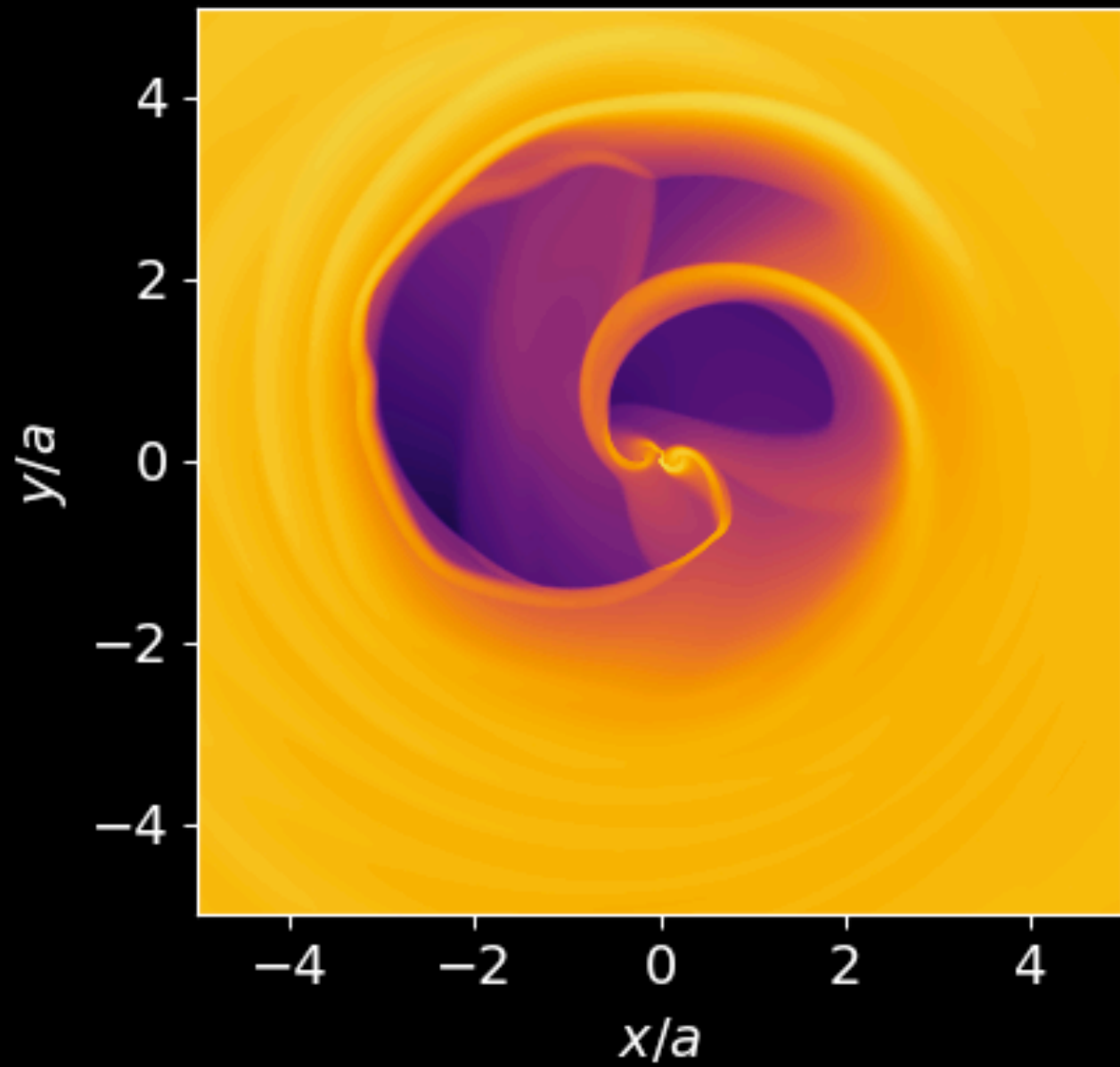


SUPERMASSIVE BLACK HOLE BINARIES - DO THEY MERGE?



BHs not to scale!

HYDRODYNAMICAL SIMULATIONS



People

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Research Topics

- * Theory at interface with observations: pencil-paper and numerics
- * Gravitational Waves and Black Hole Astrophysics
- * Many-body (relativistic) gravitational dynamics
- * Gas Accretion, Gravitational Lensing

Open Questions

- * How do black hole binaries (across the mass scale) form and merge?
 - * How do we find evidence for supermassive black hole binaries?
 - * Where/How do the stellar mass black hole binaries form/merge?
 - * What Electromagnetic and Gravitational Wave observables can we predict and use to find the answers?