

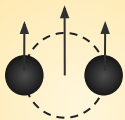
Eccentric mergers in the disks of Active Galactic Nuclei

Proposed GW Formation Channels

Isolated



Circular

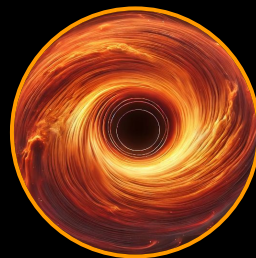


Aligned spins



Merger mass upper limit

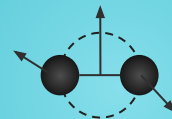
Dynamical



+ Environmental Effects



Eccentric

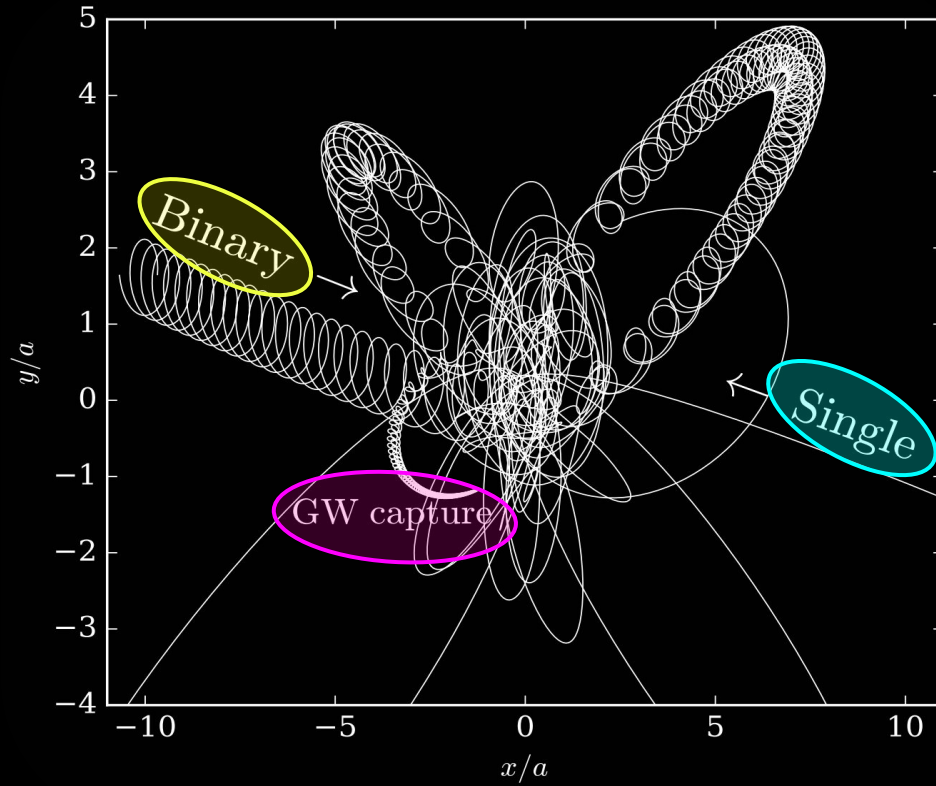


Mis-aligned spins

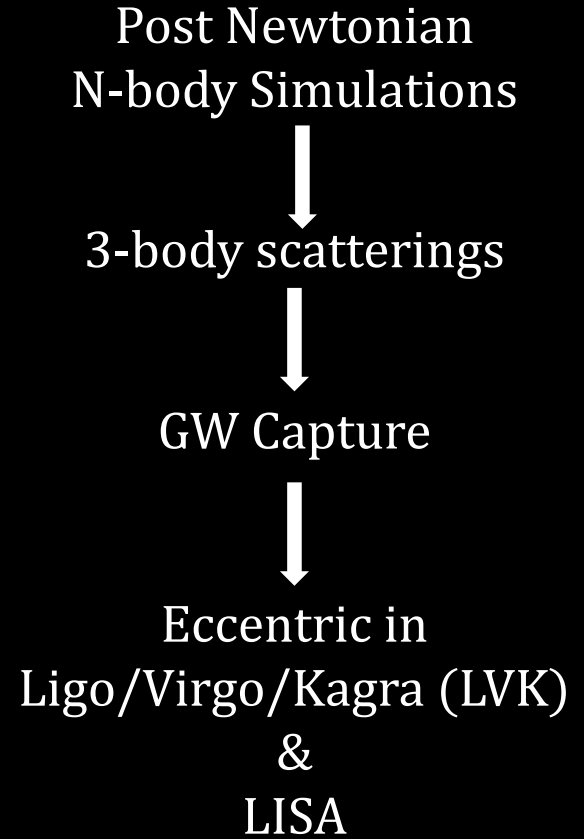


Higher merger mass

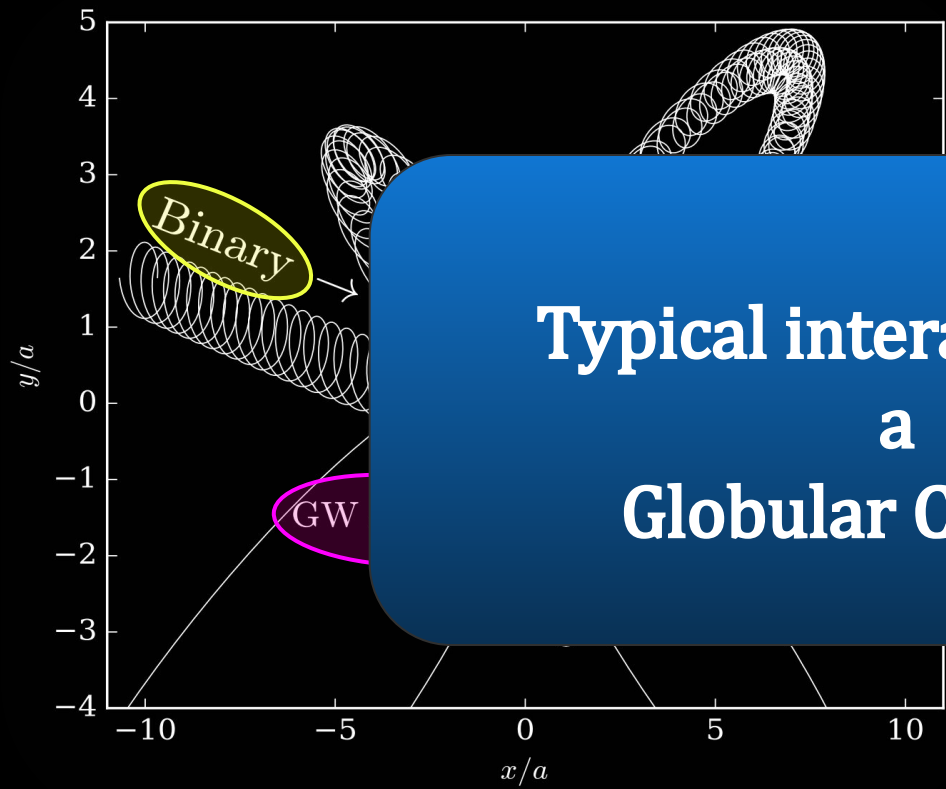
Eccentric Mergers



Samsing et al. (2018)



Eccentric Mergers



Post Newtonian
N-body Simulations

↓
scatterings

↓
Capture

↓
Eccentric in
Ligo/Virgo/Kagra (LVK)
&
LISA

Samsing et al. (2018)

Why the need for AGNs?

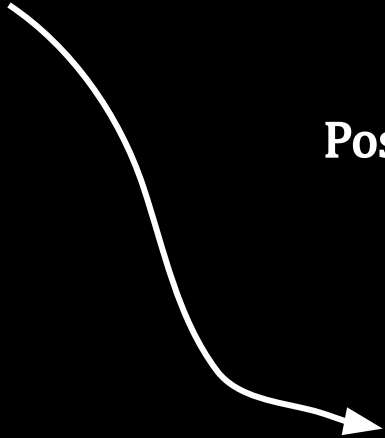
GW190521

150 M_{\odot}

High masses (in mass gap)
The LIGO & Virgo Collab+20

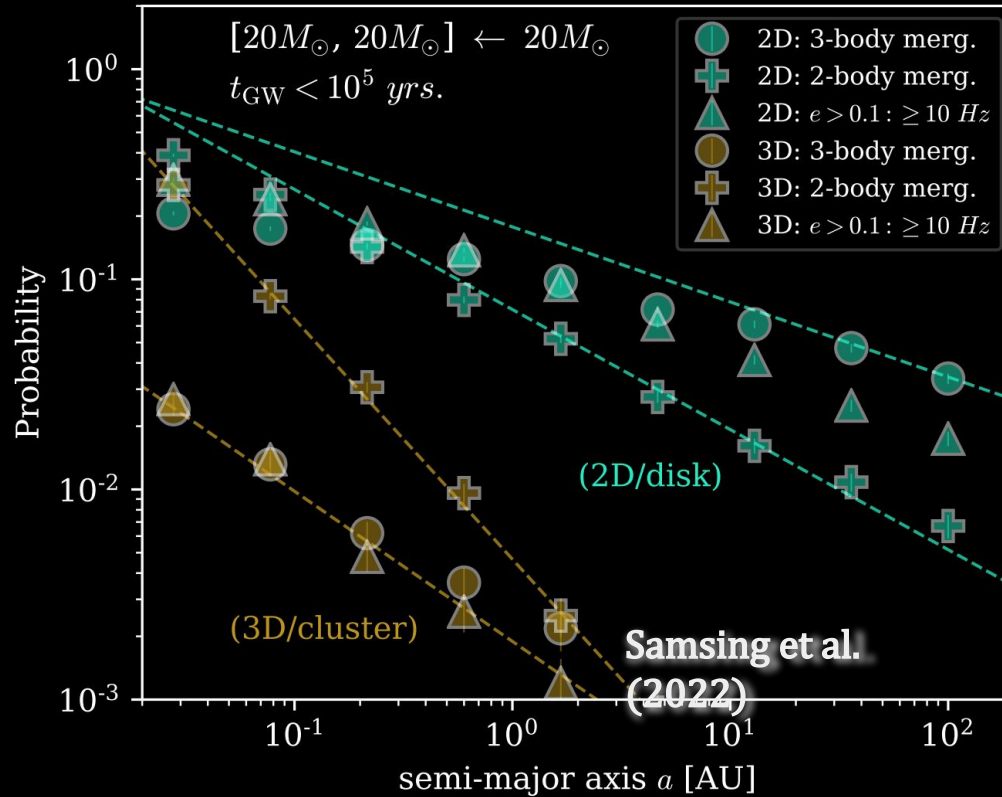
Possible EM counterpart
Graham+20

Possible eccentricity
*Romero-Shaw+20,
Gayathri+22*

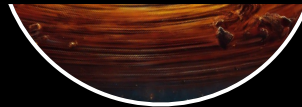


Why the need for AGNs?

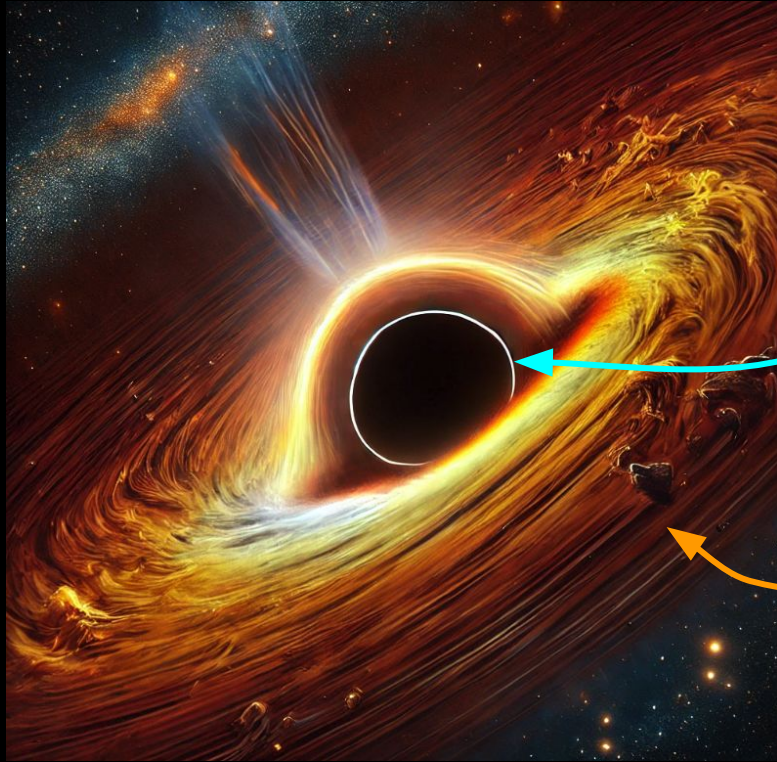
High masse:
The LIGO &



M counterpart
iham+20



Environmental Effects in AGNs



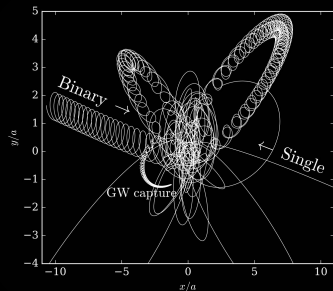
**Supermassive
Black-Hole
(SMBH)**

Tides

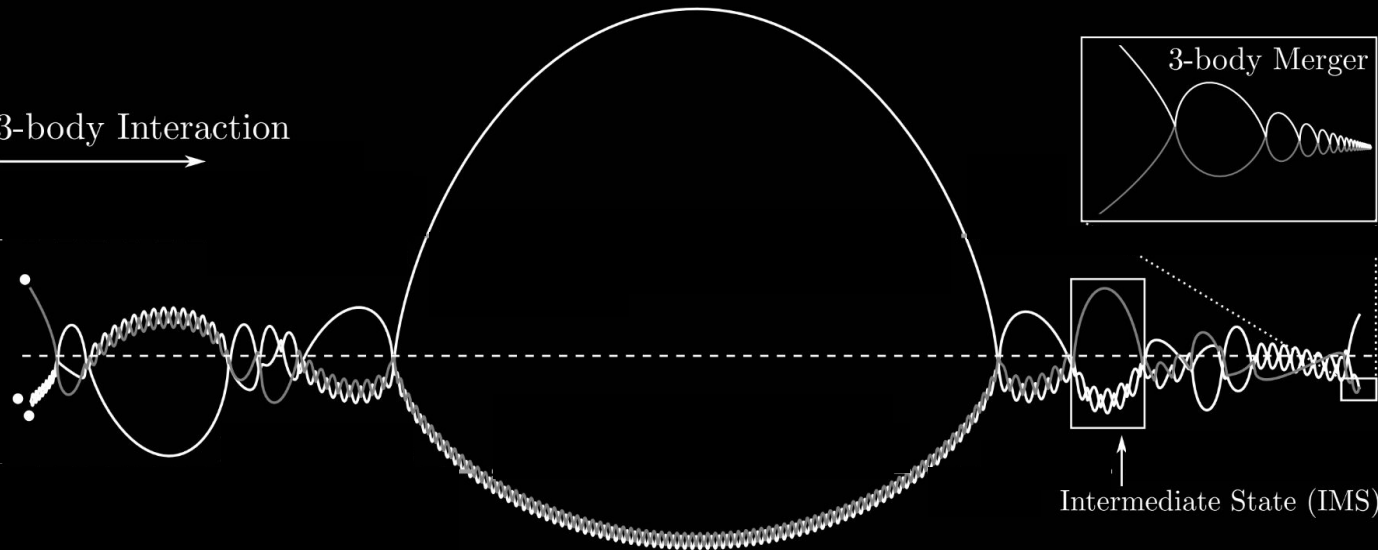
Accretion Disk

**Gas drag
force**

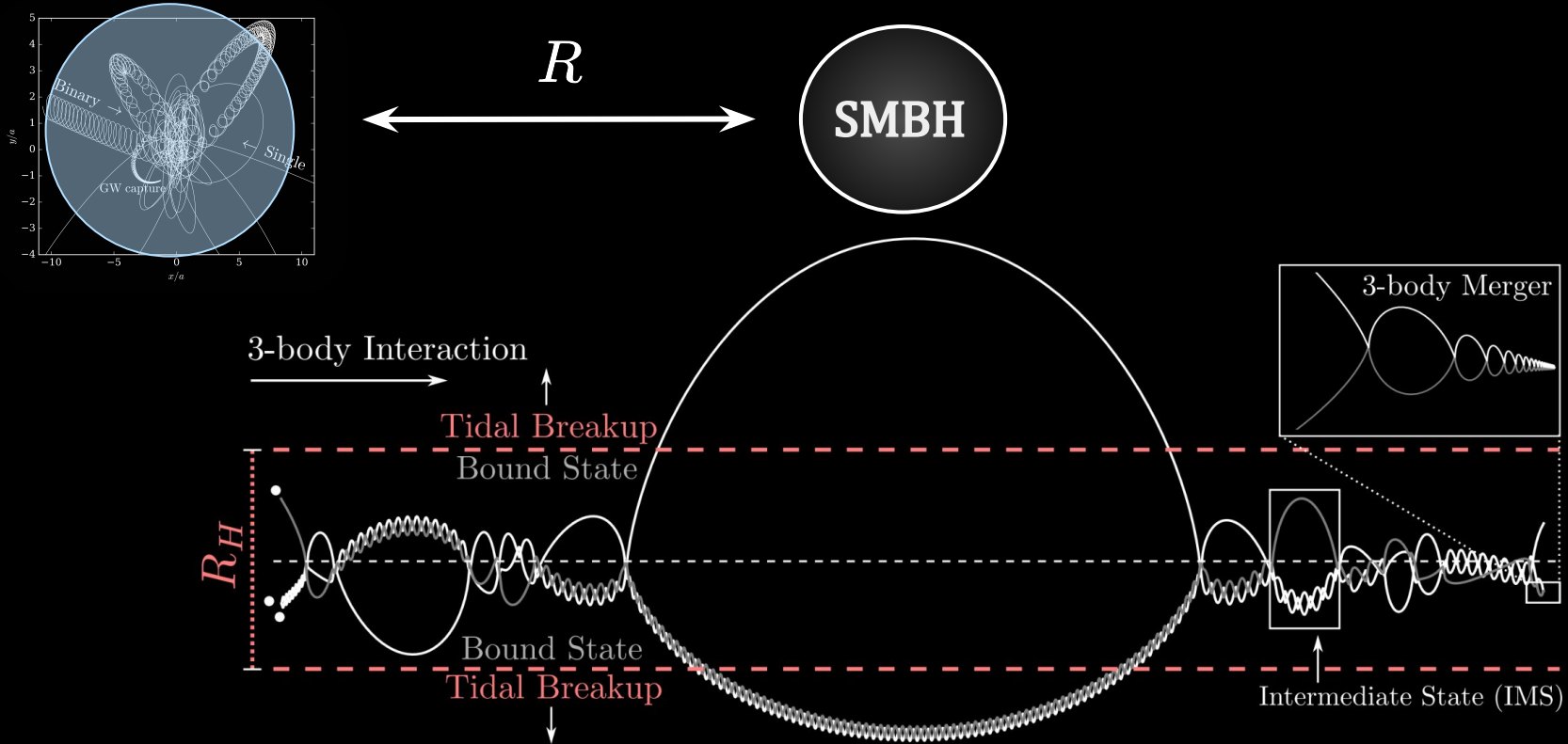
Effect of Tides on Three-Body Encounters



3-body Interaction



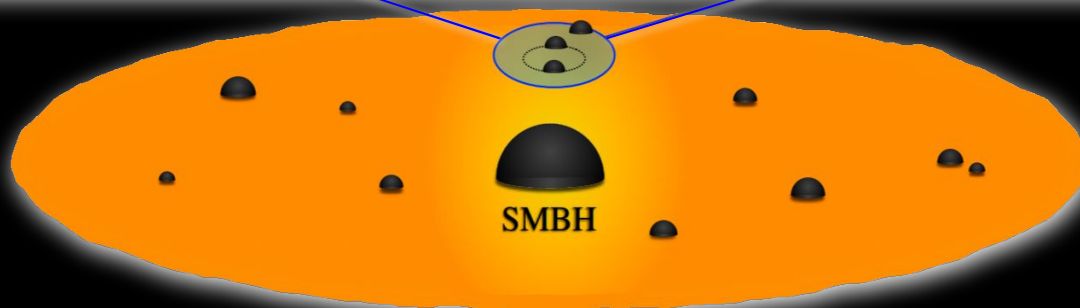
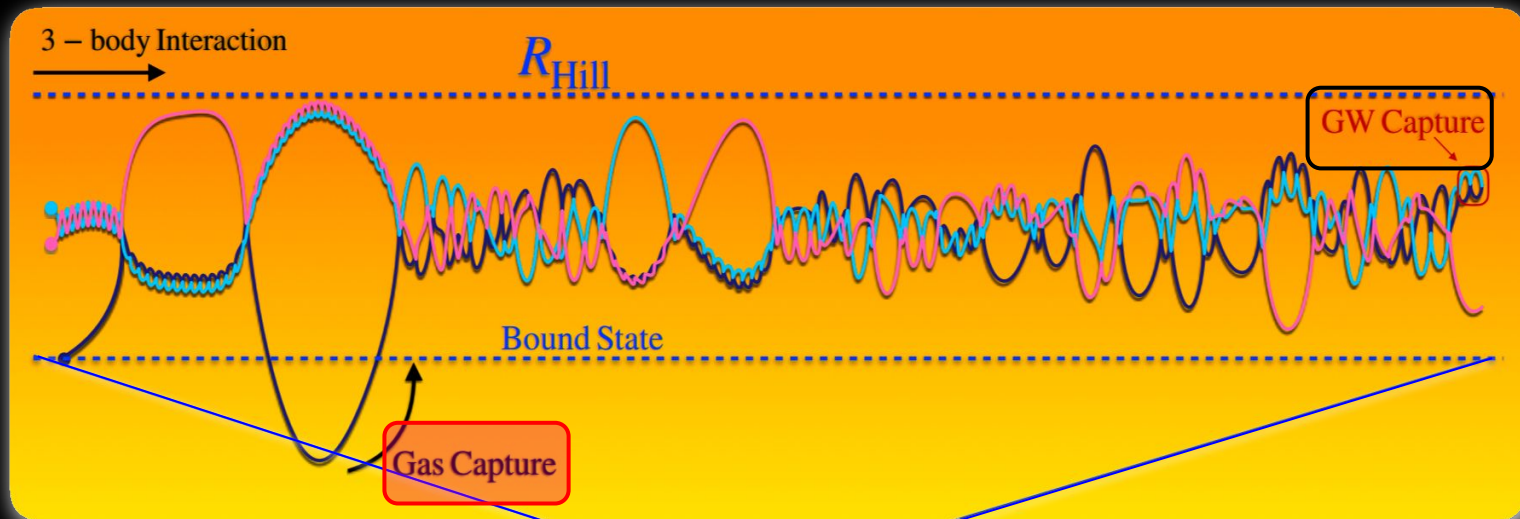
Effect of Tides on Three-Body Encounters



$$R_H = R \left(\frac{m}{M_{\text{BH}}} \right)^{1/3}$$

Fabj & Samsing (2024)

**What happens when you
add the effect from the
accretion disk?**



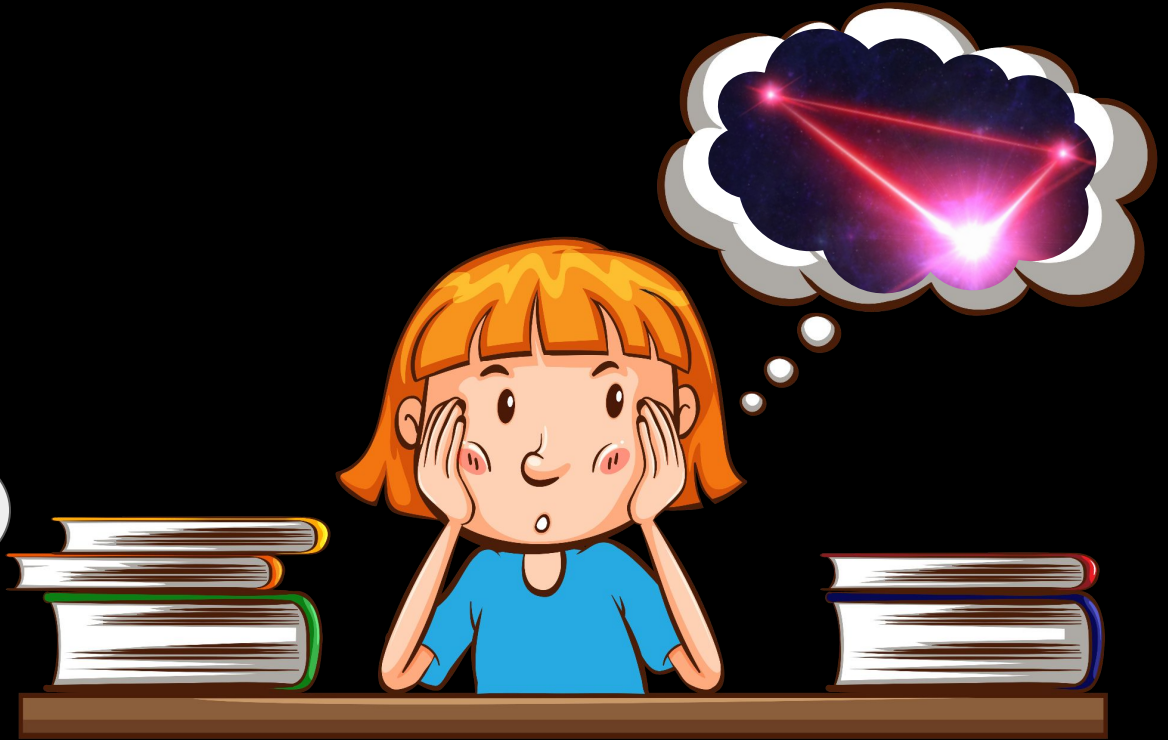
Fabj et al. (in prep.)

Can we
potentially
detect
GW190521-like
events **with**
LISA?

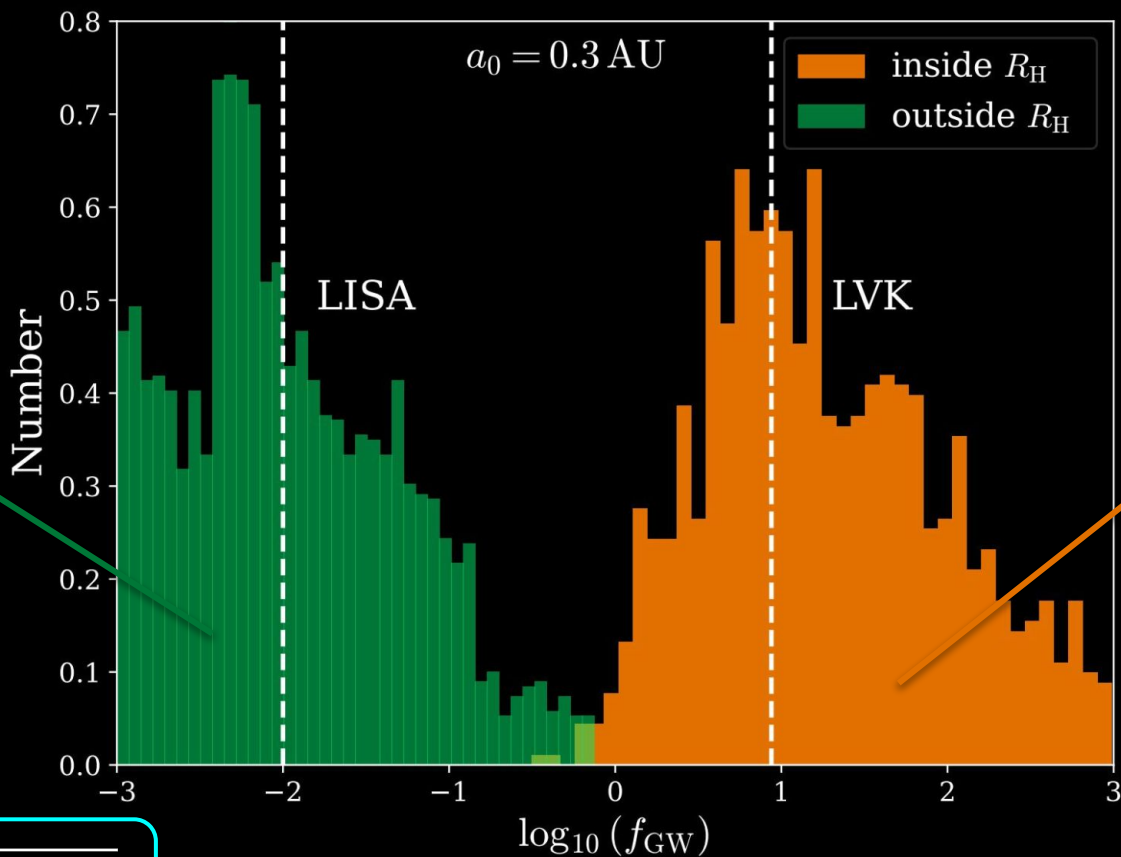
Infer properties of AGN
(e.g. SMBH mass)

e.g. Toubiana et al. (2021)

Sberna et al. (2022)



GW Peak frequency Distribution



BBHs
outside Hill
Sphere

BBHs
inside Hill
Sphere

$$f_{\text{GW}} \approx \pi^{-1} \sqrt{2Gm/r_f^3}$$

Fabj & Samsing (2024)

Summary

GW formation channels

Isolated

Dynamical

Globular Clusters
&

Active Galactic Nuclei

Eccentric Mergers
GW190521

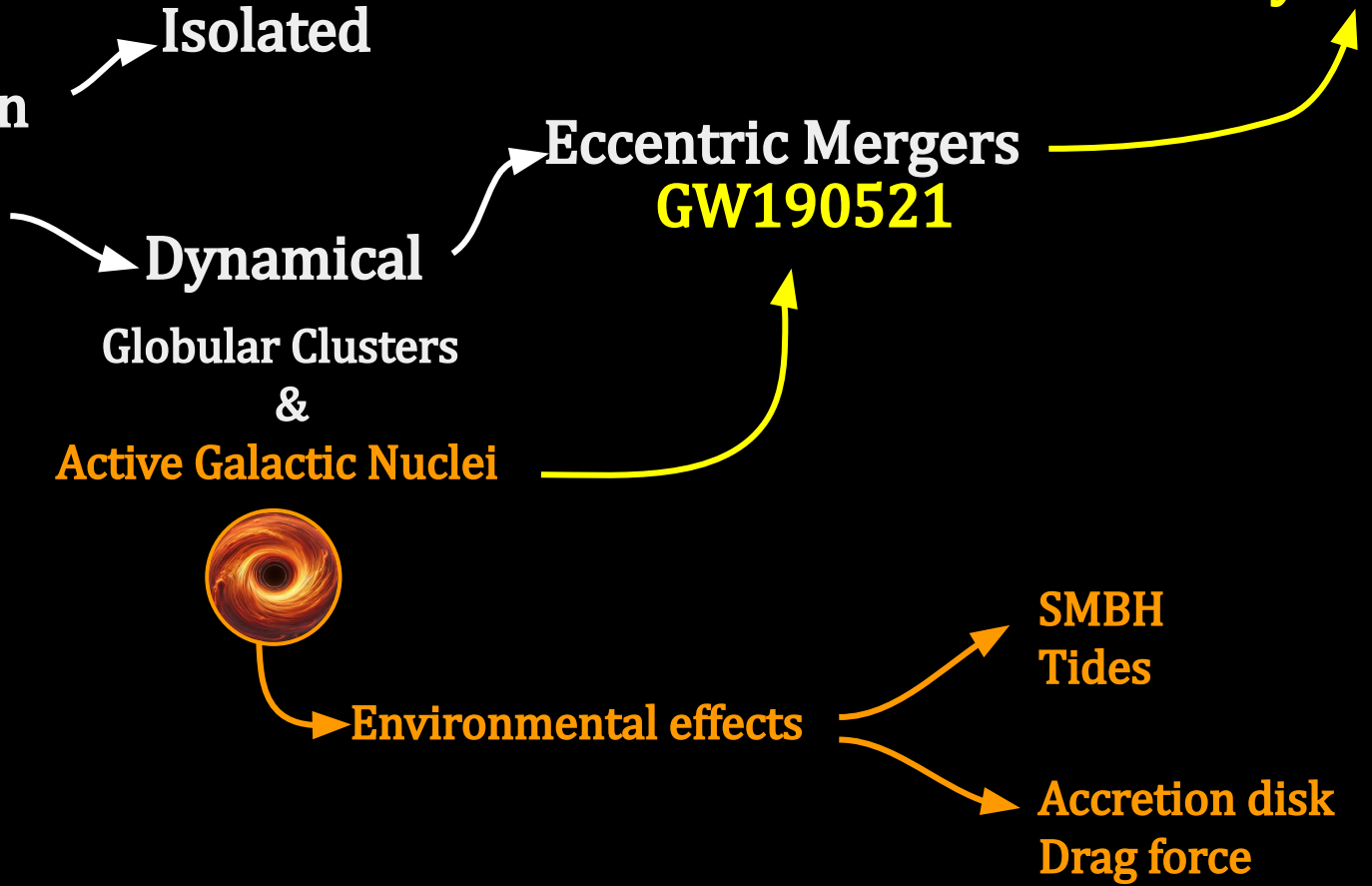
Detectable
by LISA!



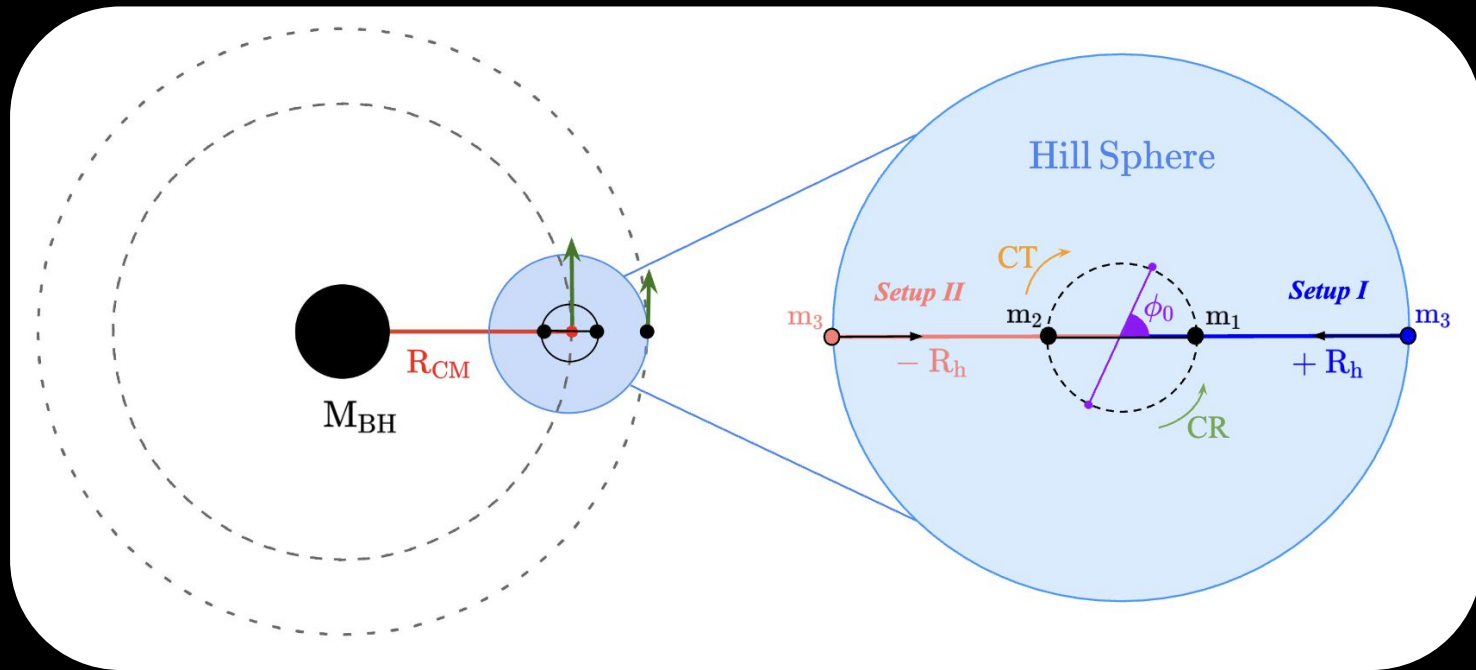
Environmental effects

SMBH
Tides

Accretion disk
Drag force



Backup Slides



Fabj & Samsing (2024)