

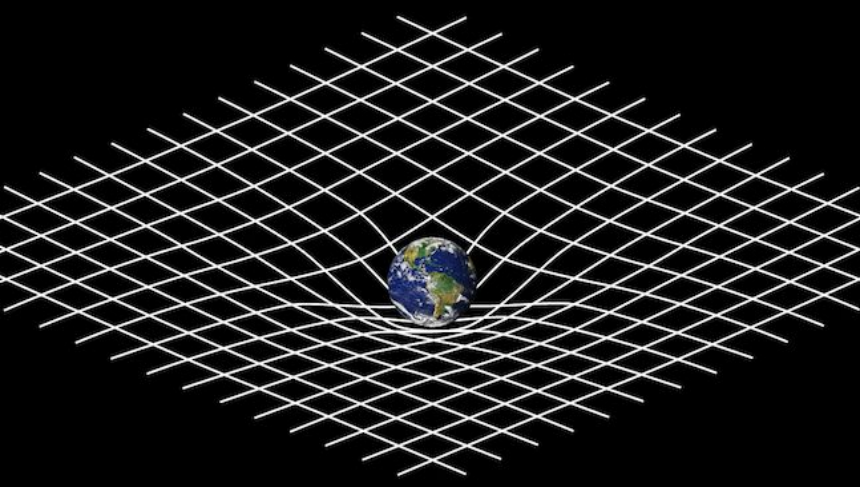


# Dirty Extreme Mass Ratio Inspirals

Lukas Arda

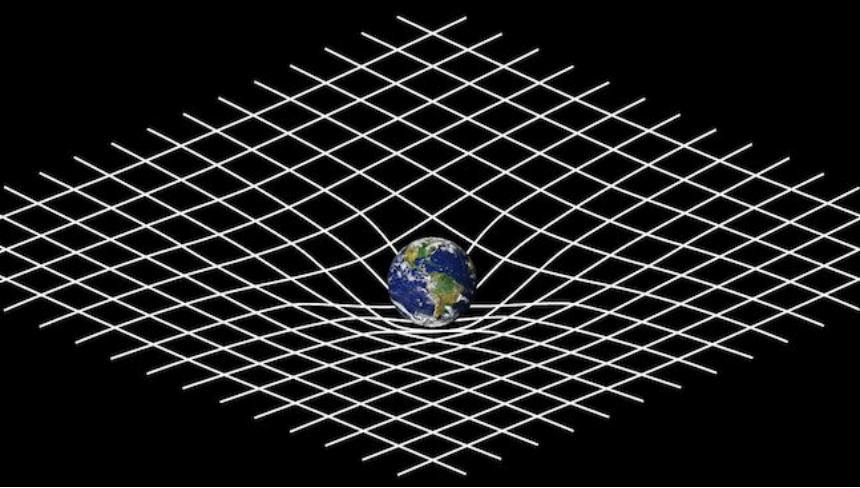


# Gravitational Waves

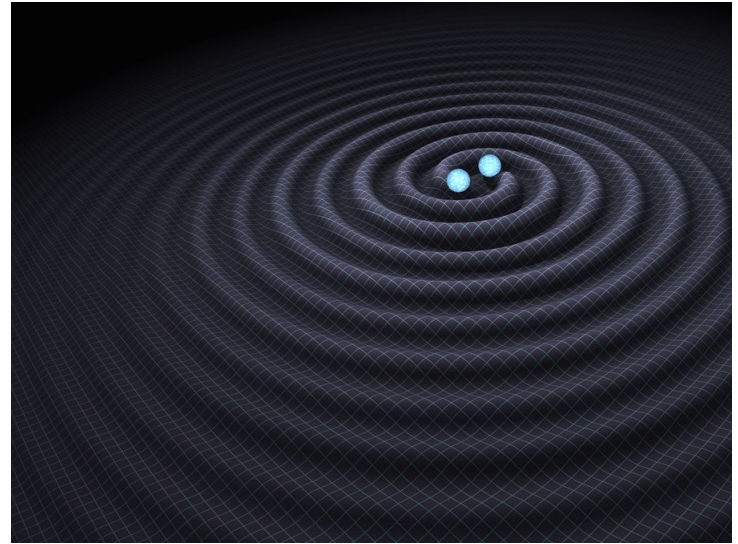


[Credit: NASA's Imagine the Universe]

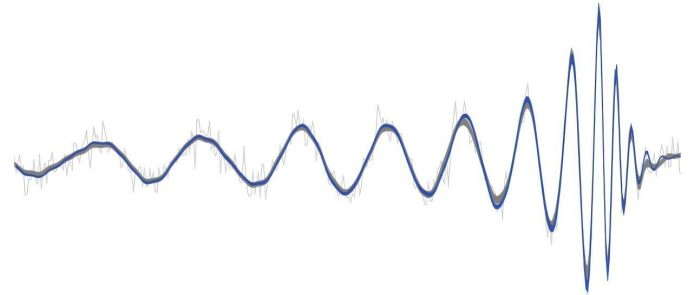
# Gravitational Waves



[Credit: NASA's Imagine the Universe]

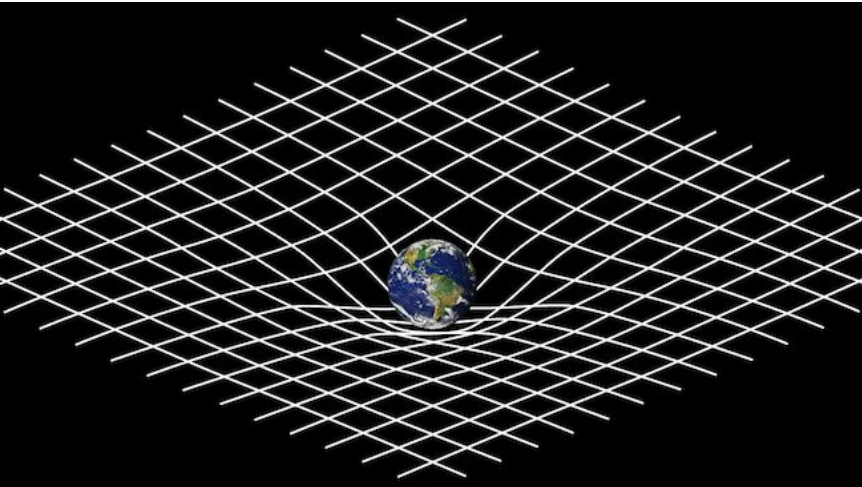


[Credit: NASA's Imagine the Universe]

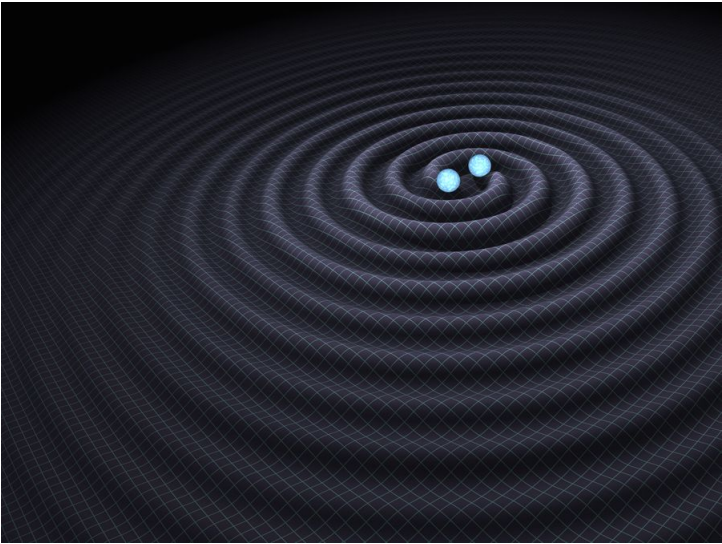


[Credit: Simon Stevenson, The Conversation, '25]

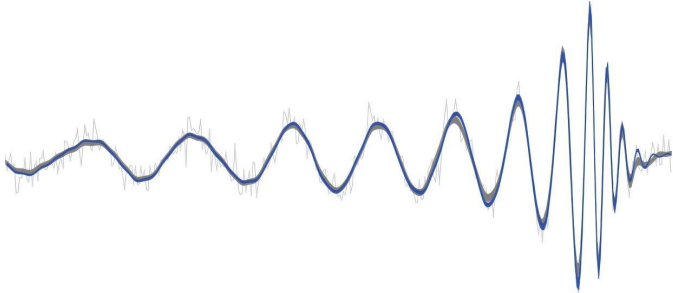
# Gravitational Waves



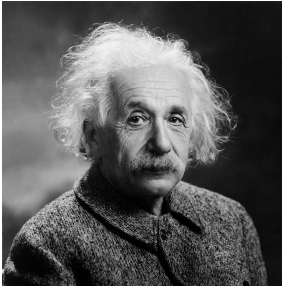
[Credit: NASA's Imagine the Universe]



[Credit: NASA's Imagine the Universe]

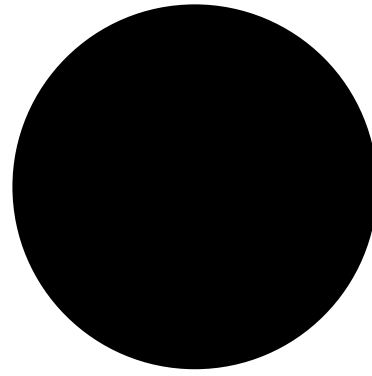


[Credit: Simon Stevenson, The Conversation, '25]



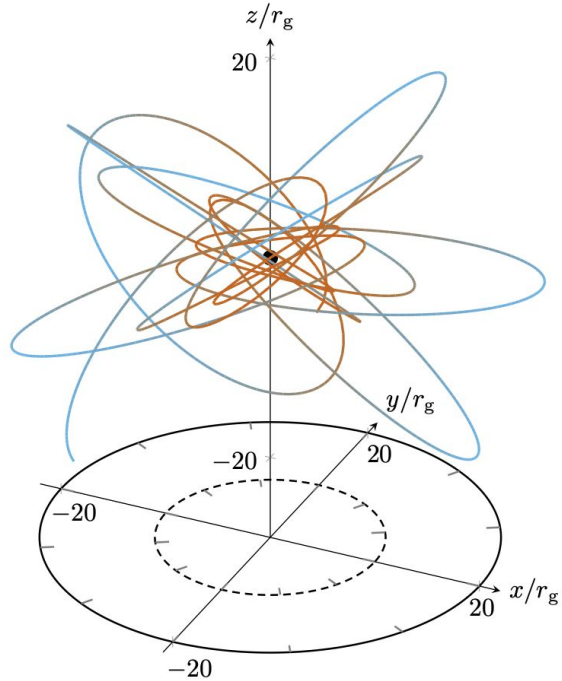
PTA 

Let's make it extreme !

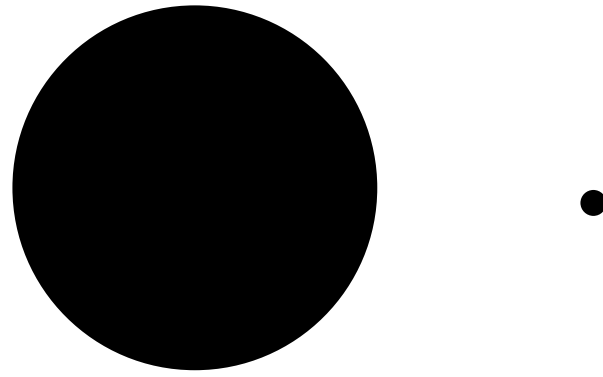


Extreme Mass Ratio Inspiral

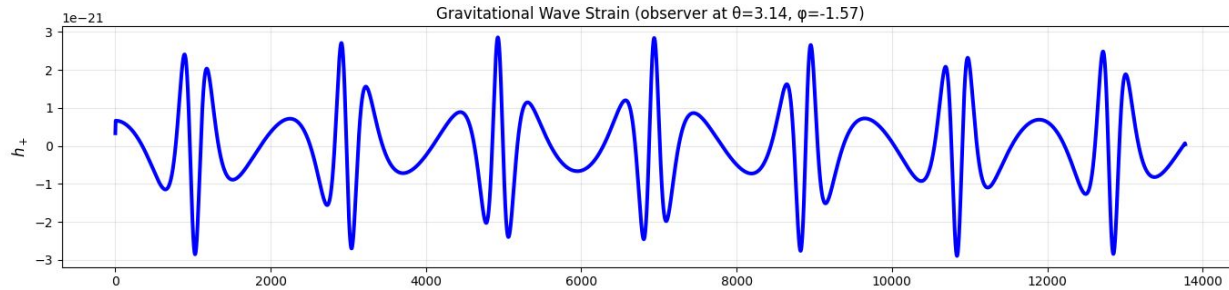
# Let's make it extreme !



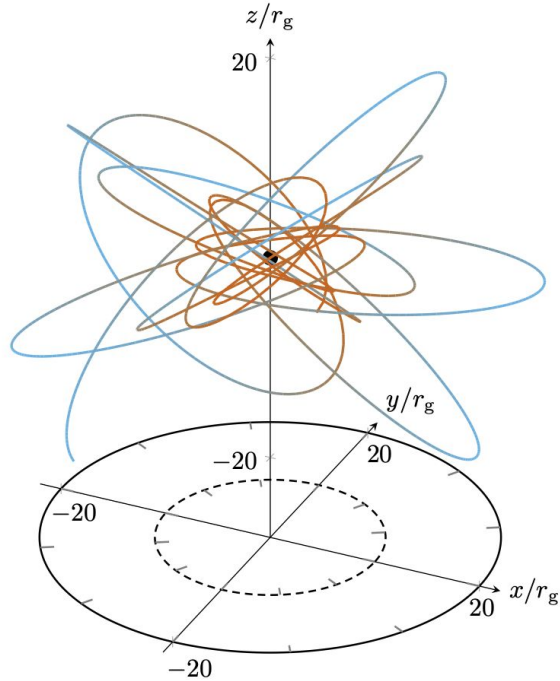
[Credit: Berry et al., '19]



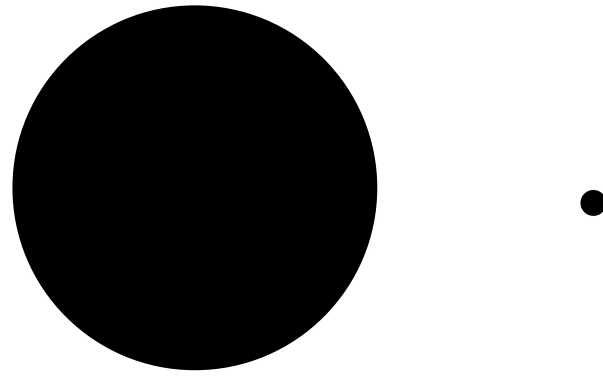
Extreme Mass Ratio Inspiral



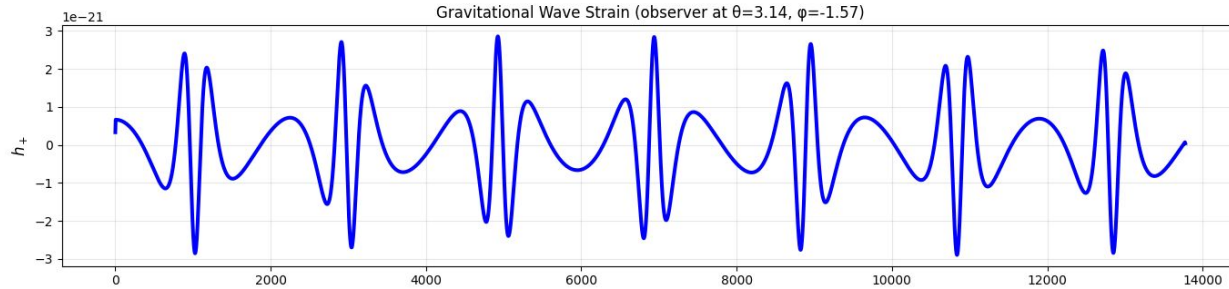
# Let's make it extreme !



[Credit: Berry et al., '19]



Extreme Mass Ratio Inspiral



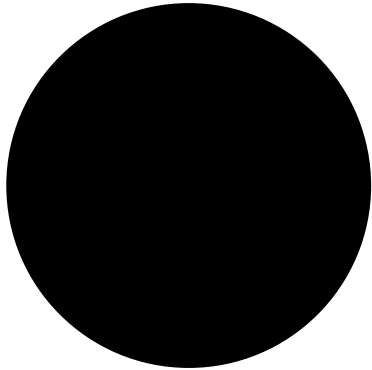
Gateway for...

Massive Black Hole population  
 Test strong General Relativity  
 Cosmology (Standard sirens)

Massive Black Hole environments

# Let's make it dirty !

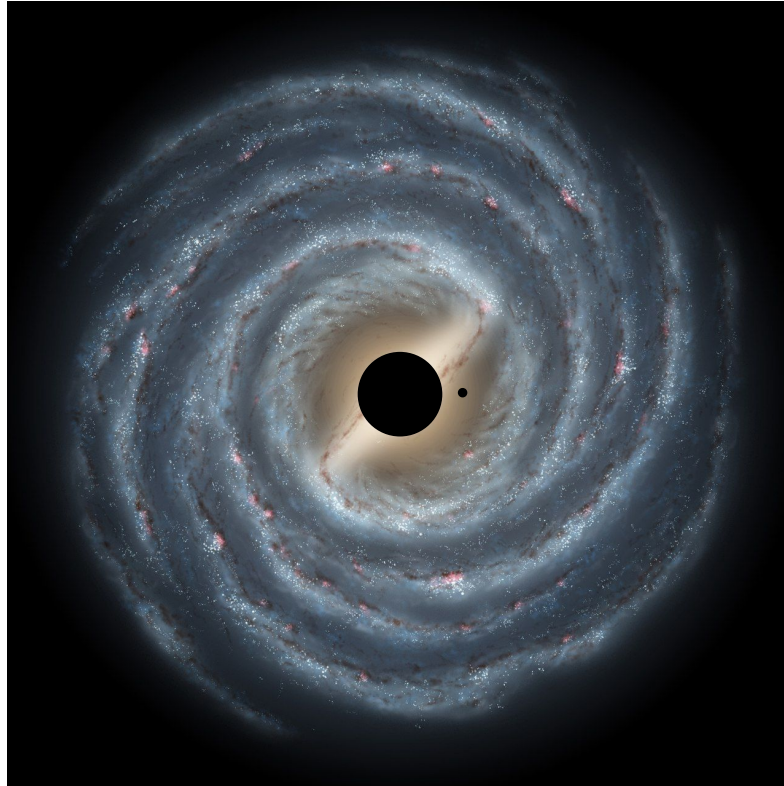
... include the environment



[Credit: Hurt, NASA/JPL, '05]

# Let's make it dirty !

... include the environment

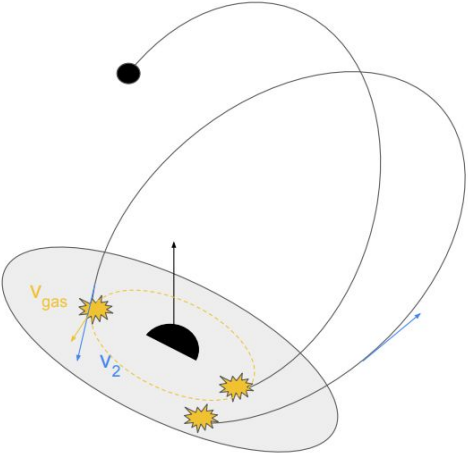


[Credit: Hurt, NASA/JPL, '05]

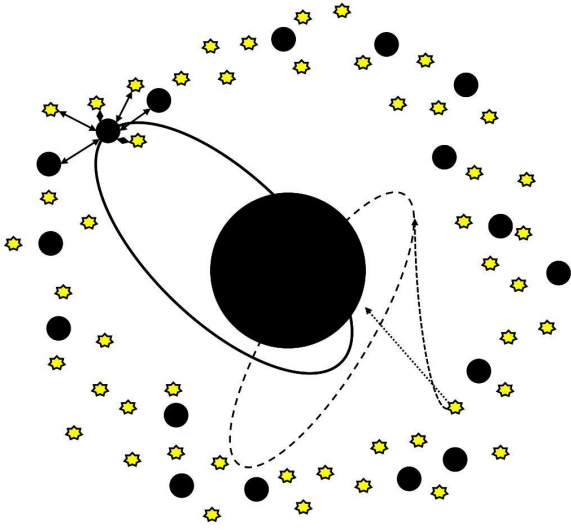
# Let's make it dirty !

... include the environment

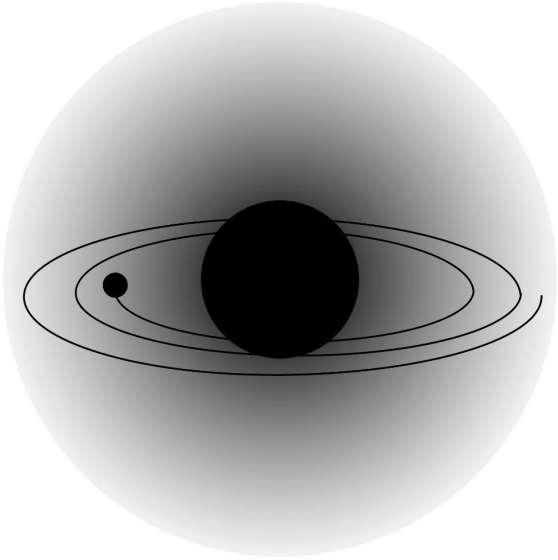
Accretion disk



Nuclear cloud



Dark matter halo

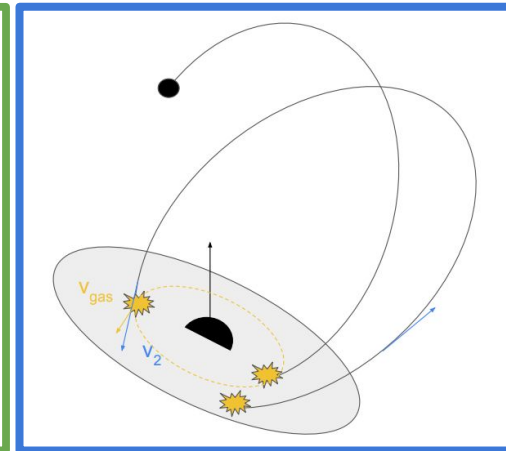
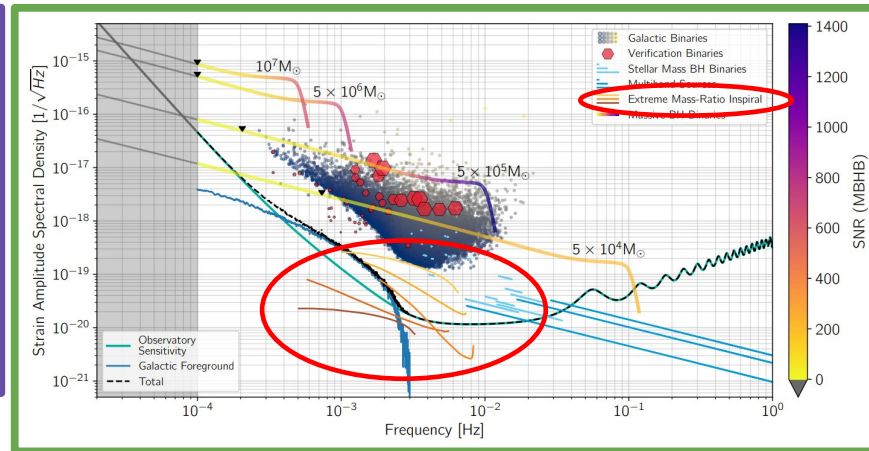
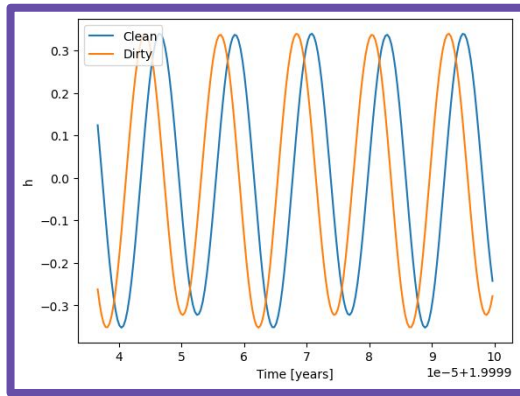


Reprinted from:  
[Franchini et al., '23]

## Dirty Extreme Mass Ratio Inspiral

# My tasks...

1. **Model/Simulate** Dirty Extreme Mass Ratio Inspirals
2. **Estimate detectability** with future detector LISA
3. **Leverage** e/m-counterpart observations → multi-messenger astronomy



[Credit: LISA Definition Study Report (arXiv:2402.07571)]

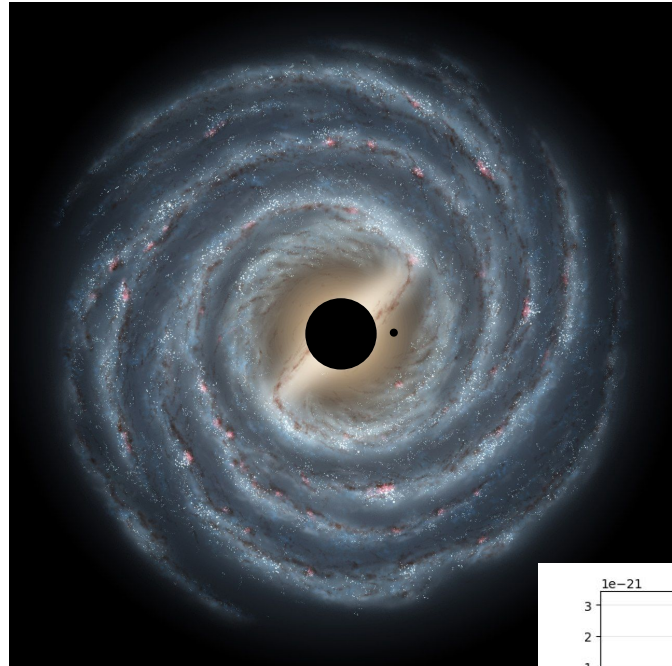
Reprinted from: [Franchini et al., '23]



# Thank you !

Please talk to me !  
arda@apc.in2p3.fr – Office 267A

# Burst signals from the center of the Milky Way



[Credit: Hurt, NASA/JPL, '05]

