

# Welcome: Gravity Wave Session

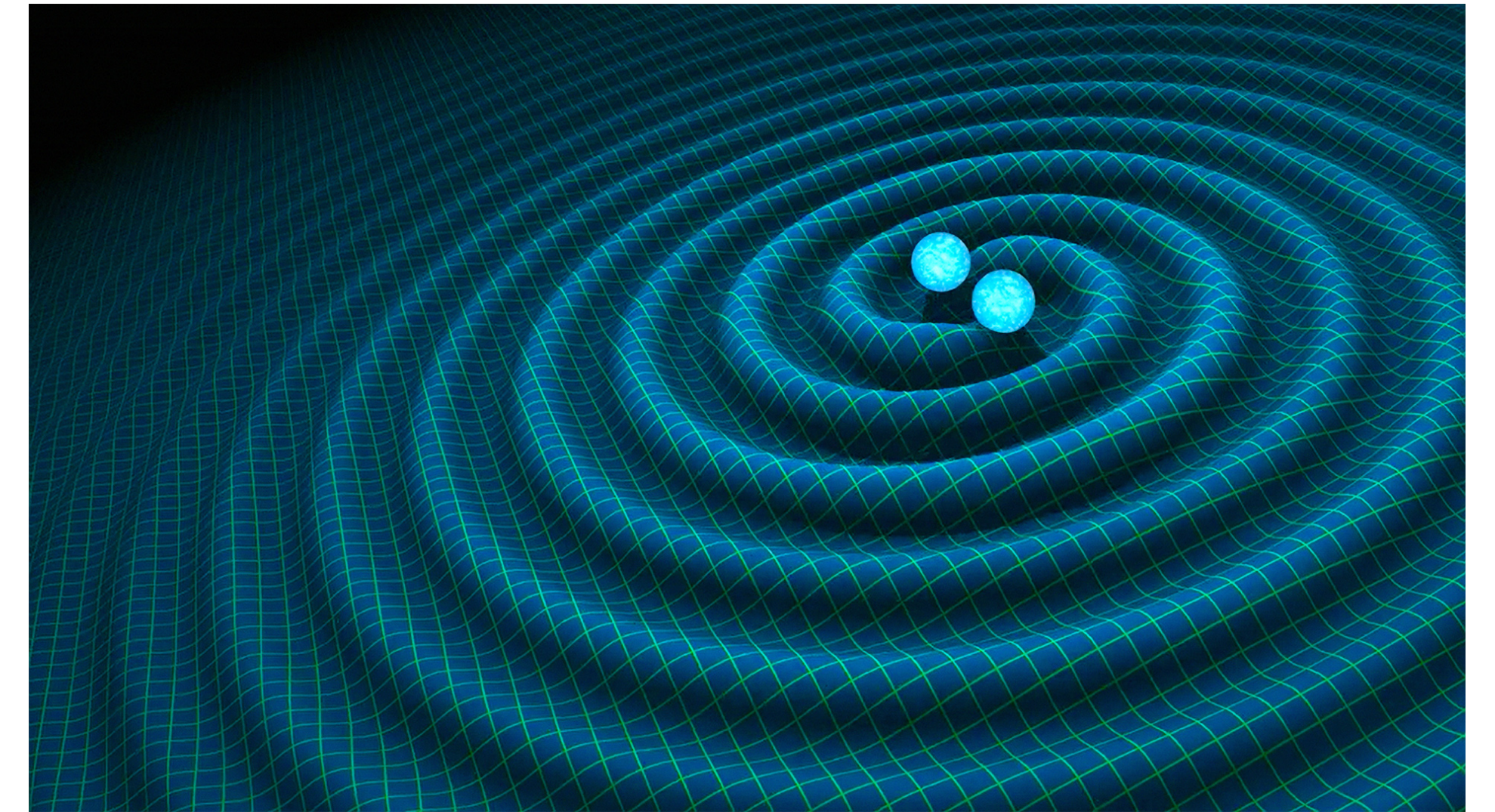
Roni Harnik,  
Fermilab

SQMS Science Thrust Lead  
Quantum Theory Department





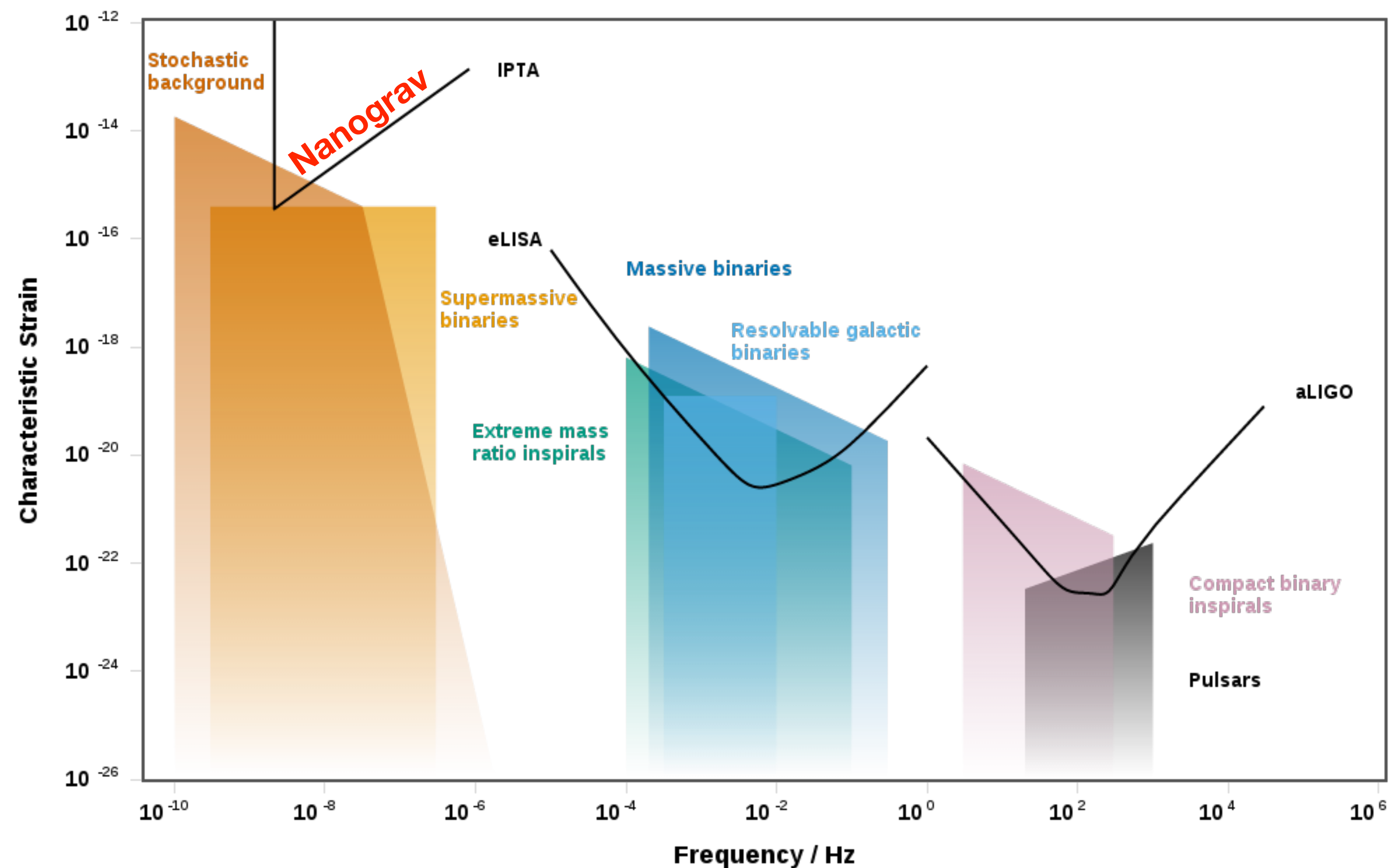
# LIGO



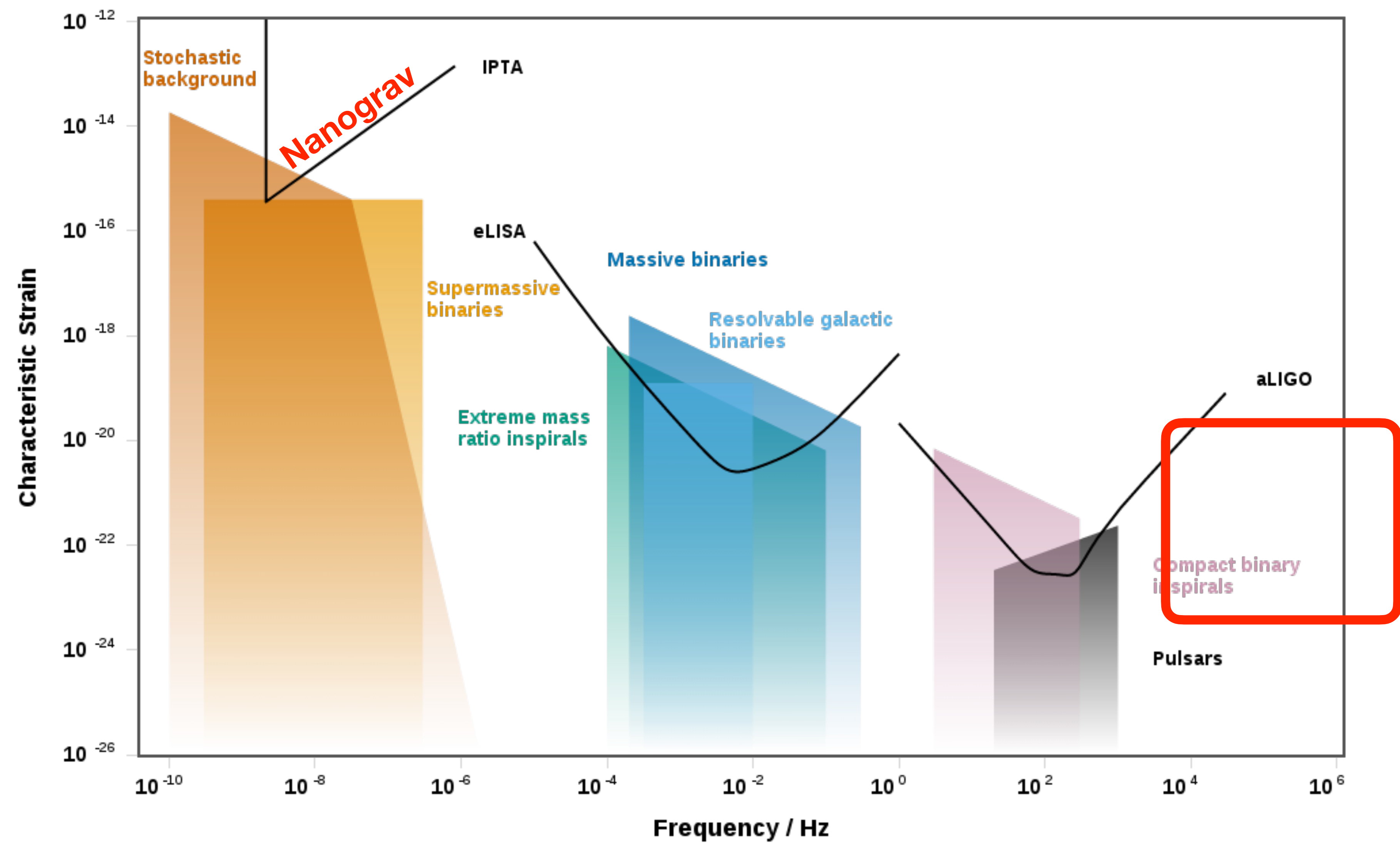
- We Learnt - gravitational waves exists... (but we knew that)
- .. and we can detect them!
- **GWs open a new eyes to look at the Universe, beyond light.**
- In light, every frequency band teaches use something new (once discovered).



# Beyond LIGO

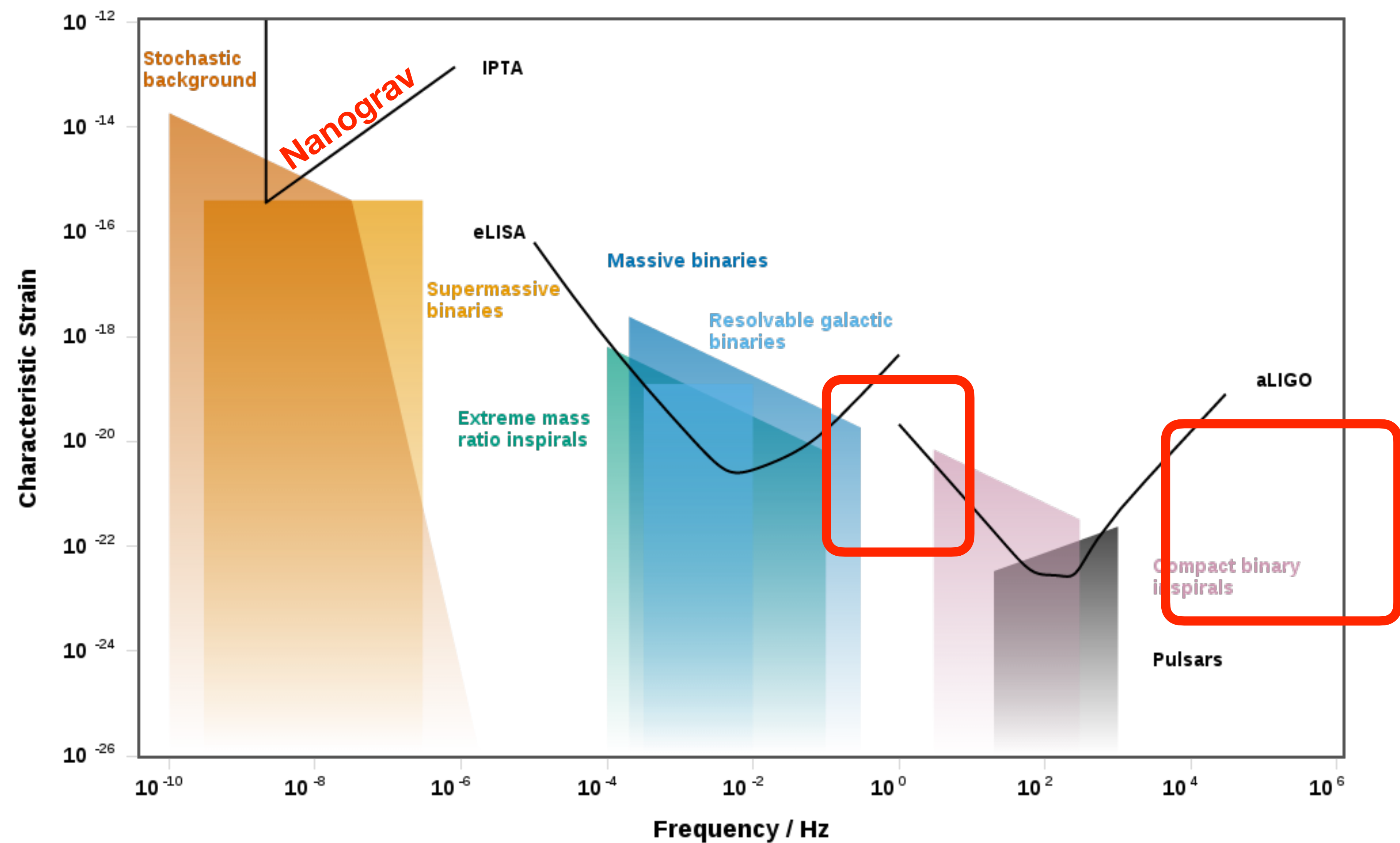


# Beyond LIGO

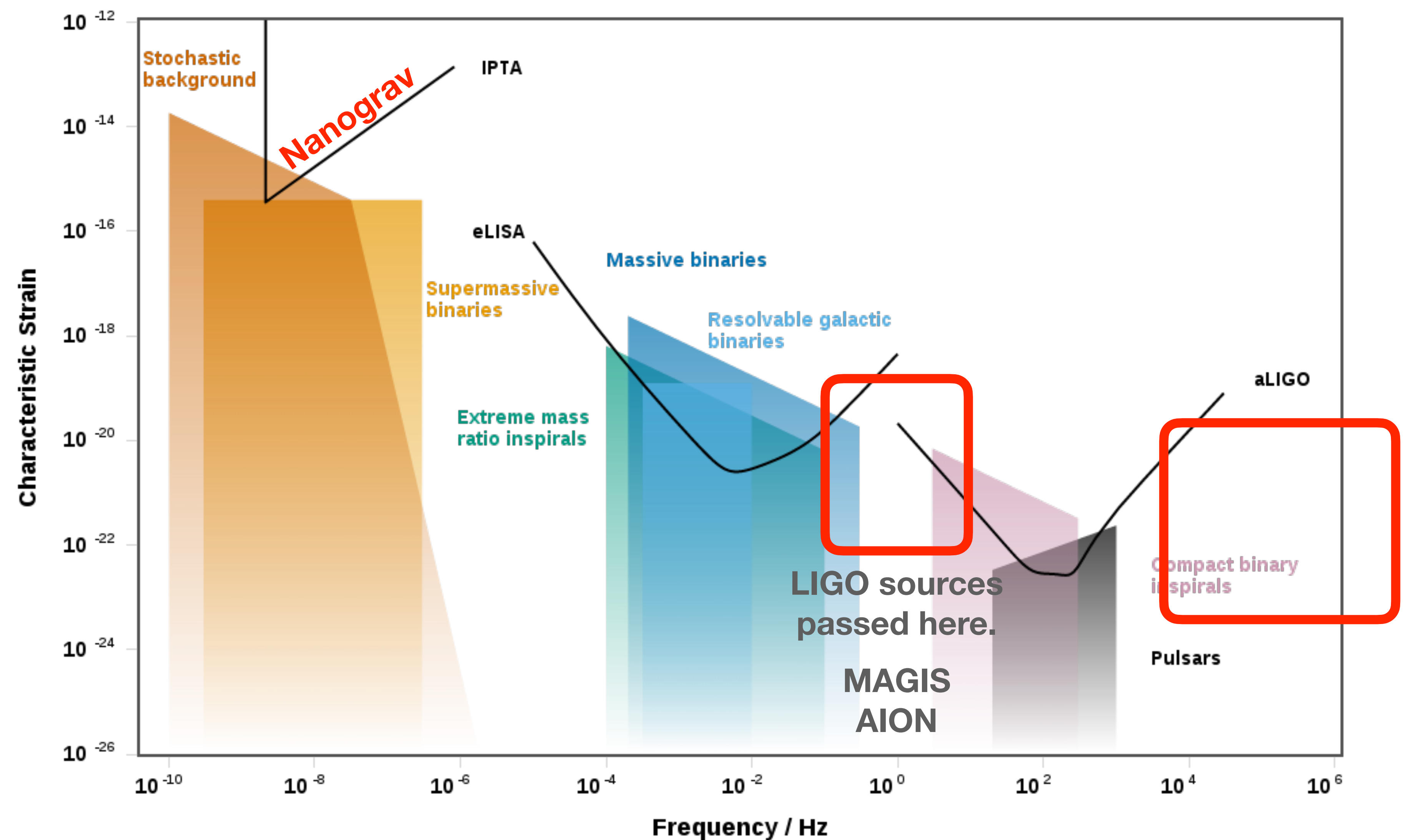




# Beyond LIGO

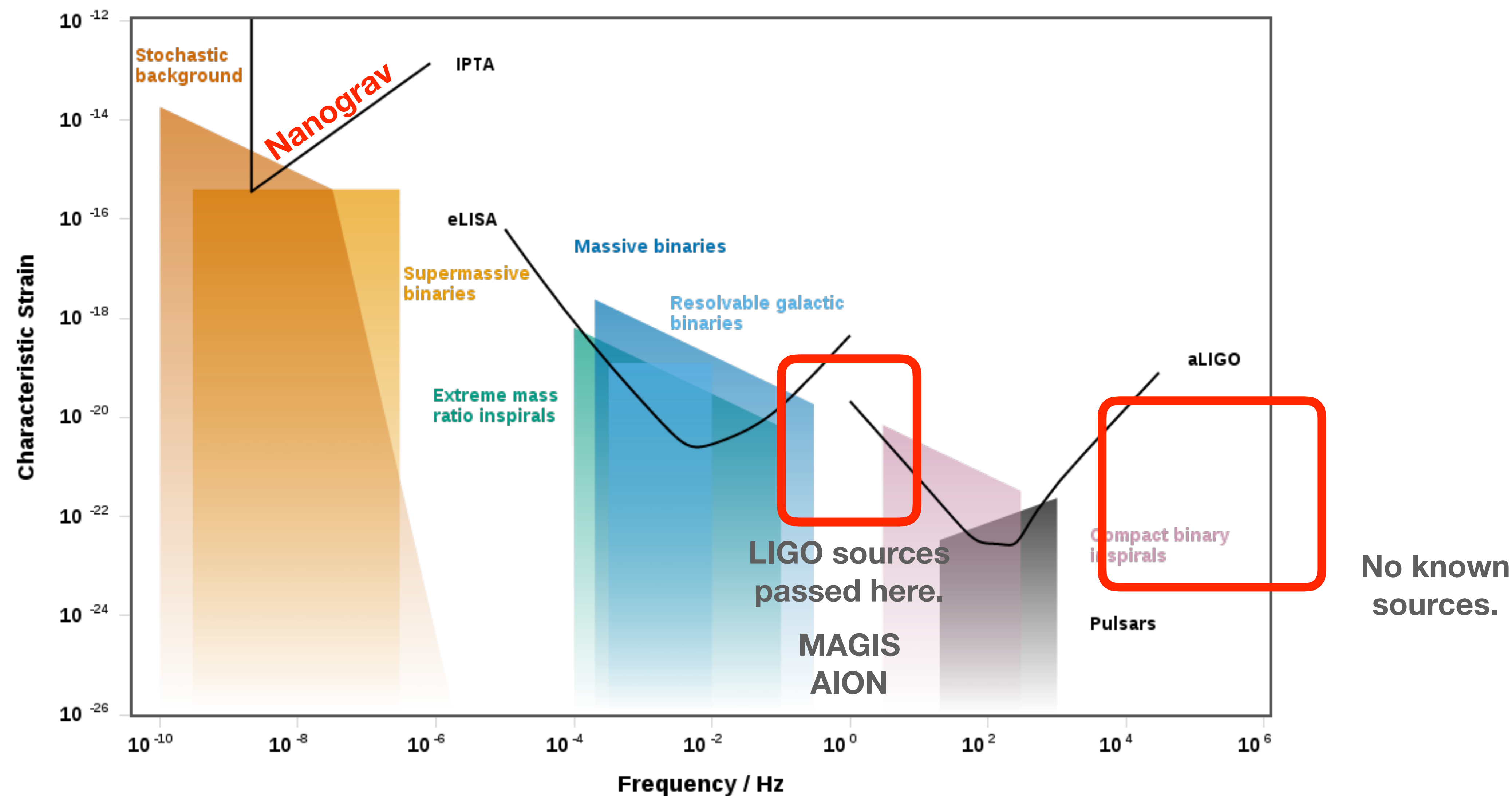


# Beyond LIGO

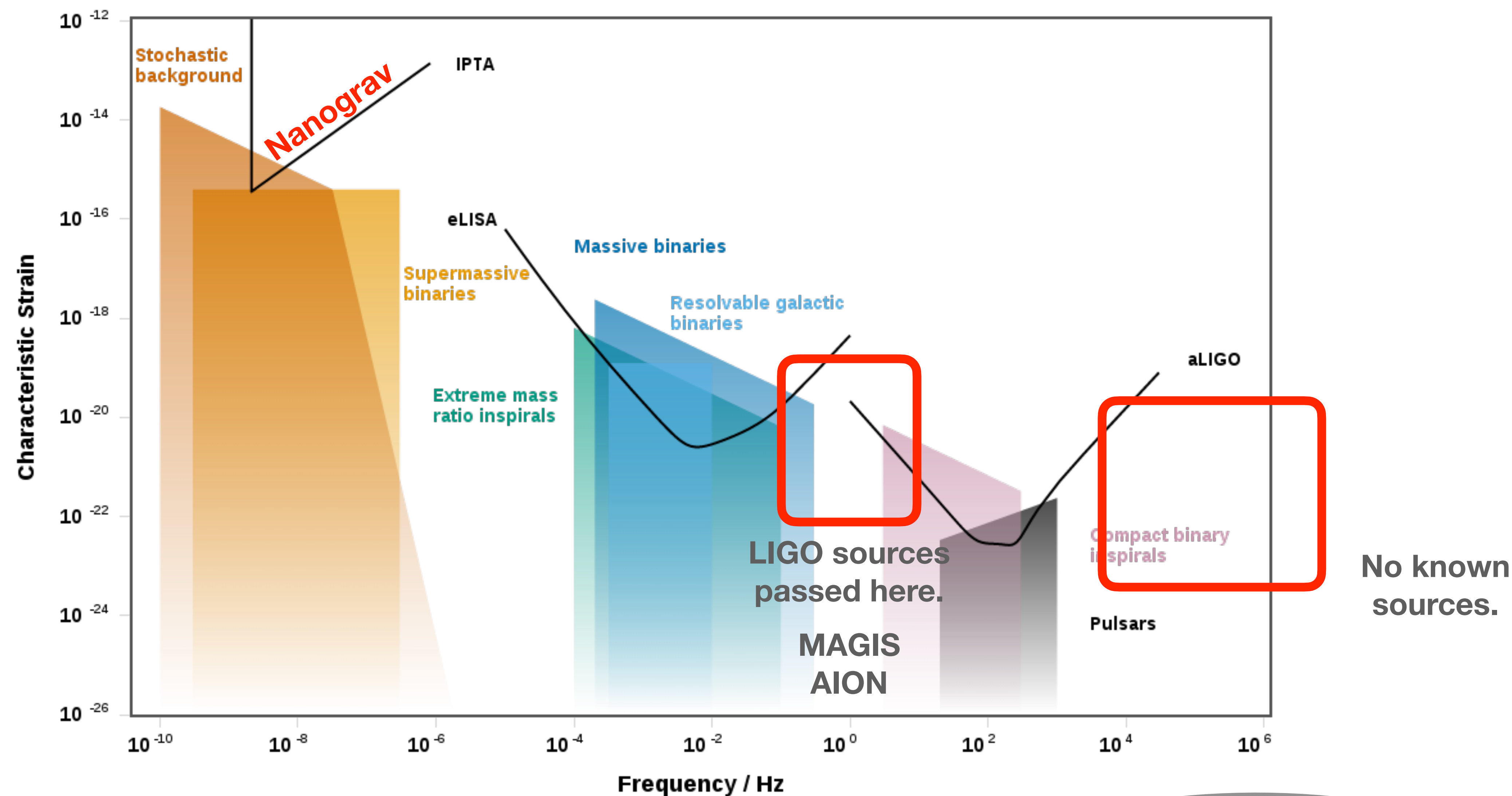




# Beyond LIGO



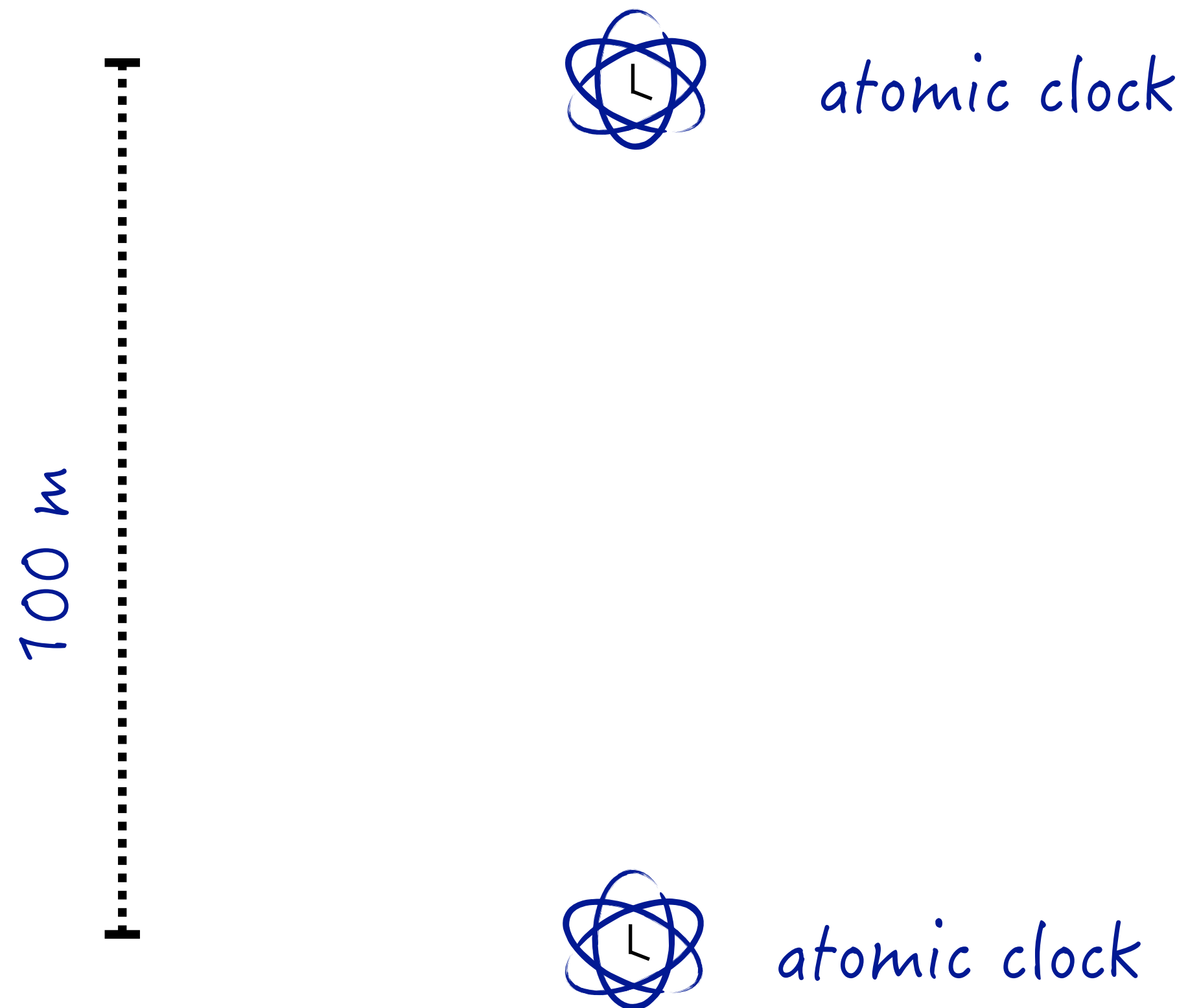
# Beyond LIGO





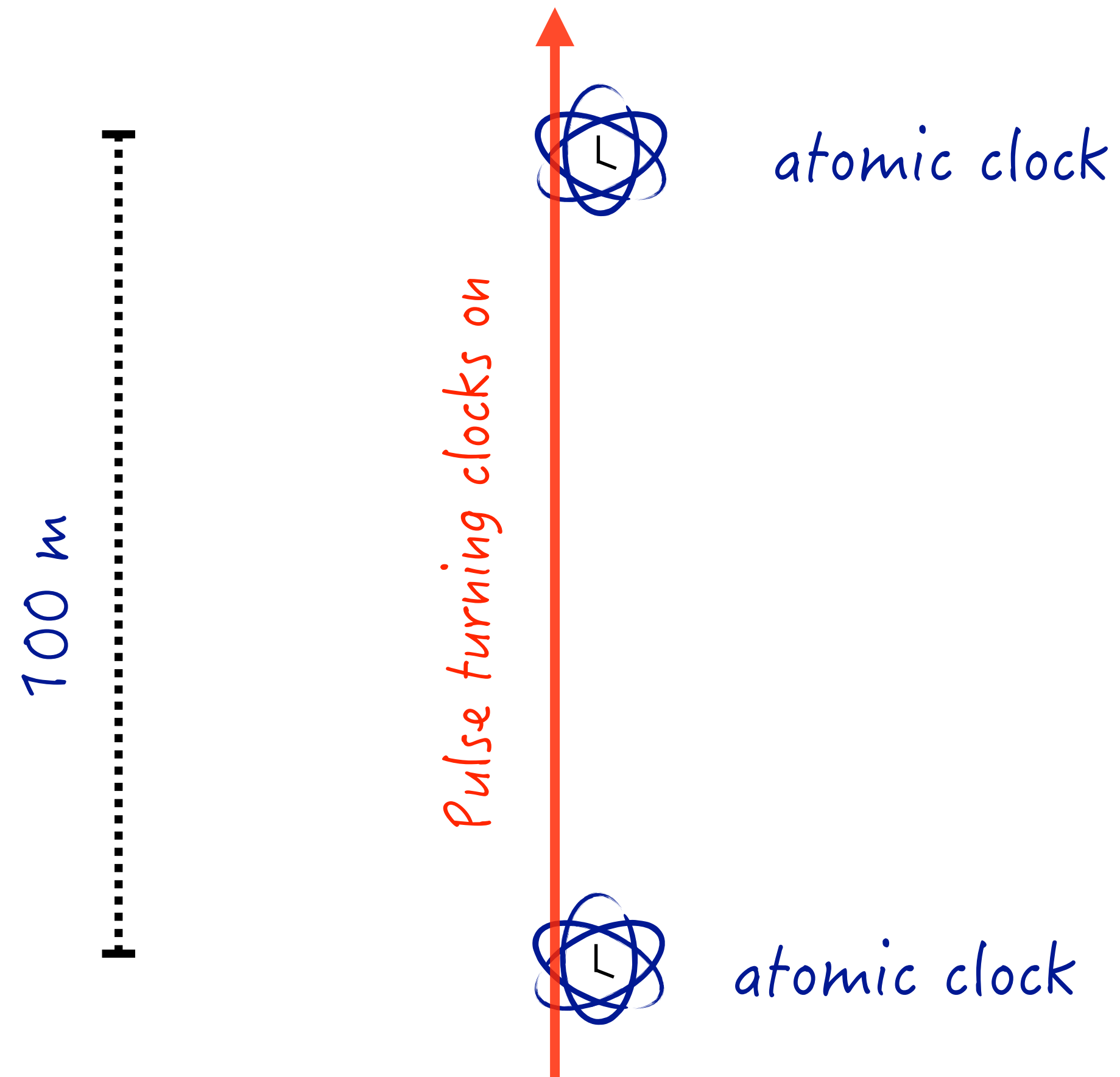
# MAGIS-100

- Two free falling atom interferometers with a common baseline:



# MAGIS-100

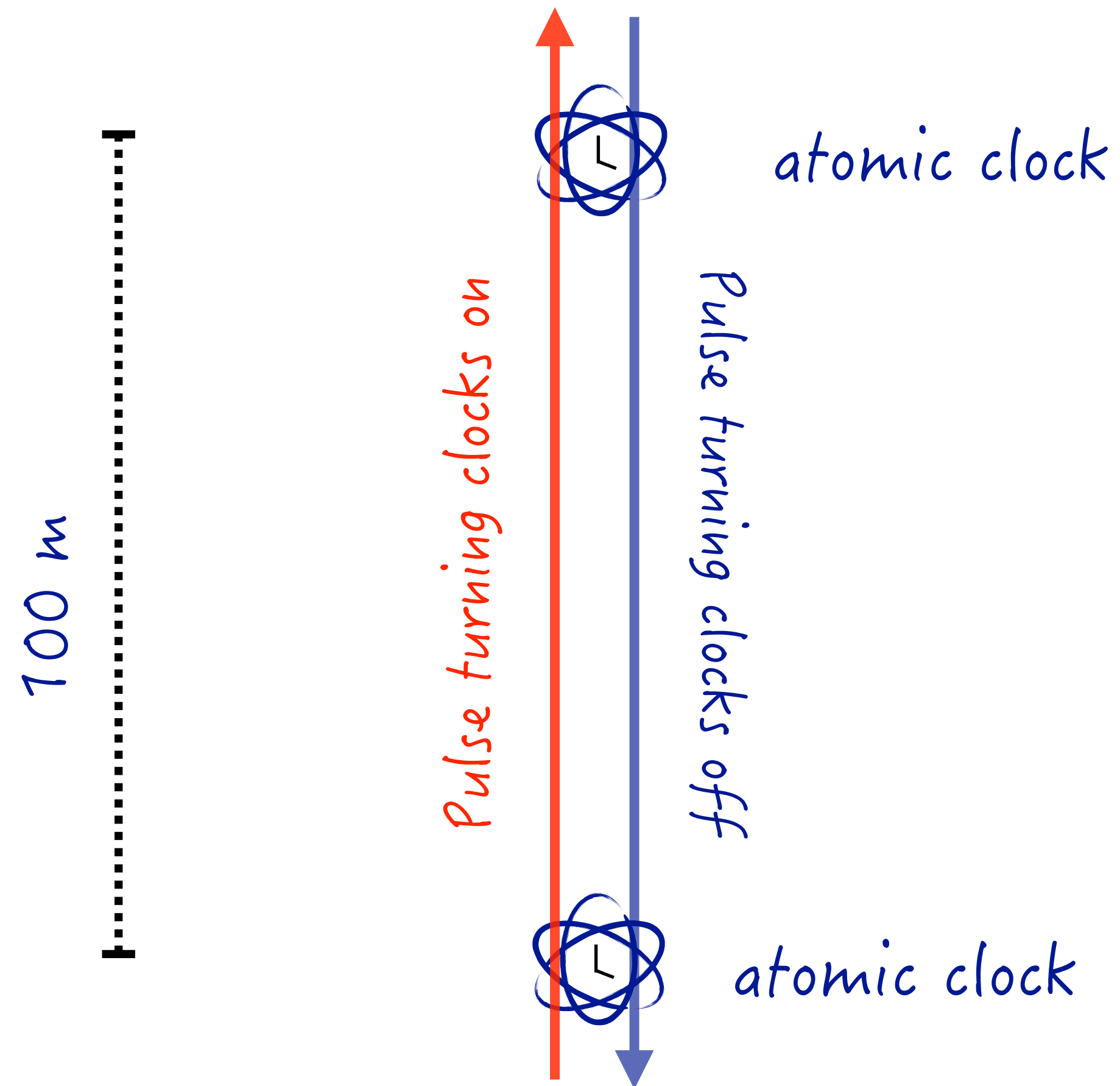
- Two free falling atom interferometers with a common baseline:





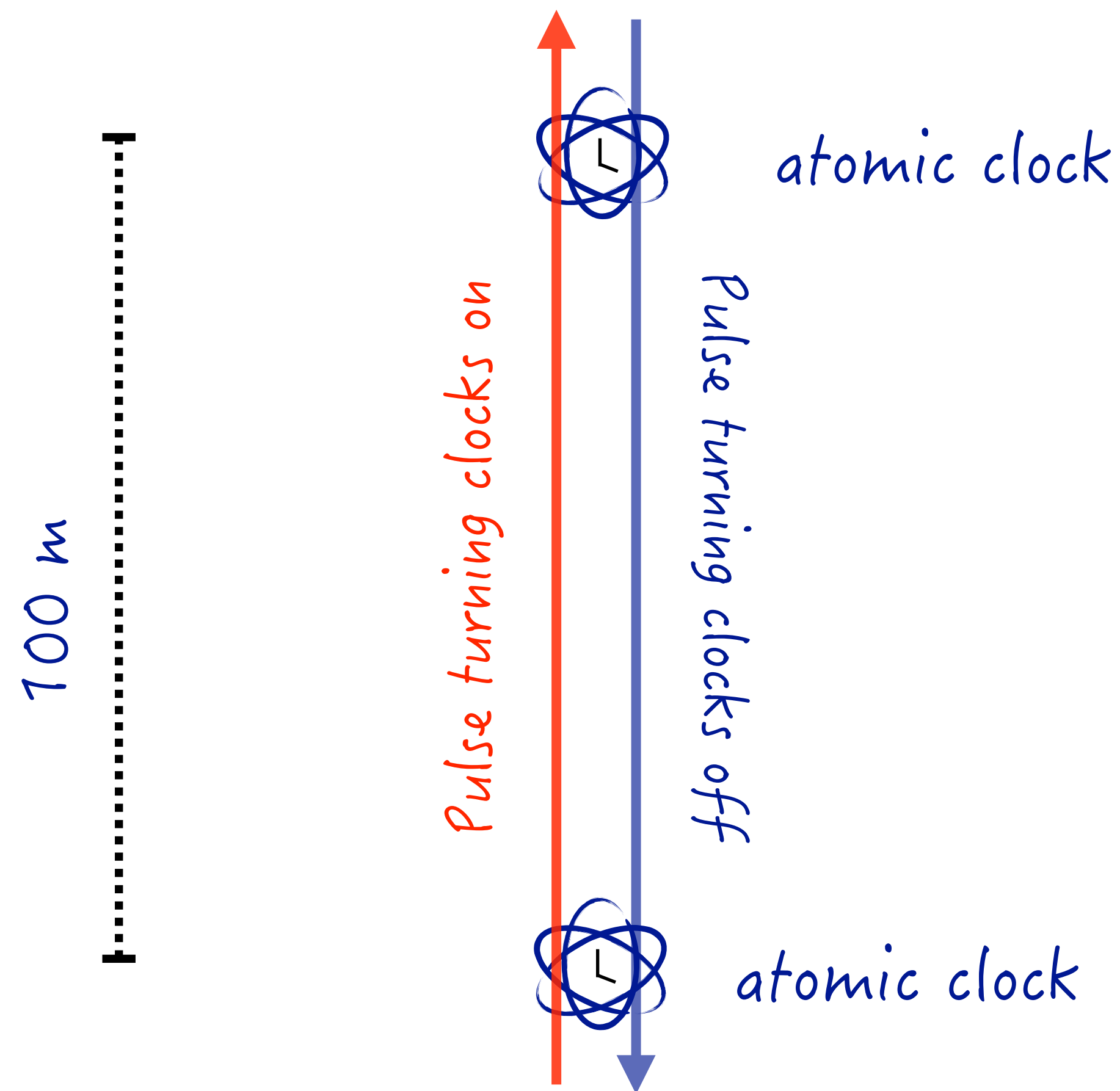
# MAGIS-100

- Two free falling atom interferometers with a common baseline:



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- Two free falling atom interferometers with a common baseline:

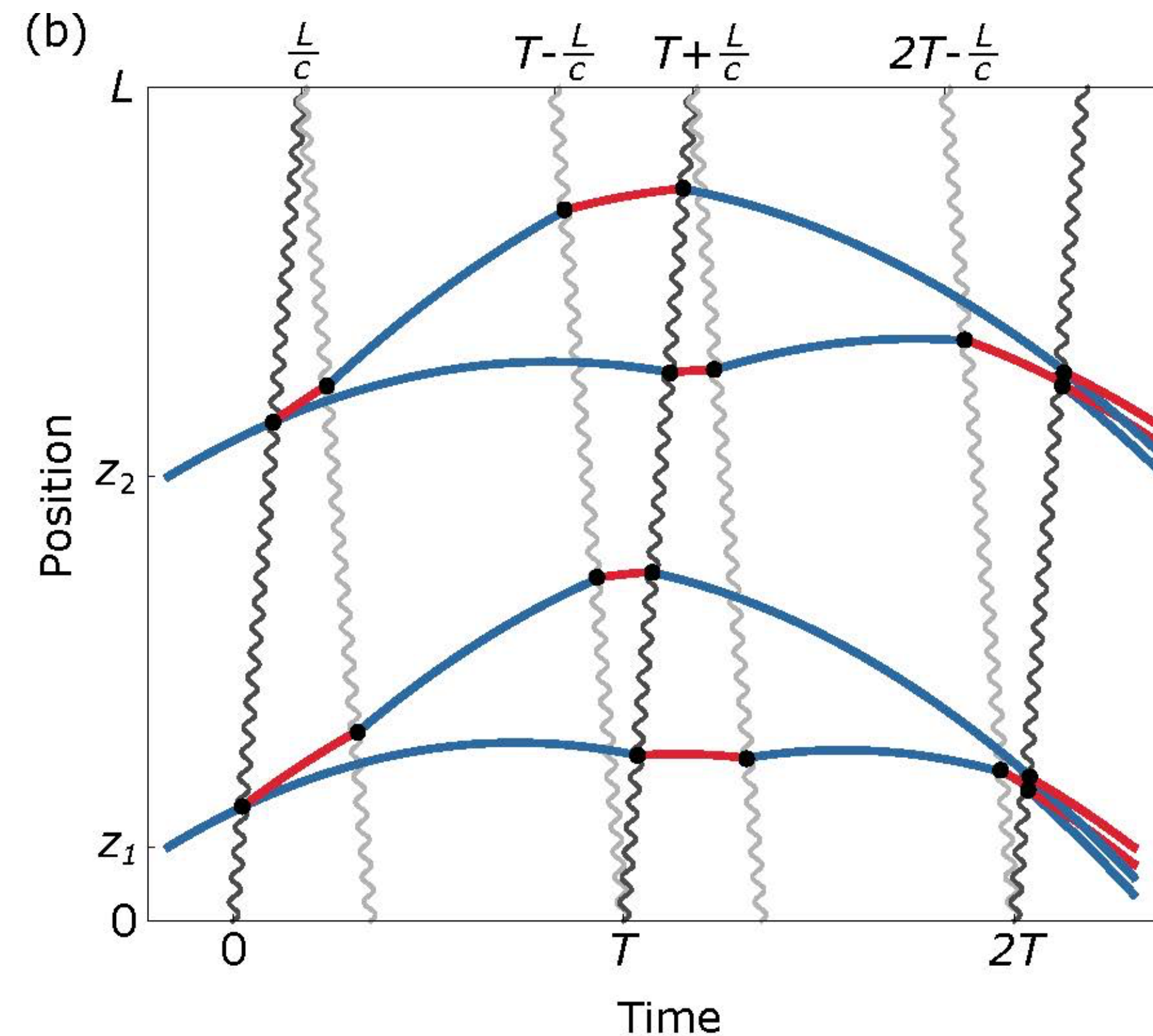
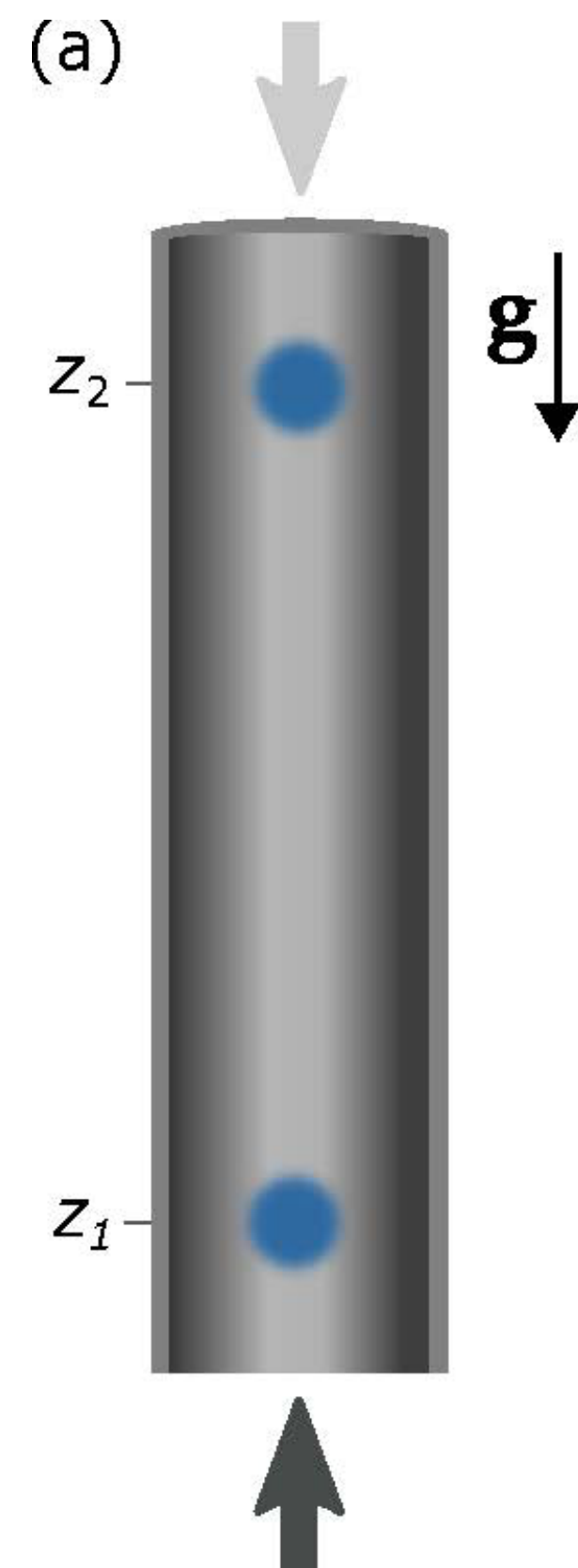
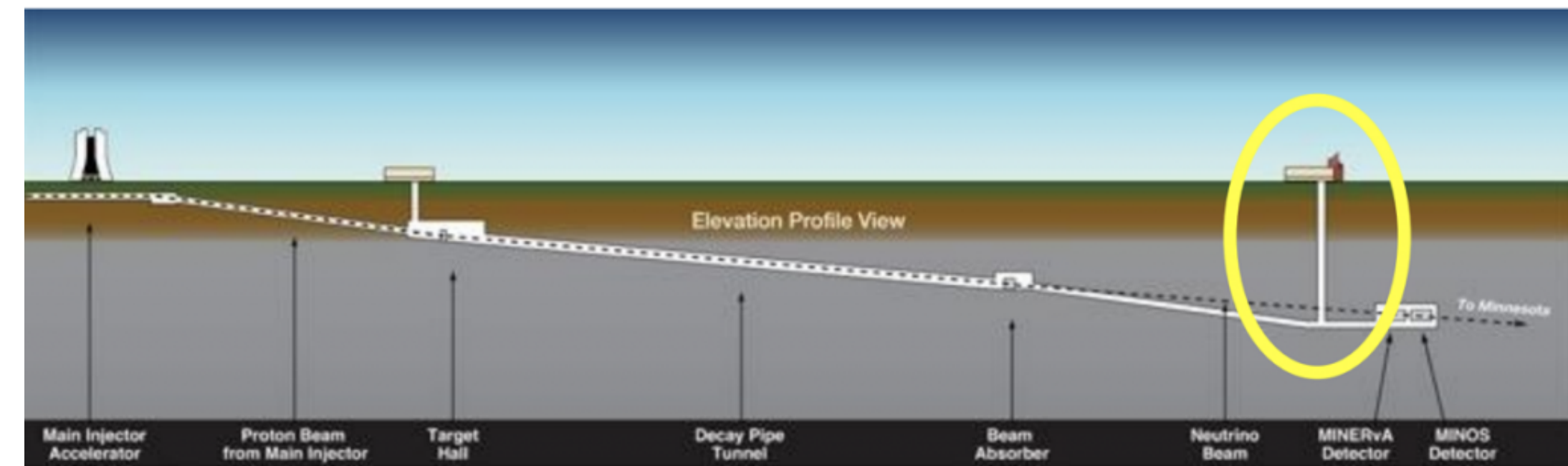


$$\Delta t = 2 \text{ light travel time}$$

A precise measurement  
of the distance between  
test masses

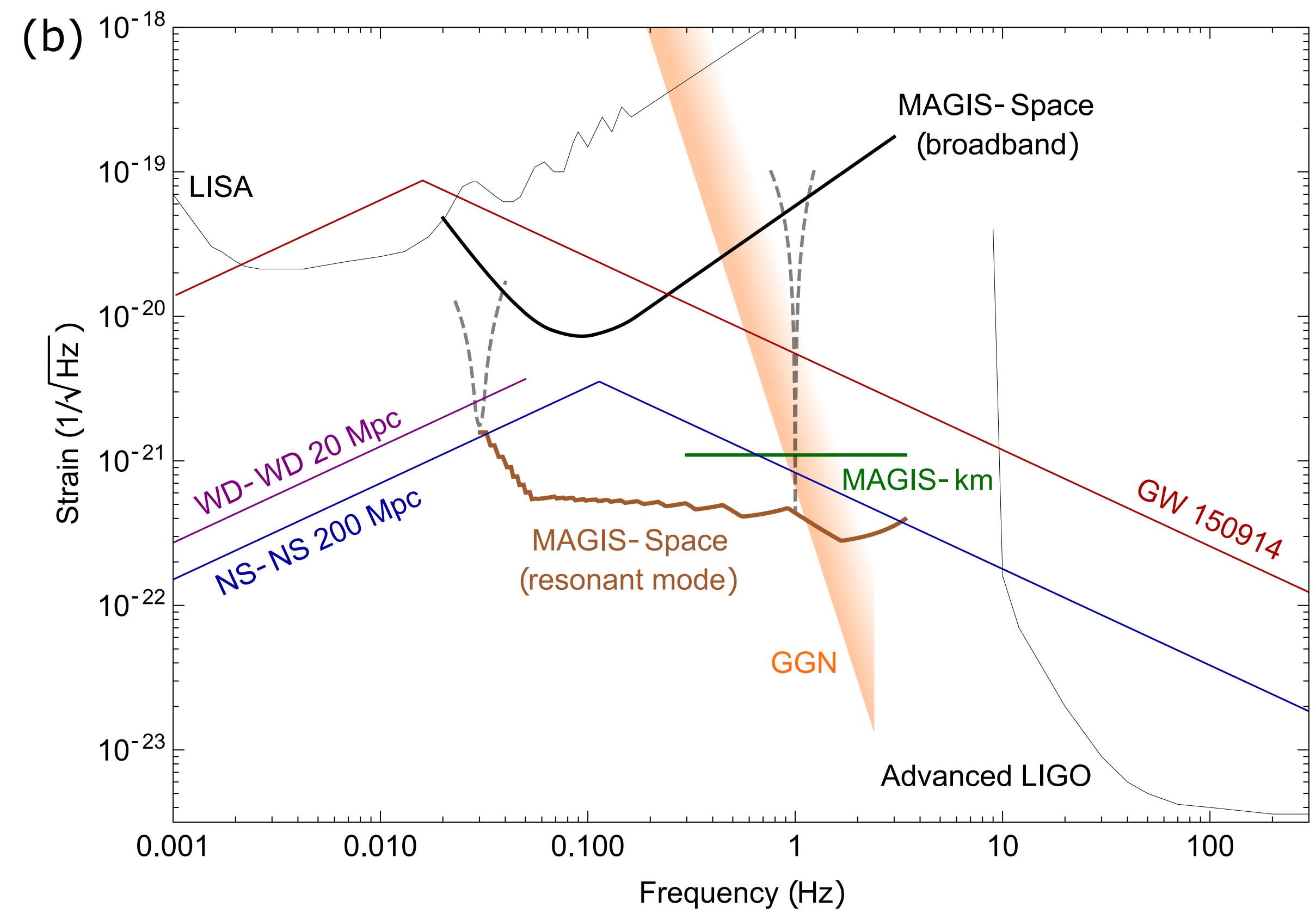
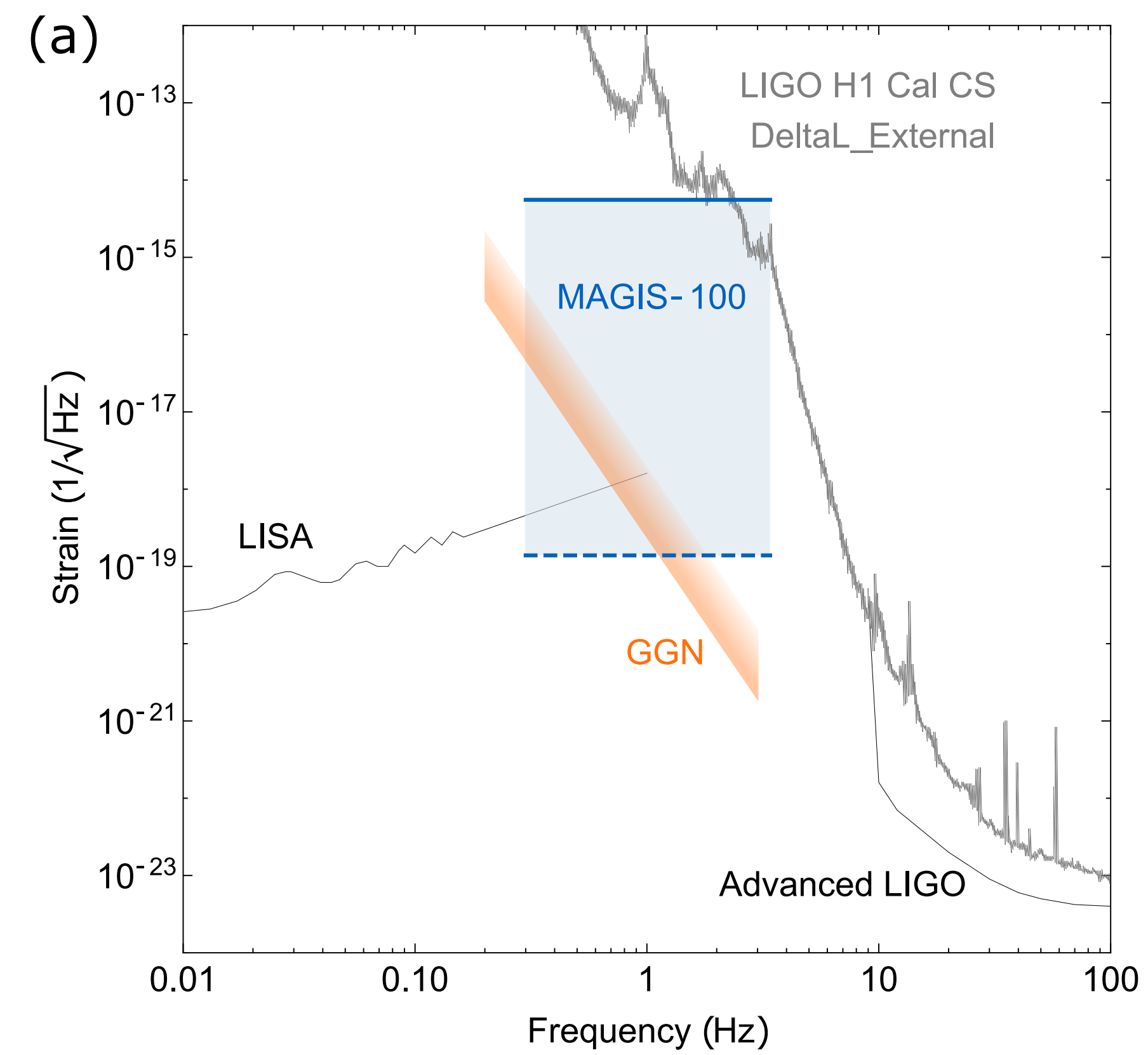


# MAGIS-100



**MAGIS 100 is a separate project. Under construction at Fermilab. SQMS involved in related research of pulse control.**

# MAGIS



<https://arxiv.org/abs/2104.02835>

<https://arxiv.org/abs/1711.02225>

<https://arxiv.org/abs/1908.00802>



# MAGO

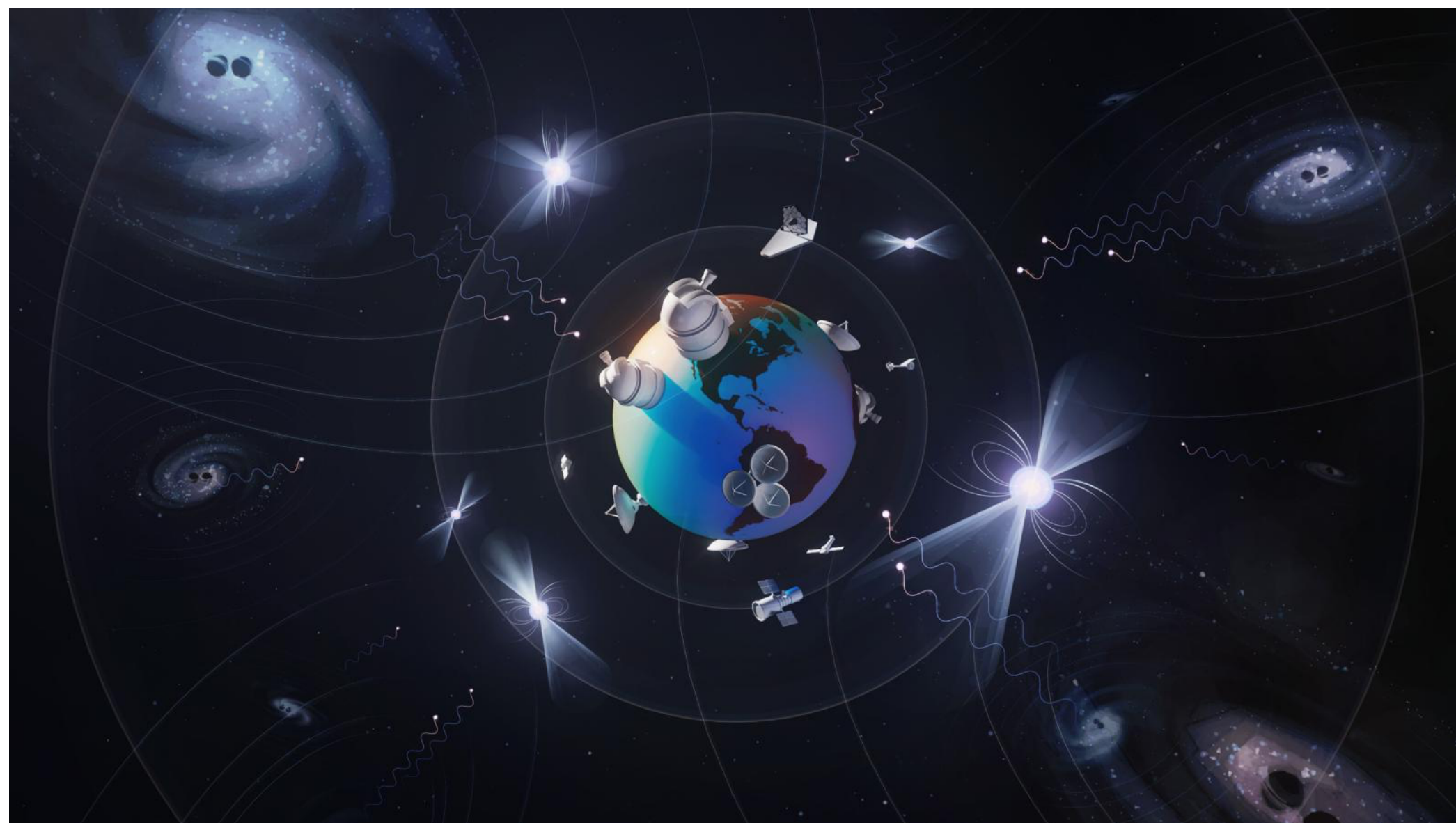


**An SRF based GW detection concept. (kHz-GHz).**  
**Launched by INFN decades ago, and paused.**  
**Rekindled in a new collaboration of INFN, DESY, and SQMS.**



# GW Session

- Sources: Francesco - postponed till tomorrow.
- Sebastian: GW interactions with light. GR in a cavity. (A bit of sources)
- Asher: MAGO - multimode cavity search ( + multimode axion search).
- Experimental updates of MAGO from DESY and Fermilab
- RF systems, vibrations
- (Update on multimode axion DM search experiment)



# NanoGrav