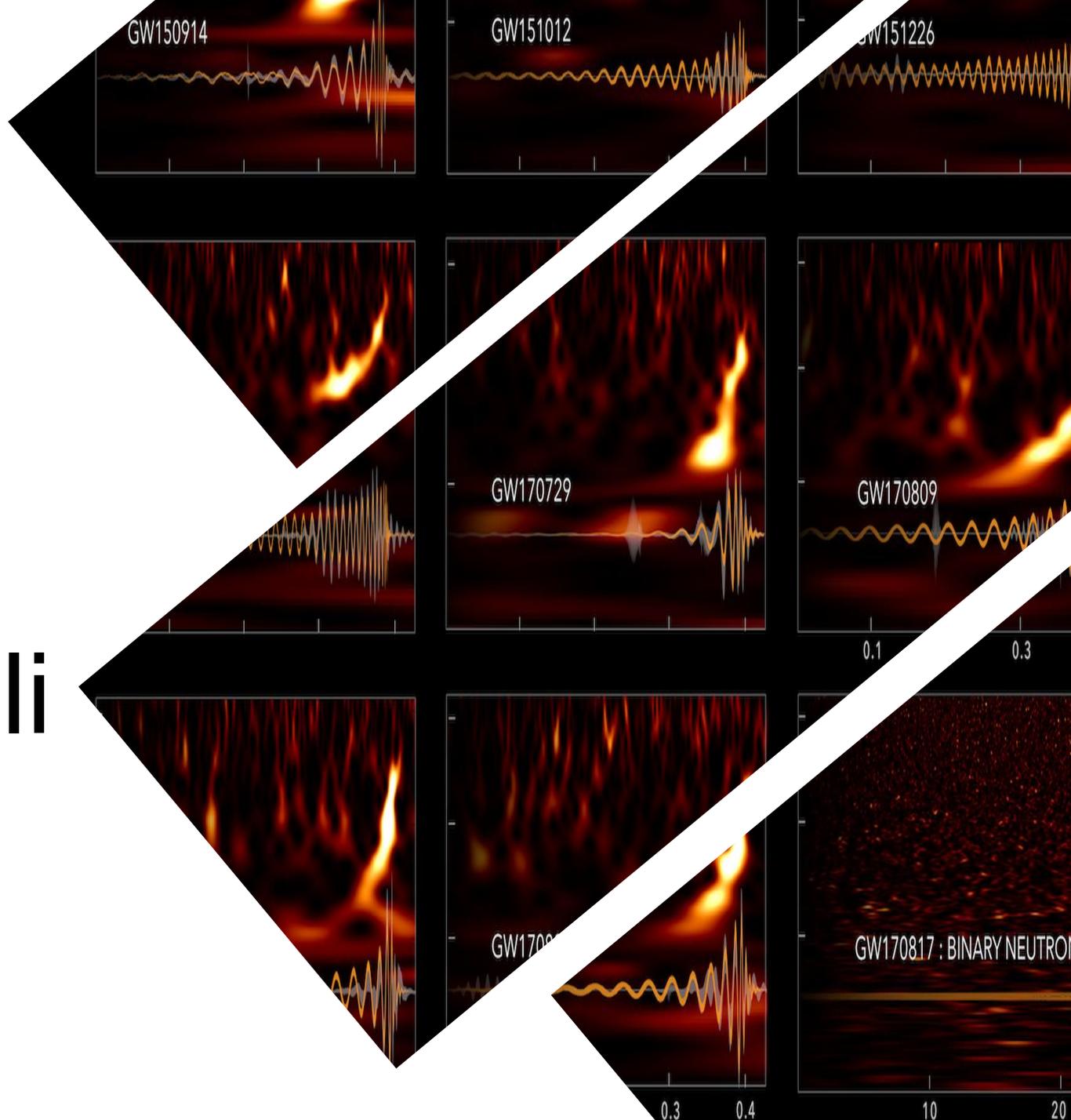


# La rivelazione di onde gravitazionali

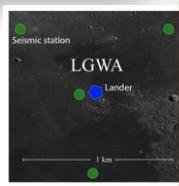
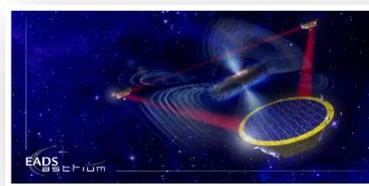
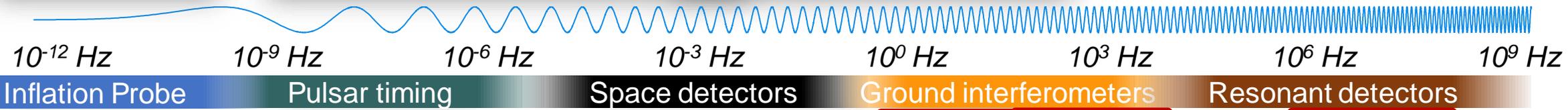
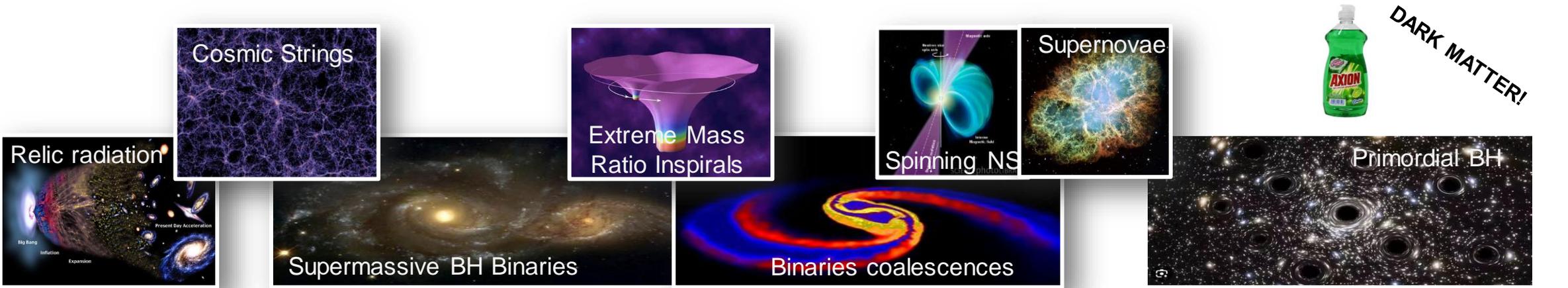
Matteo Borghesi



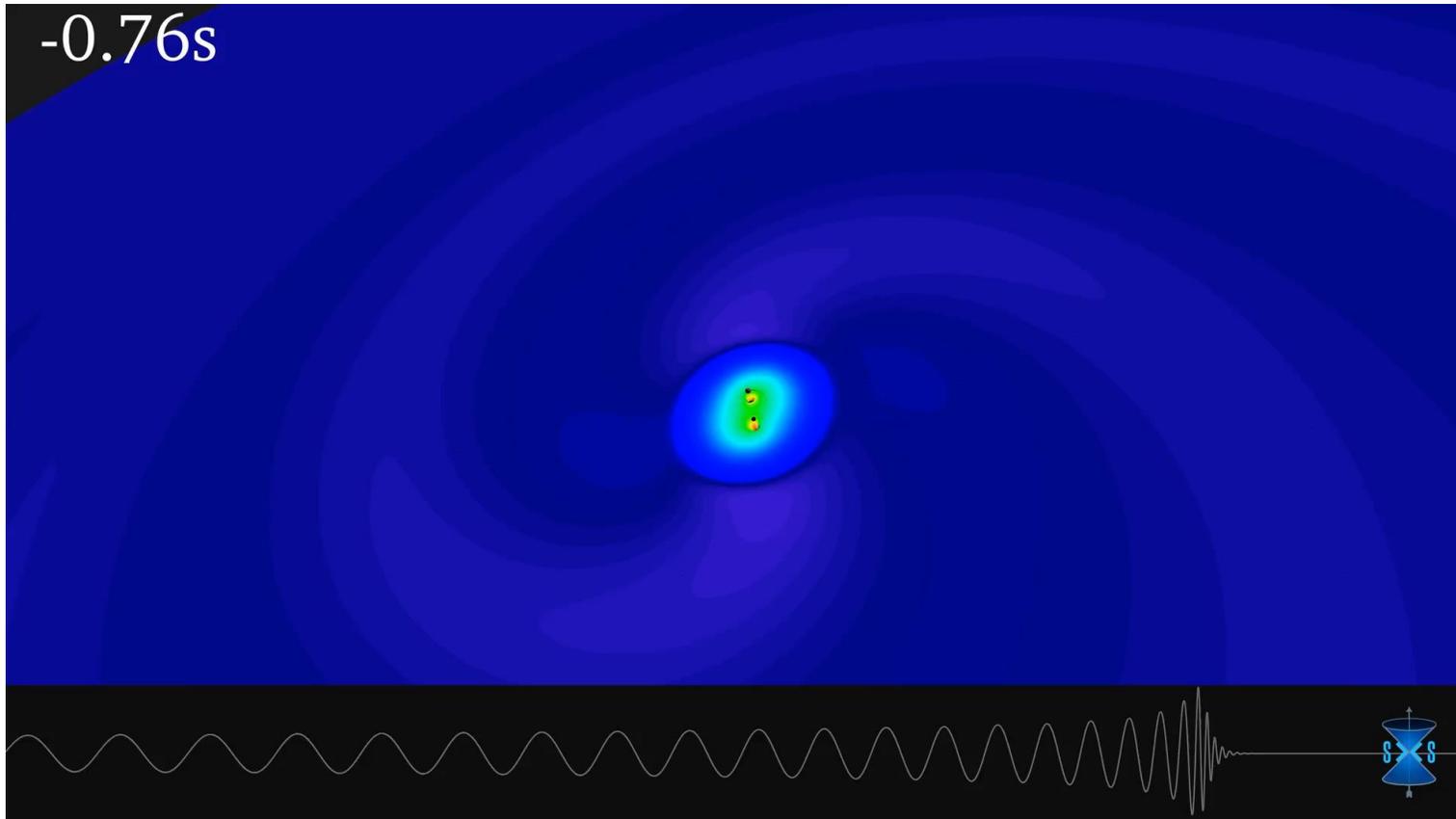
# Onde gravitazionali

Sorgenti

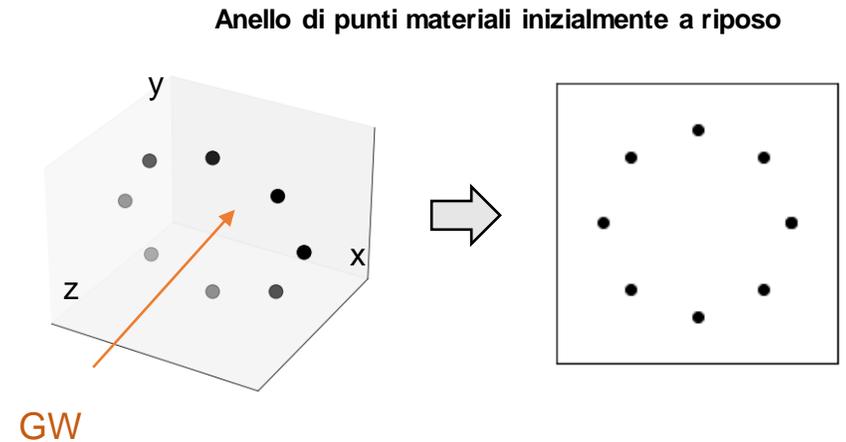
Rivelatori



# Onde gravitazionali: il segnale



- Il passaggio dell'onda gravitazione deforma la materia



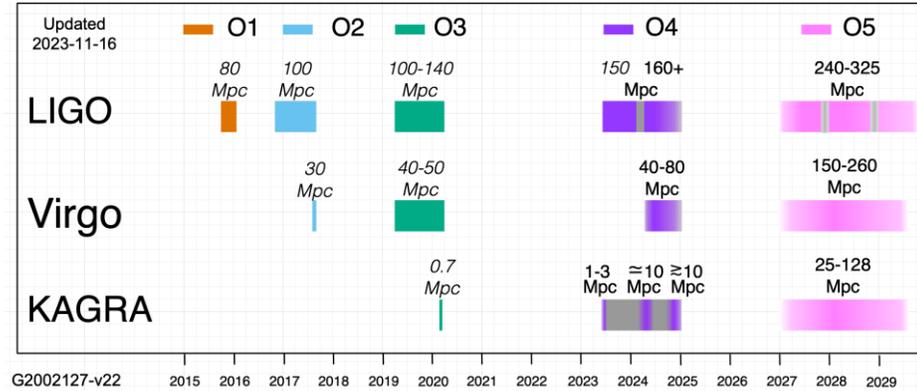
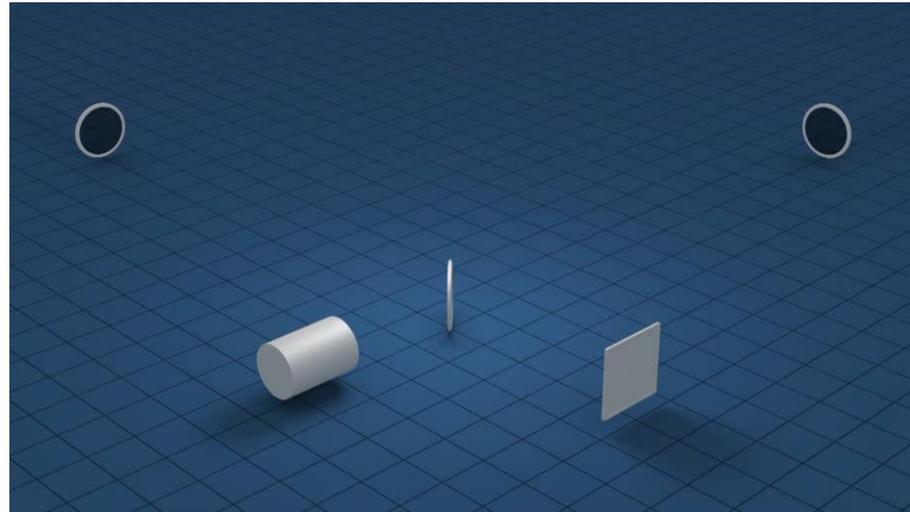
- Ampiezza onda  $\delta L/L \approx 10^{-21}$

La distanza tra due masse distanti qualche km verrà modificata di

$$\delta L \approx 10^{-18} \text{ m}$$

# Onde gravitazionali a bassa frequenza

- Interferometri di seconda generazione:

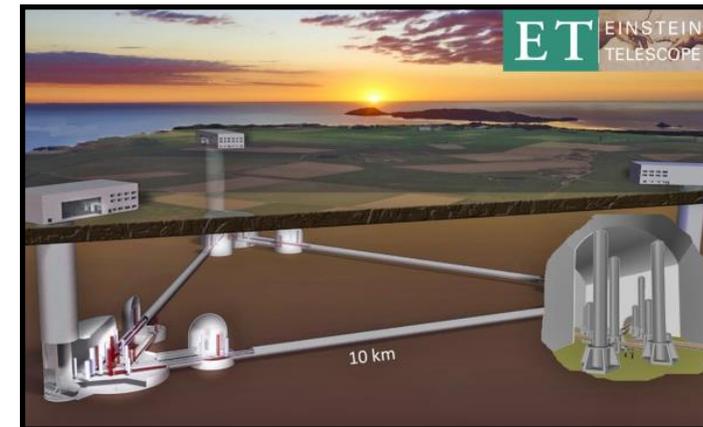


  
90 GW detections reported

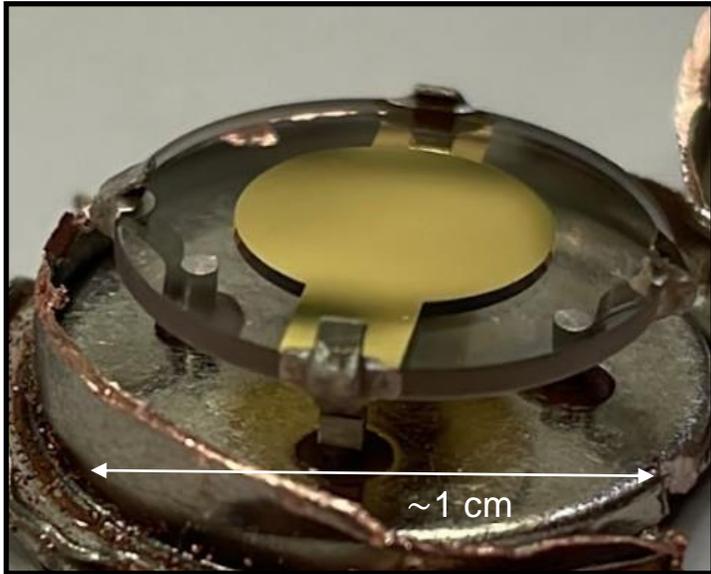
  
Coalescence of black holes and neutron stars

  
1 multimessenger event (GW + EM observation)

- Interferometri di terza generazione:



# Onde gravitazionali ad alta frequenza



- Bulk Acoustic Wave Sensors for a High Frequency Antenna (BAUSCIA, nel dialetto Milanese)
- Masse risonanti per la rivelazione di onde gravitazionali.

Oscillazioni smorzate e forzate (laboratorio 1)

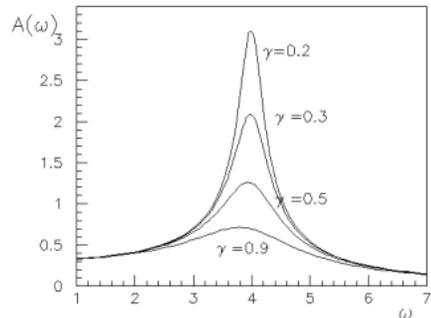
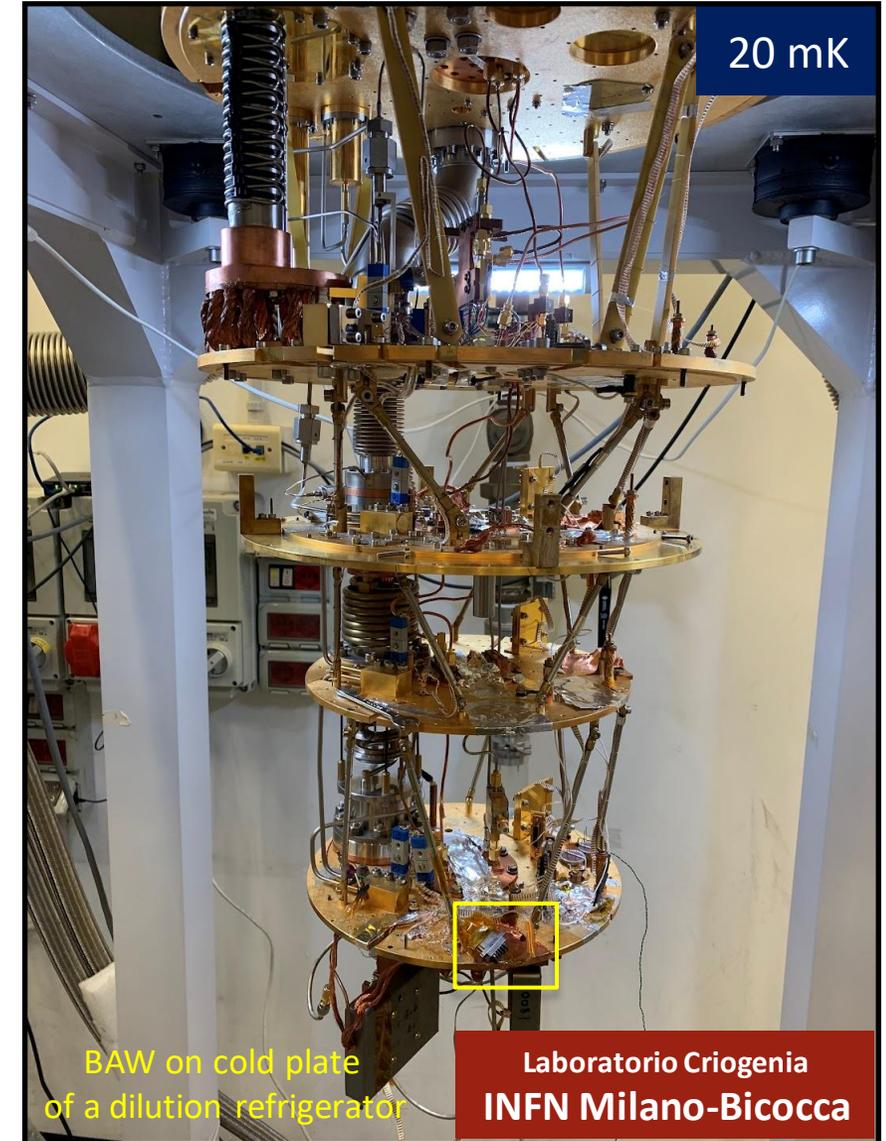
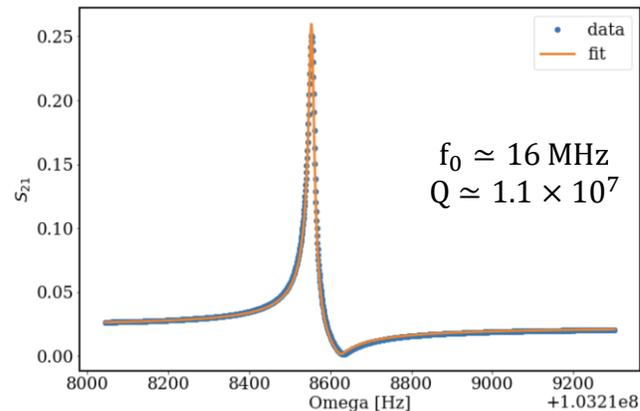


Figura 1.

$A(\omega)$  per  $\omega_0=4$ ,  $M_0=5$  e diversi valori di  $\gamma$ .

Esempio della forma di una risonanza di un BAW

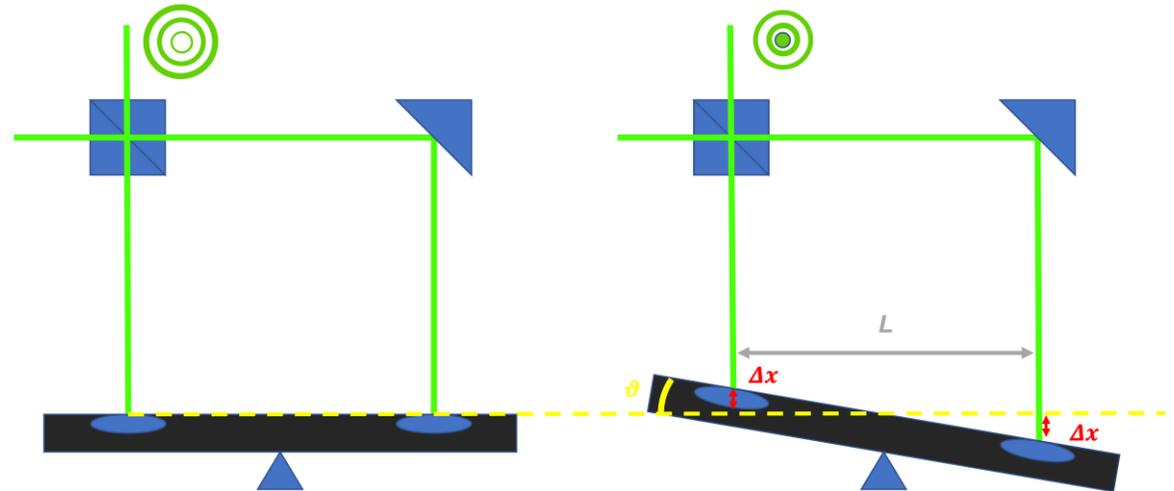
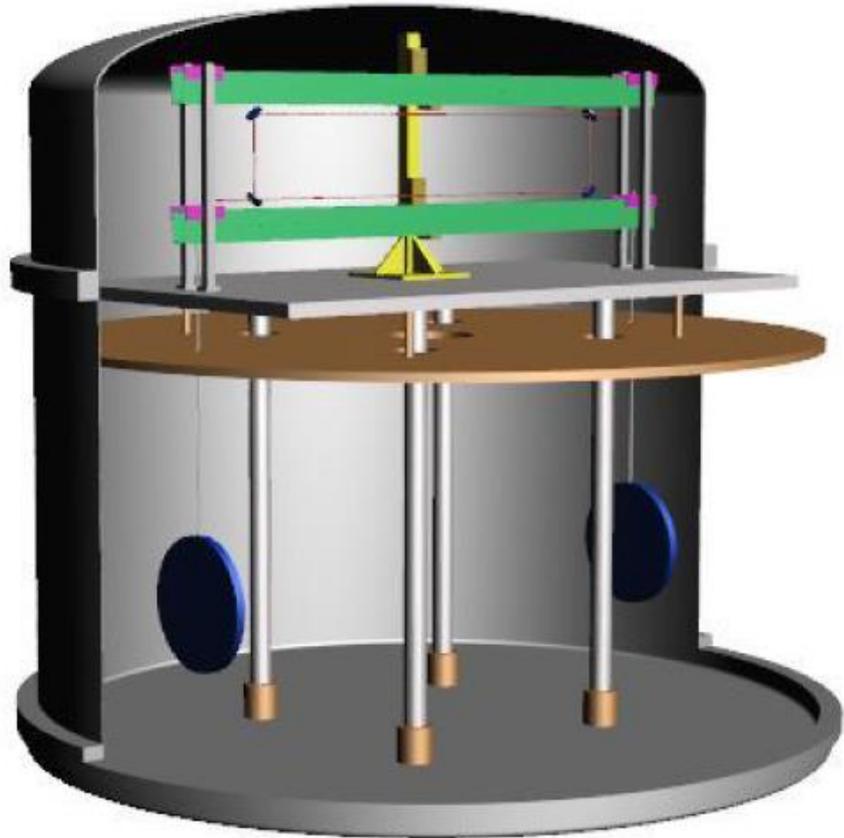


BAW on cold plate  
of a dilution refrigerator

Laboratorio Criogenia  
INFN Milano-Bicocca

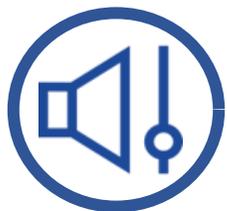
# L'esperimento Archimedes

- Obiettivo: misurare le interazioni tra le fluttuazioni di vuoto e la gravità.



# Opportunità di tesi

## VIRGO/LIGO, ET & ARCHIMEDES



Caratterizzazione  
dei rumori



Sensori e controlli



Analisi dati e  
simulazioni di onde  
gravitazionali



prof. Massimo Carpinelli  
(ufficio U2-5003 quinto piano)



dr. Davide Rozza  
(ufficio U2-3018 terzo piano)

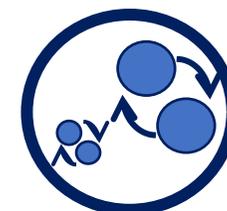
## BAUSCIA



Caratterizzazione  
dei sensori



Simulazioni per design di  
nuovi rivelatori



Studi di sensibilità



prof. Tommaso Tabarelli de Fatis  
(ufficio U2-4006 quarto piano)