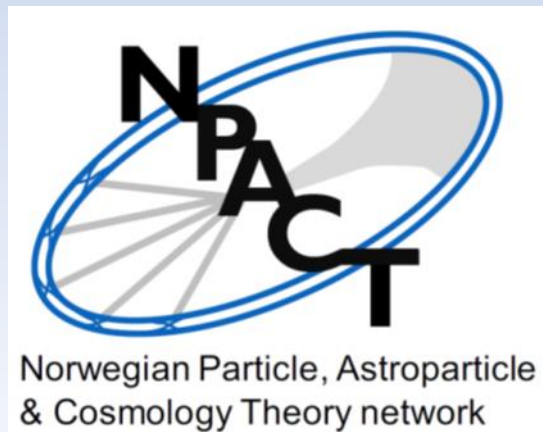


Gravitational waves with ground-based detectors of the LVK collaborations

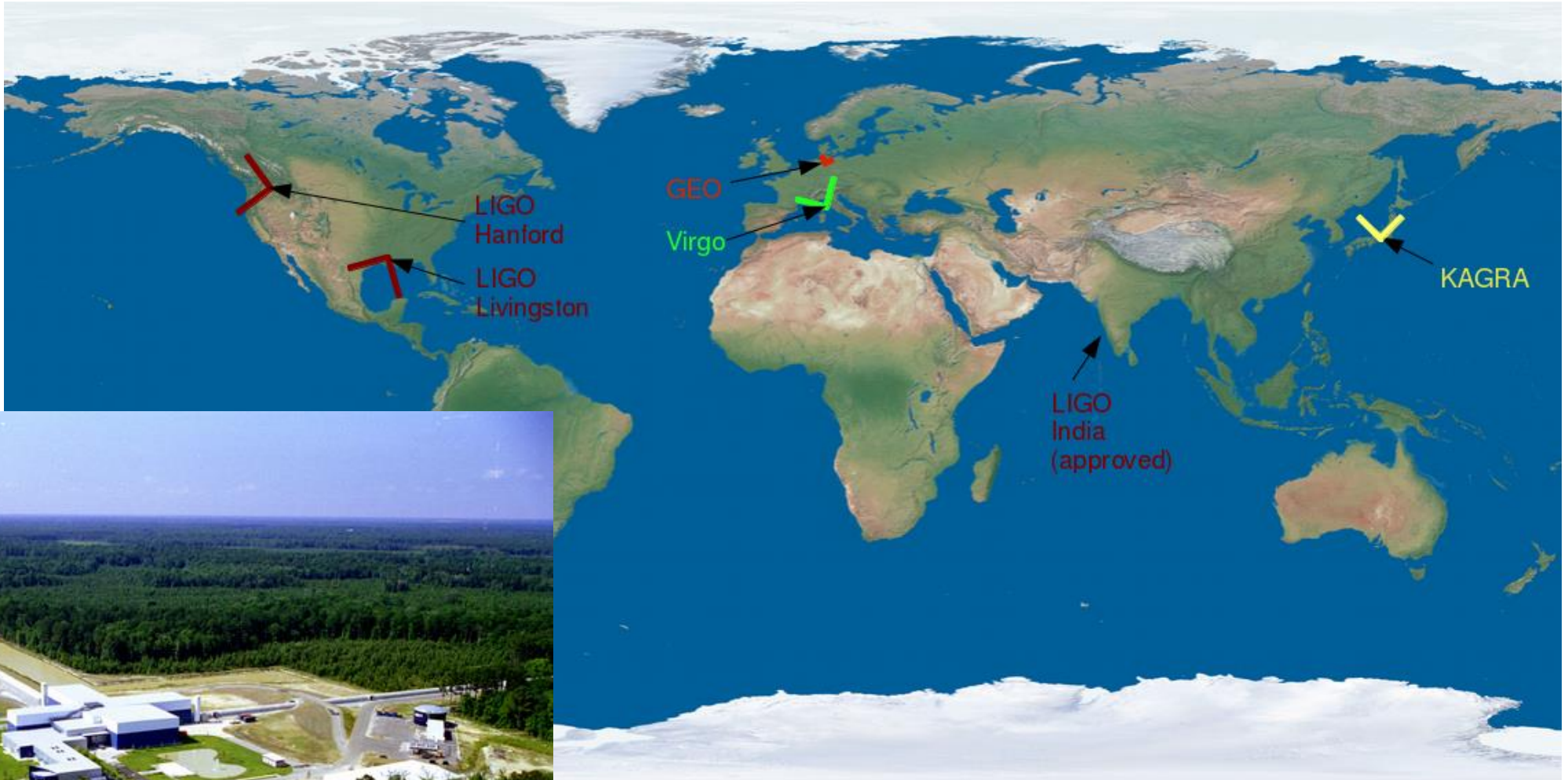
Alex Nielsen

University of Stavanger

Fysikermøte, Bergen, 10th August 2023



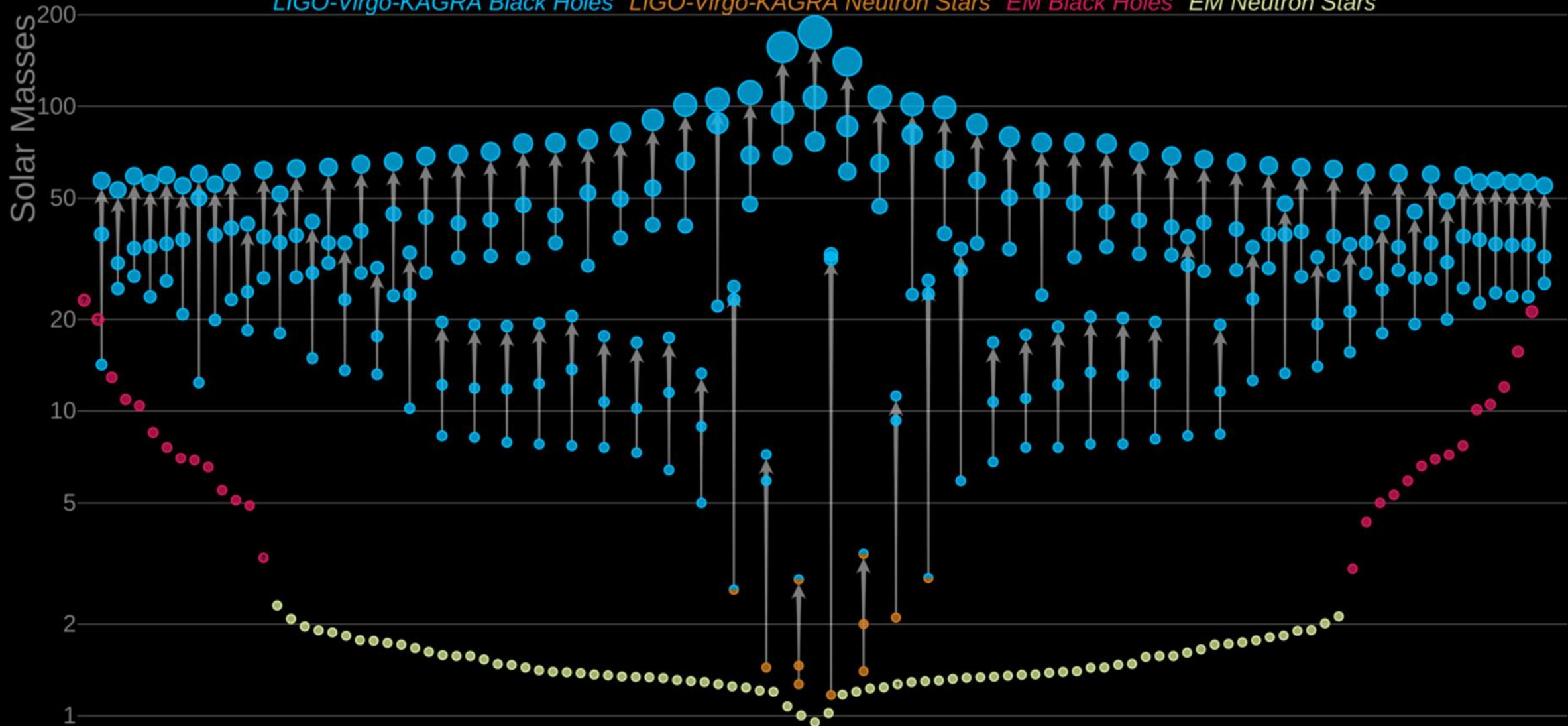
LIGO Virgo KAGRA (LVK)



Credits: Caltech/MIT/LIGO Lab/The Virgo Collaboration/LAPP and Tom Patterson (www.shadedrelief.com)

Masses in the Stellar Graveyard

LIGO-Virgo-KAGRA Black Holes *LIGO-Virgo-KAGRA Neutron Stars* *EM Black Holes* *EM Neutron Stars*



"For the greatest benefit to mankind"
Alfred Nobel



The Royal Swedish Academy of Sciences has decided to award the

2017 NOBEL PRIZE IN PHYSICS

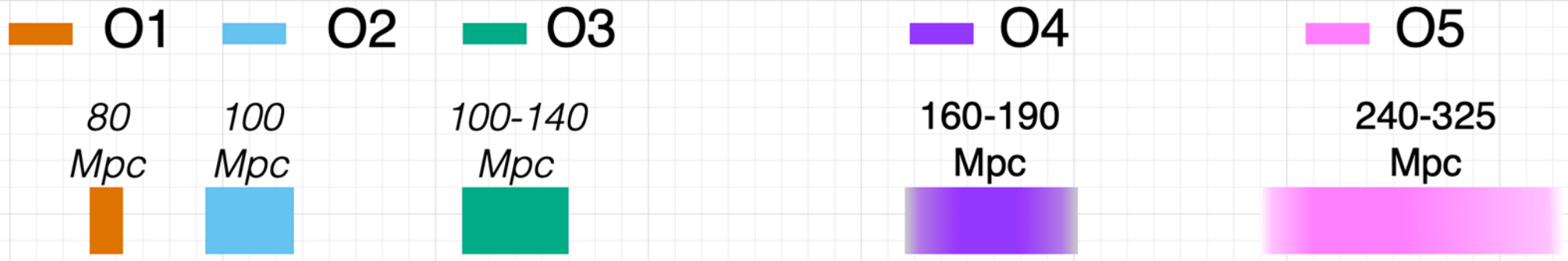


Illustrations: Niklas Elmehed. Nobel Prize Medal: © The Nobel Foundation. Photo: Lovisa Engblom.

Rainer Weiss
Barry C. Barish
Kip S. Thorne

"for decisive contributions to the LIGO detector and the observation of gravitational waves"

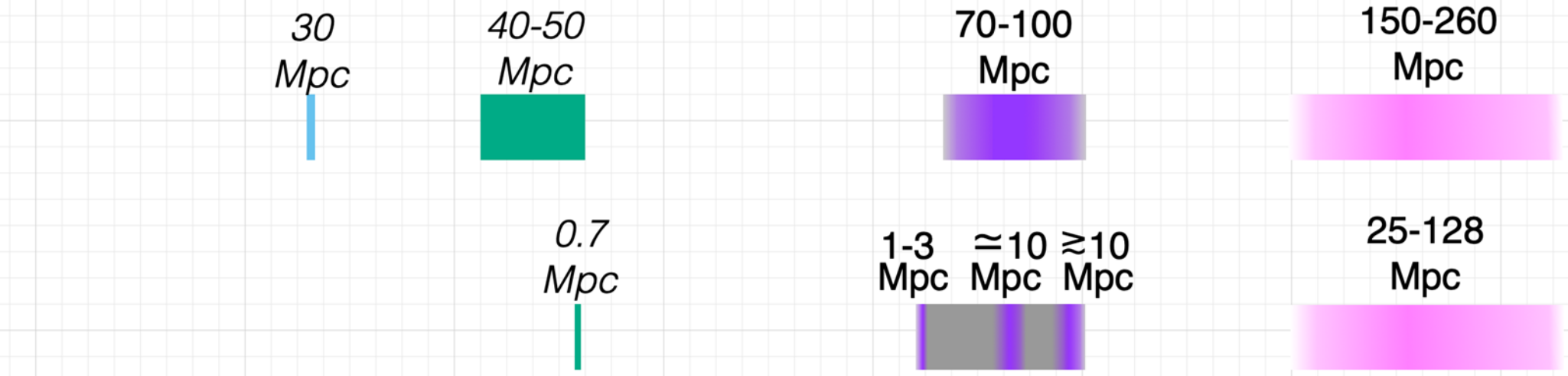
Updated
2023-05-16



LIGO

Virgo

KAGRA



G2002127-v19

2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029

O4 began May 24th 2023 15:00 UTC

- Changed test masses (1 at LHO, 2 at LLO) nanometer point absorbers
- Double circulating beam power (400kW from 200kW)
- Frequency dependent squeezing, 300m filter cavity added
- More squeezing at low frequencies (4.5dB from 2-3dB)
- More baffling, control noise reduction, better electronics

Five detectors running, June 1st

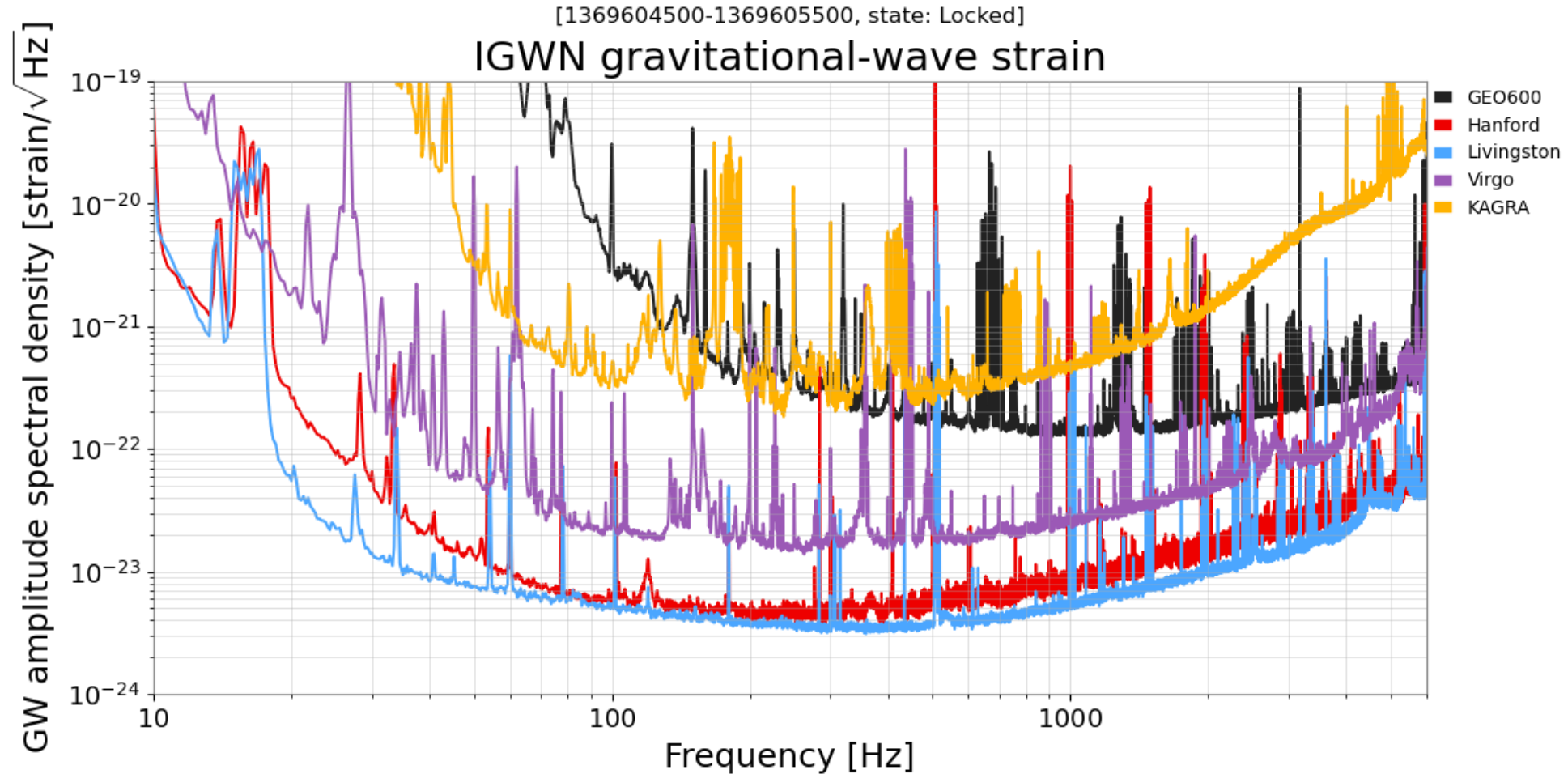


Figure courtesy of Derek Davis. Virgo was at the time in a detector commissioning period.

KAGRA and Virgo

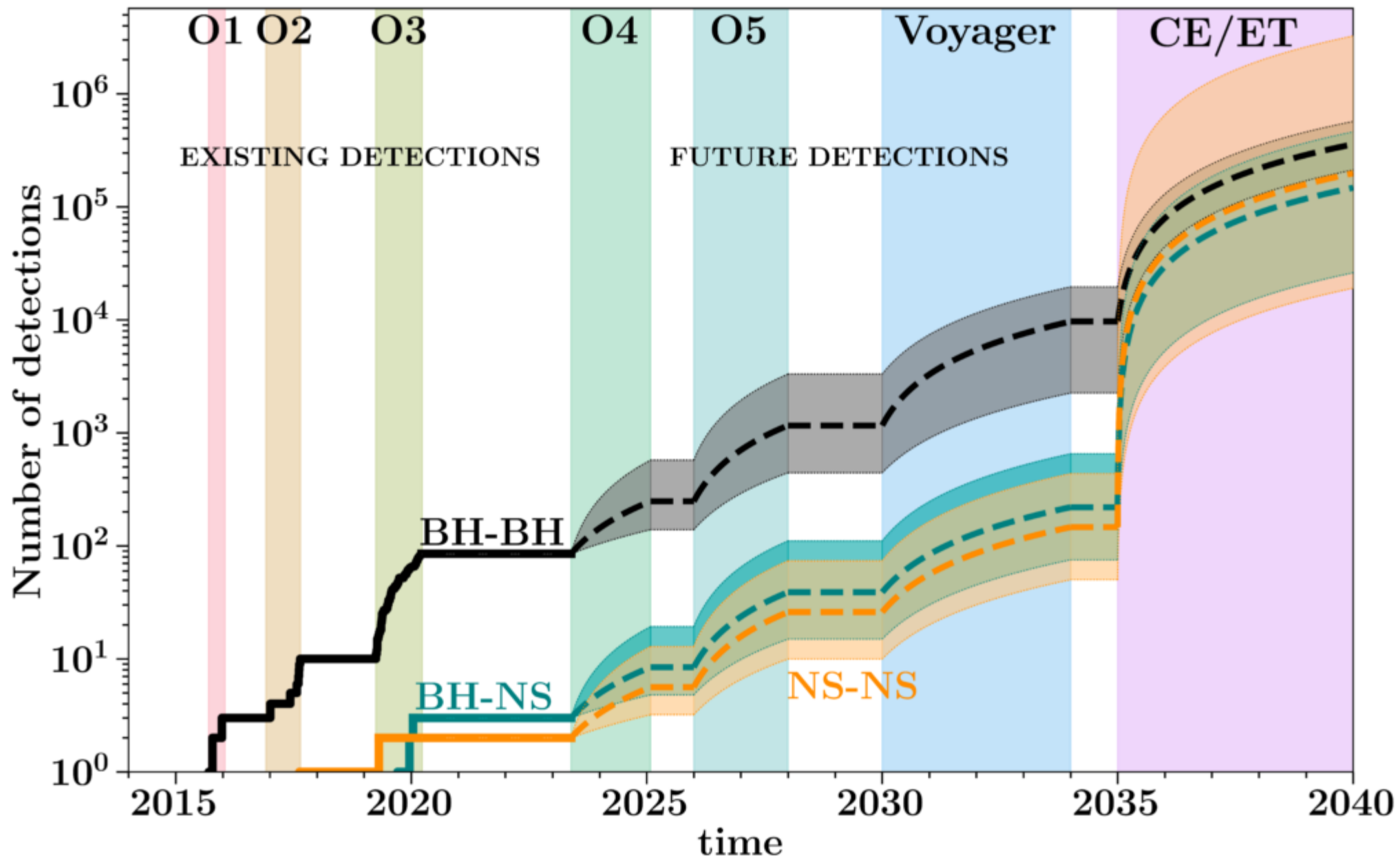
[HOME](#) > [NEWS](#) > [ALL NEWS](#) > [DAMAGE DELAYS RESTART OF ITALY'S GIANT GRAVITATIONAL WAVE DETECTOR](#)

[NEWS](#) | [PHYSICS](#)

Damage delays restart of Italy's giant gravitational wave detector

Hunt for cosmic collisions resumes without Virgo detector, limiting research

16 MAY 2023 · 5:05 PM · BY [ADRIAN CHO](#)



Please log in to view full database contents.

LIGO/Virgo/KAGRA Public Alerts

- More details about public alerts are provided in the [LIGO/Virgo/KAGRA Alerts User Guide](#).
- Retractions are marked in **red**. Retraction means that the candidate was manually vetted and is no longer considered a candidate of interest.
- Less-significant events are marked in **grey**, and are not manually vetted. Consult the [LVK Alerts User Guide](#) for more information on significance in O4.
- Less-significant events are not shown by default. Press "**Show All Public Events**" to show significant and less-significant events.

O4 Significant Detection Candidates: **26** (31 Total - 5 Retracted)

O4 Low Significance Detection Candidates: **469** (Total)

Show All Public Events

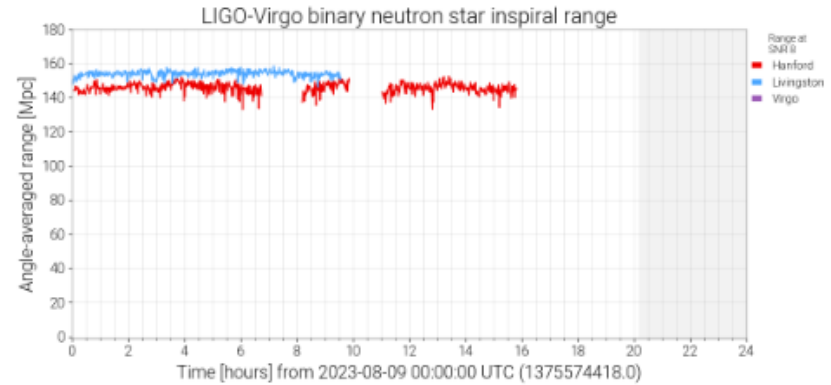
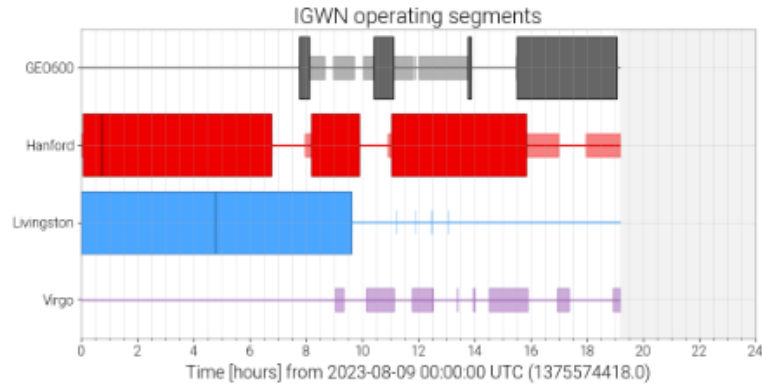
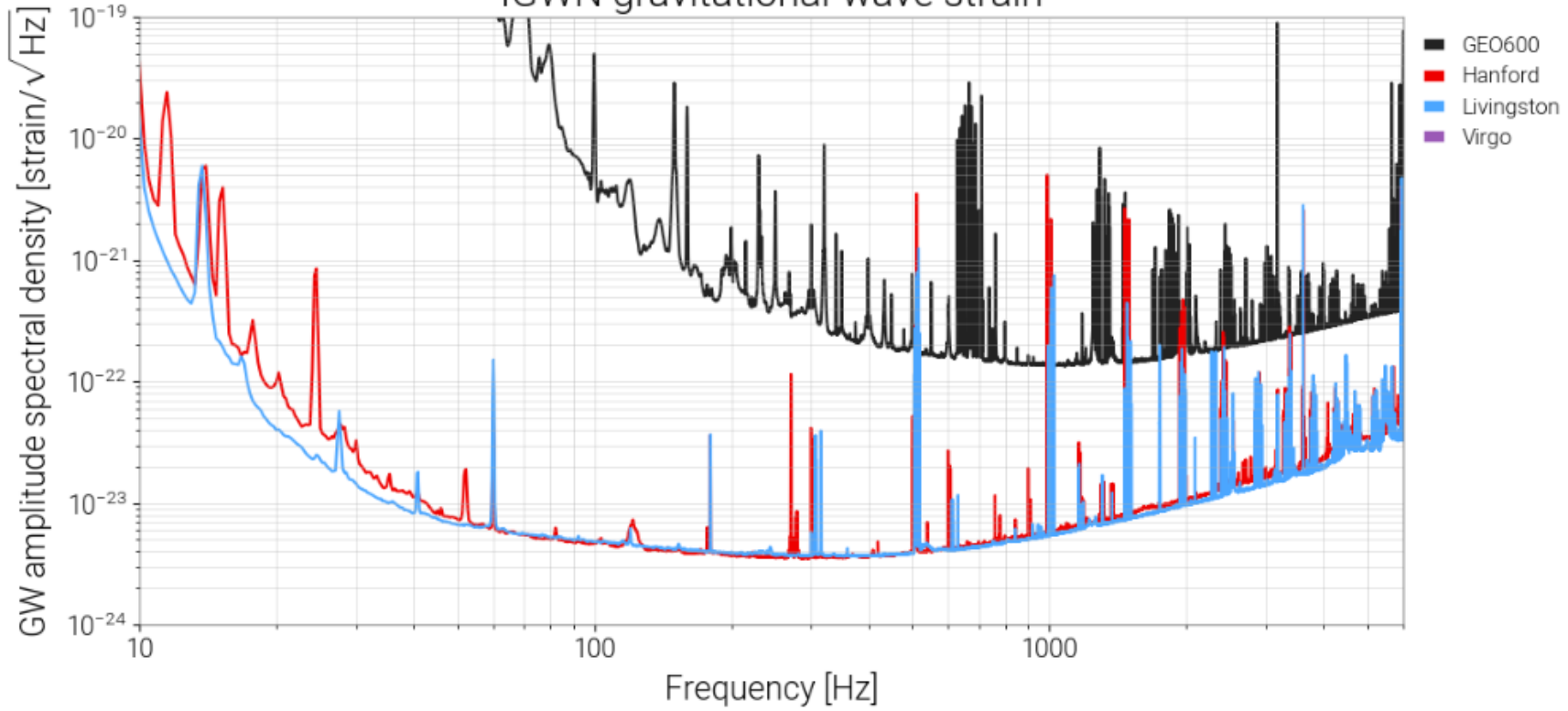
Page 1 of 3. [next](#) [last](#) »

SORT: EVENT ID (A-Z) ▾



Event ID	Possible Source (Probability)	Significant	UTC	GCN	Location	FAR	Comments
S230806ak	BBH (98%), Terrestrial (2%)	Yes	Aug. 6, 2023 20:40:41 UTC	GCN Circular Query Notices VOE		1 per 10.711 years	

IGWN gravitational-wave strain



H1 General

ryan.crouch@LIGO.ORG - posted 08:07, Monday 31 July 2023 (71838)

OPS Monday day shift start

TITLE: 07/31 Day Shift: 15:00-23:00 UTC (08:00-16:00 PST), all times posted in UTC

STATE of H1: Observing at 146Mpc

CURRENT ENVIRONMENT:

SEI_ENV state: CALM

Wind: 3mph Gusts, 2mph 5min avg

Primary useism: 0.01 $\mu\text{m/s}$

Secondary useism: 0.06 $\mu\text{m/s}$

QUICK SUMMARY:

- CDS/SEI/SUS/VAC/Dust looks good
- Taking over from Oli

H1 General

oli.patane@LIGO.ORG - posted 08:06, Monday 31 July 2023 (71839)

Ops OWL Shift End

TITLE: 07/31 Owl Shift: 07:00-15:00 UTC (00:00-08:00 PST), all times posted in UTC

STATE of H1: Observing at 146Mpc

SHIFT SUMMARY:



A1 | fx Week #

	A	B	C	G	H	I	J	
1	Week #	Operator shift (Choose from drop menu)	UTC (approx)	Summary from Operator's log	Classification (Choose from drop menu)	Sub-classification (Choose from drop menu)	IFO recovery (Did you have to do something to get it back to LOW NOISE / OBSERVE?)	What did you
93	9	Owl	2023-07-21 10:48:27.288086 UTC	Logging seismic noise very high in the 1-10Hz band	SEI	Anthropogenic	No	To date haven't trying during t
94	9	Evening	2023-07-22 22:04:07.038574 UTC	Wind from thunderstorm knocked us out	SEI	Windy	Yes	Troubles lockin running an in aligning ar
95	9	Owl	2023-07-24 10:46:46.646484 UTC	Logging seismic noise very high in the 1-10Hz band	SEI	Anthropogenic	No	It took a number through
96	9	Owl	2023-07-24 12:36:39.375000 UTC	Logging seismic noise very high in the 1-10Hz band	SEI	Anthropogenic	No	We never made

SEI breakdown		
TOTAL	56	
EQ	19	33.9%
Anthropogenic	18	32.1%
Useism	7	12.5%
Windy	12	21.4%

Source: https://docs.google.com/spreadsheets/d/1W7rLxEY-9_xyS-pbhONdDUrLucVGpdRAqxjwn4pJMHk

May 29th

Please log in to view full database contents.

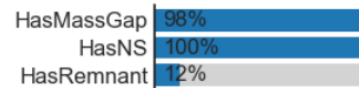
S230529ay

Log Messages

Full Event Log

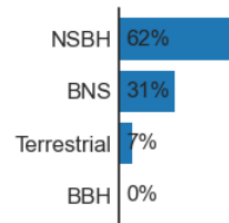
S230529ay

Log Image



Source properties visualization from [em_bright.json](#)
— Submitted by LIGO/Virgo EM Follow-Up on May 29, 2023 18:15:25 UTC

Log Image



Superevent Information

Superevent ID	S230529ay
Category	Production
FAR (Hz)	1.975e-10
FAR (yr ⁻¹)	1 per 160.44 years
t ₀	1369419318.75
t _{end}	1369419319.75
Submitted ▾	2023-05-29 18:15:16 UTC
Links	Data



Forskere har brukt pulsarer, blinkende døde stjerner, til å lete etter lavfrekvente gravitasjonsbølger. (Illustrasjon: Aurore Simonnet for the NANOGrav Collaboration)

Nå har forskere bedre bevis: Rommet vogges av enorme gravitasjonsbølger

Forskere mener å ha avslørt bakgrunnsstøyen fra kollisjoner av supermassive sorte hull. – Det gir enorme muligheter, sier forsker.

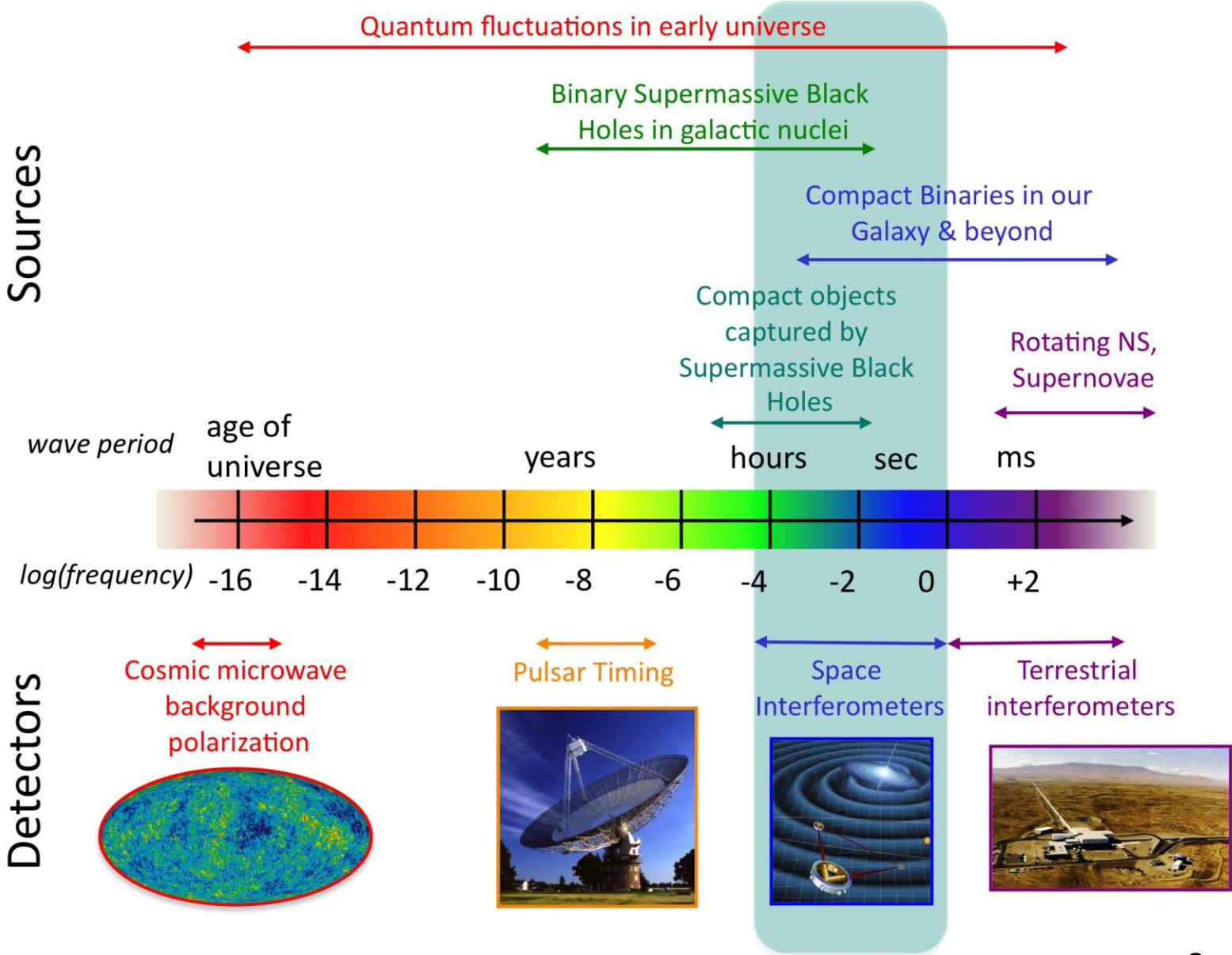


Elise Kjørstad

JOURNALIST

Tirsdag 04. juli 2023 - 04:30

The Gravitational Wave Spectrum



Summary

- The gravitational wave spectrum is being opened up.
- LIGO's O4 run is now in progress and can be followed.
- The future for gravitational wave science is bright.

Thank you