SPAnet
Rede Paulista de Astronomia

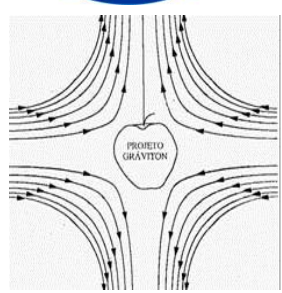
Universidade Presbiteriana Mackenzie

SAGO – South American Gravitational wave Observatory

Odylio D. Aguiar

October 25th, 2019

INPE



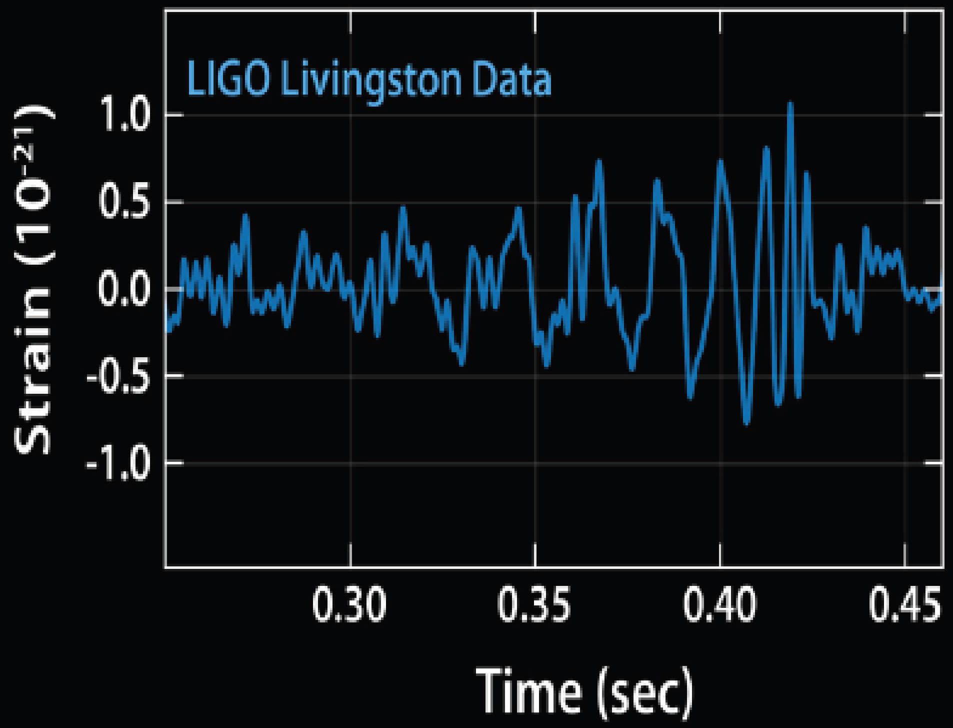
GRAVITON GROUP

CNPq
Conselho Nacional de Desenvolvimento Científico e Tecnológico

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA, INOVAÇÕES E COMUNICAÇÕES
BRASIL GOVERNO FEDERAL

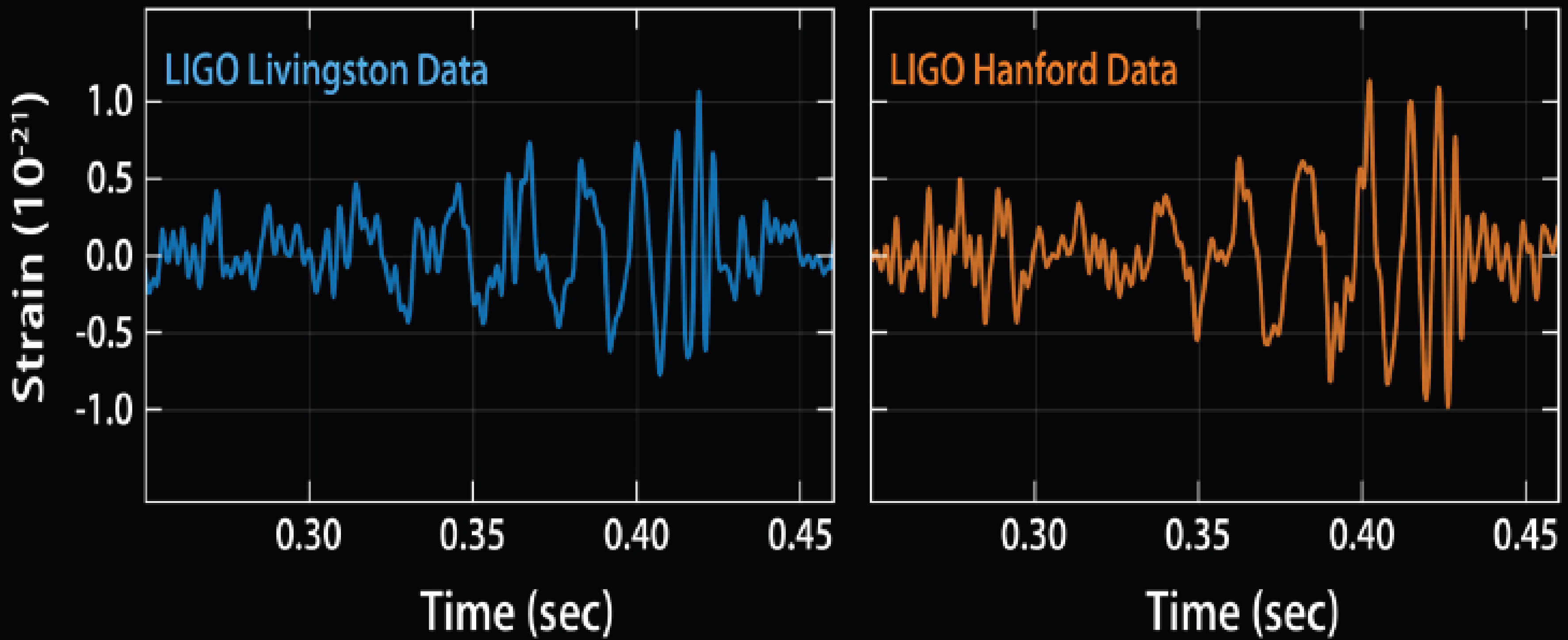
CAPES

FAPESP

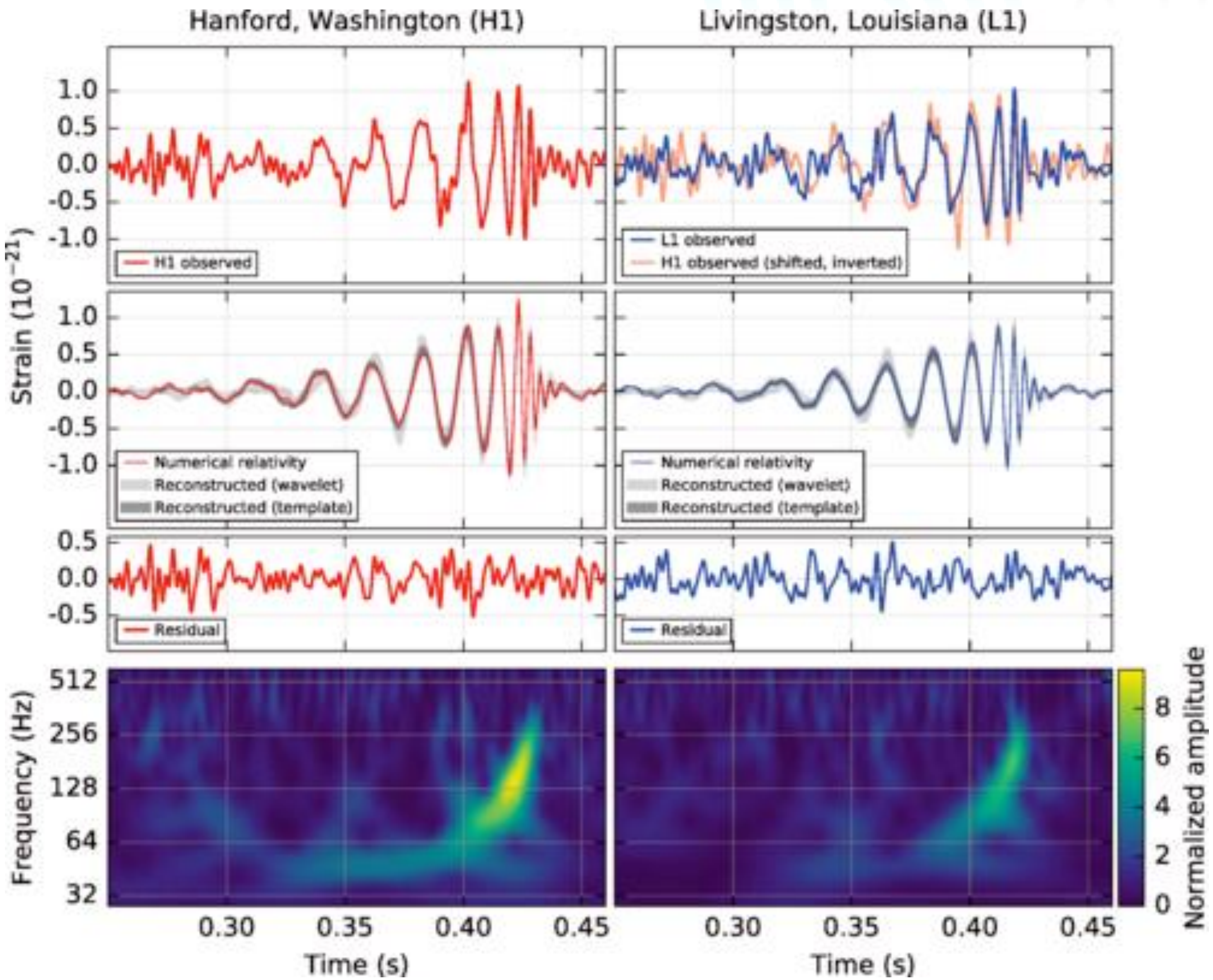

LIGO Livingston Data
Strain (10^{-21})
1.0
0.5
0.0
-0.5
-1.0
0.30
0.35
0.40
0.45
Time (sec)

G1701480

and 7 milliseconds later ...



G1701480



http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.116.061102

The Astrophysical Journal Letters, 848:L13 (27pp), 2017 October 20 Abbott et al.

https://doi.org/10.3847/2041-8213/aa920c

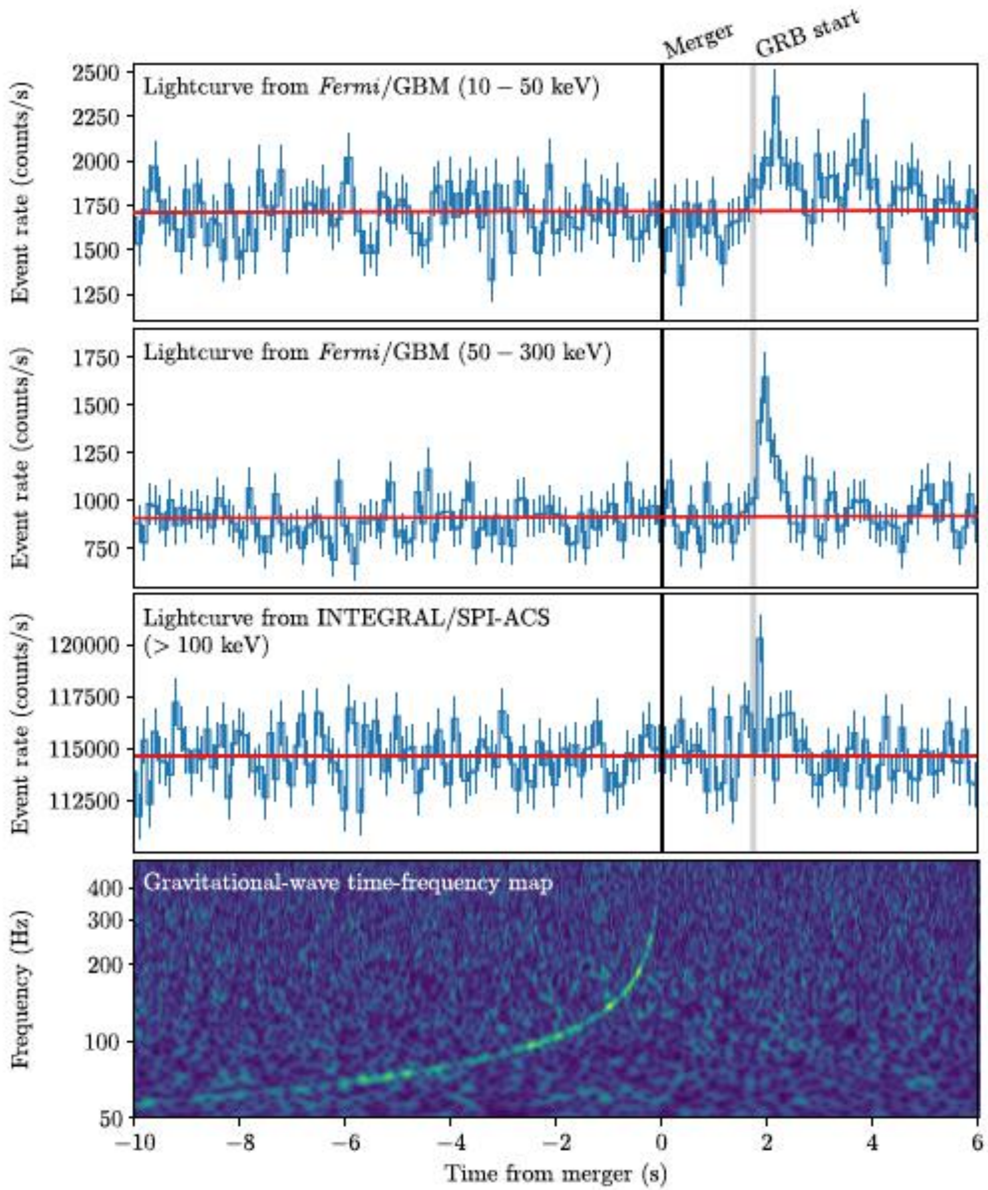


Figure 2. Joint, multi-messenger detection of GW170817 and GRB 170817A. Top: the summed GBM lightcurve for sodium iodide (NaI) detectors 1, 2, and 5 for GRB 170817A between 10 and 50 keV, matching the 100 ms time bins of the SPI-ACS data. The background estimate from Goldstein et al. (2016) is overlaid in red. Second: the same as the top panel but in the 50–300 keV energy range. Third: the SPI-ACS lightcurve with the energy range starting approximately at 100 keV and with a high energy limit of least 80 MeV. Bottom: the time-frequency map of GW170817 was obtained by coherently combining LIGO-Hanford and LIGO-Livingston data. All times here are referenced to the GW170817 trigger time T_0^{GW}.

THE ASTROPHYSICAL JOURNAL LETTERS, 848:L12 (59pp), 2017 October 20 Abbott et al.

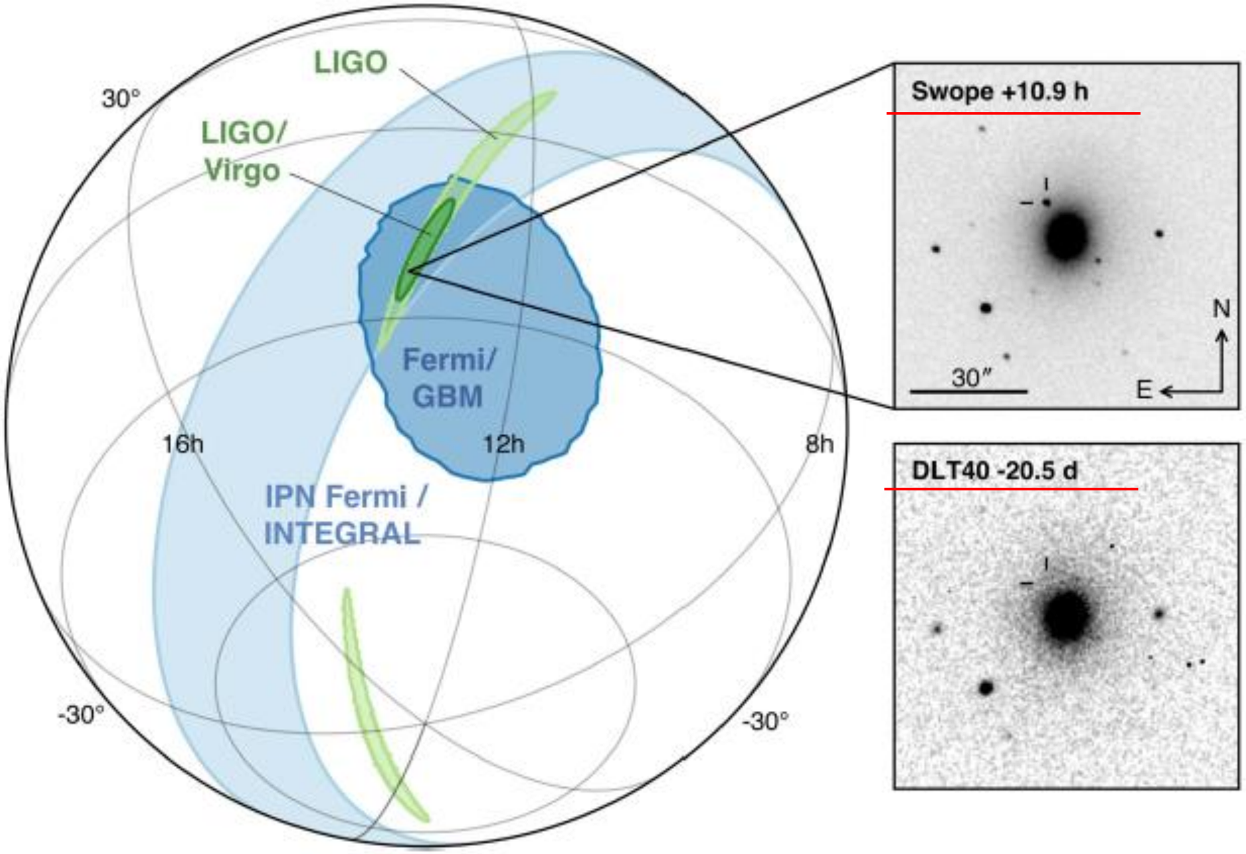
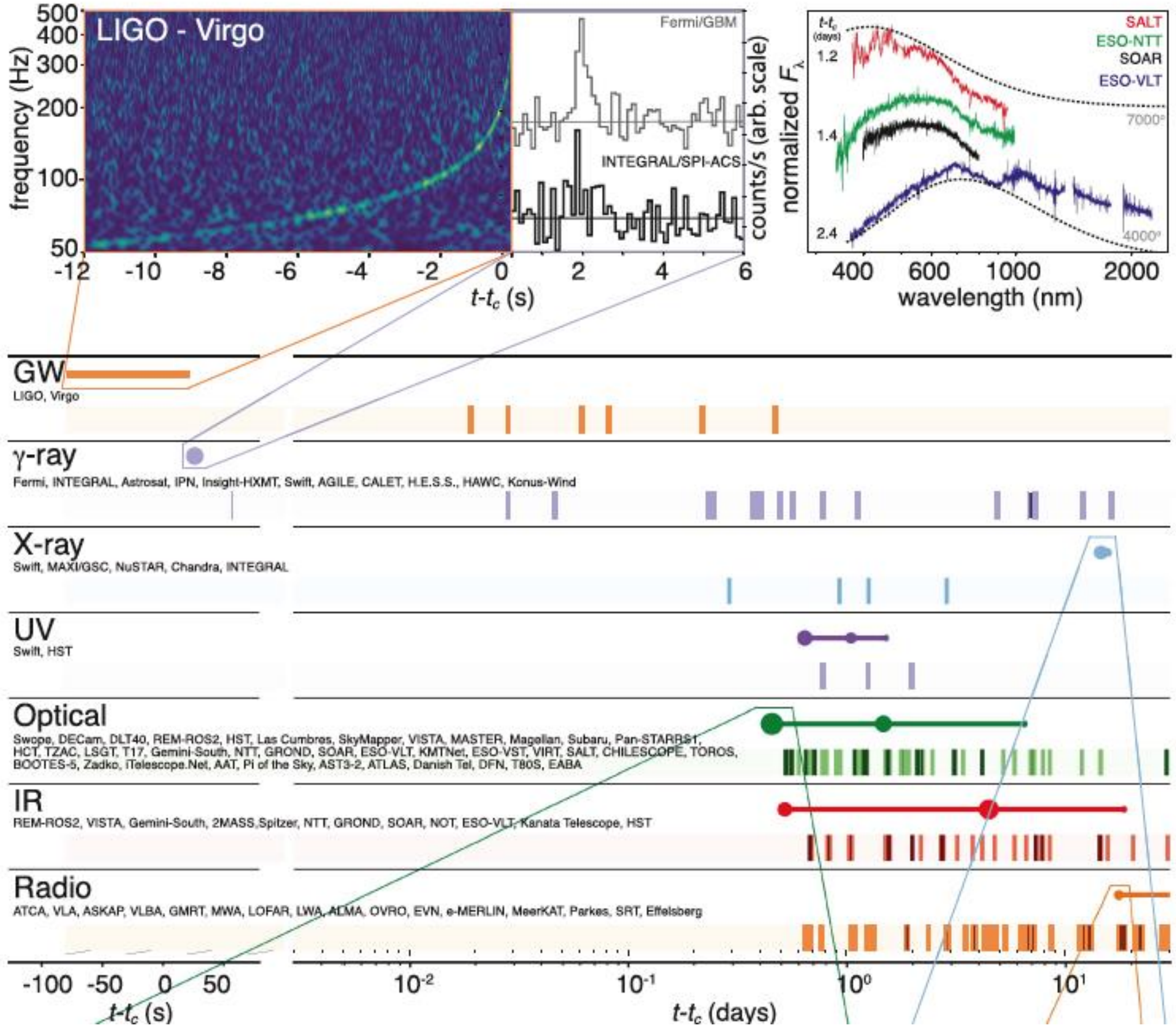


Figure 1. Localization of the gravitational-wave, gamma-ray, and optical signals. The left panel shows an orthographic projection of the 90% credible regions from LIGO (190 deg^2; light green), the initial LIGO-Virgo localization (31 deg^2; dark green), IPN triangulation from the time delay between *Fermi* and *INTEGRAL* (light blue), and *Fermi*-GBM (dark blue). The inset shows the location of the apparent host galaxy NGC 4993 in the Swope optical discovery image at 10.9 hr after the merger (top right) and the DLT40 pre-discovery image from 20.5 days prior to merger (bottom right). The reticle marks the position of the transient in both images.

https://doi.org/10.3847/2041-8213/aa91c9

The Astrophysical Journal Letters, 848:L12 (59pp), 2017 October 20

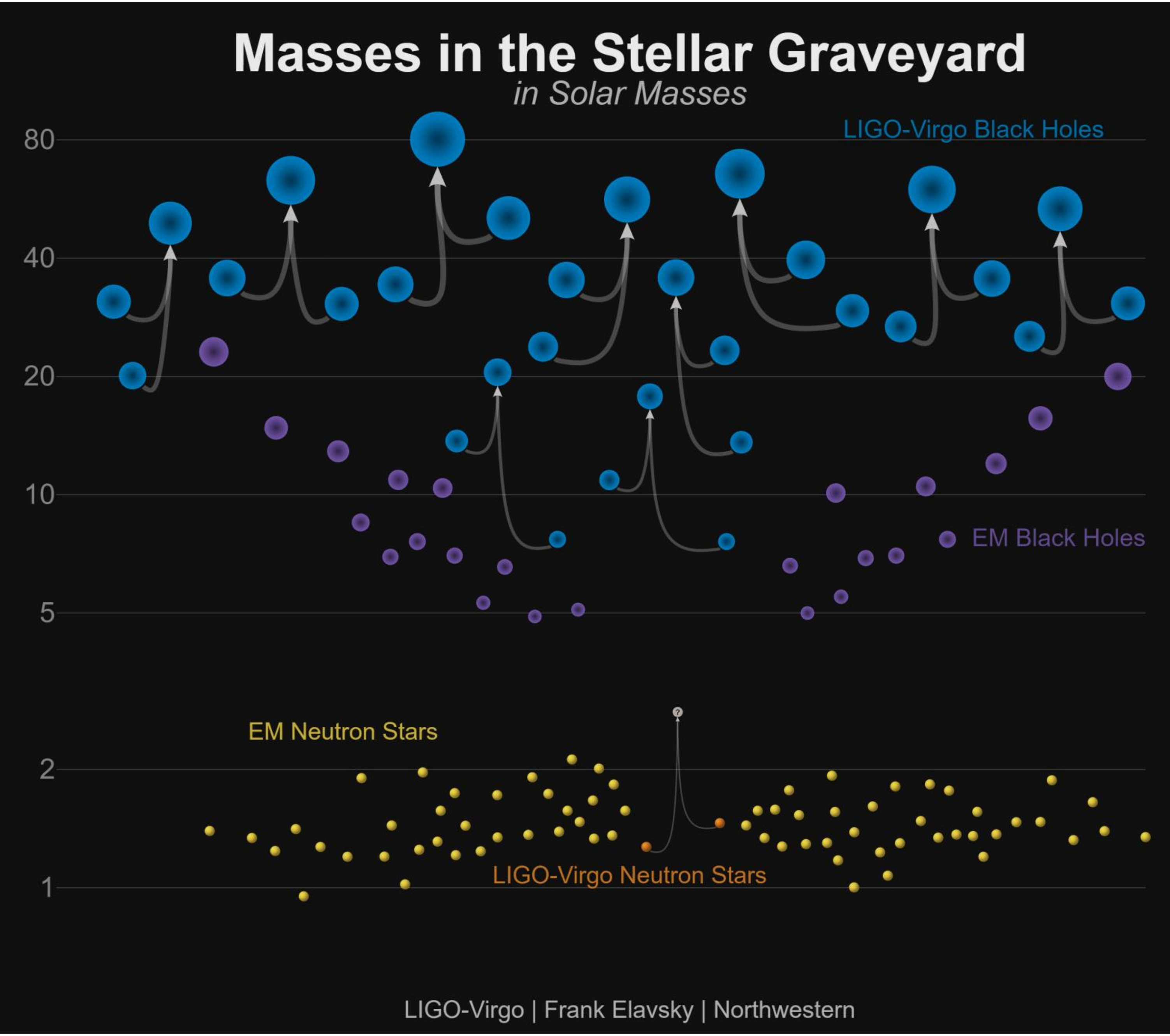


MULTIMESSENGER ASTROPHYSICS:
Simultaneous search with electromagnetic window instruments

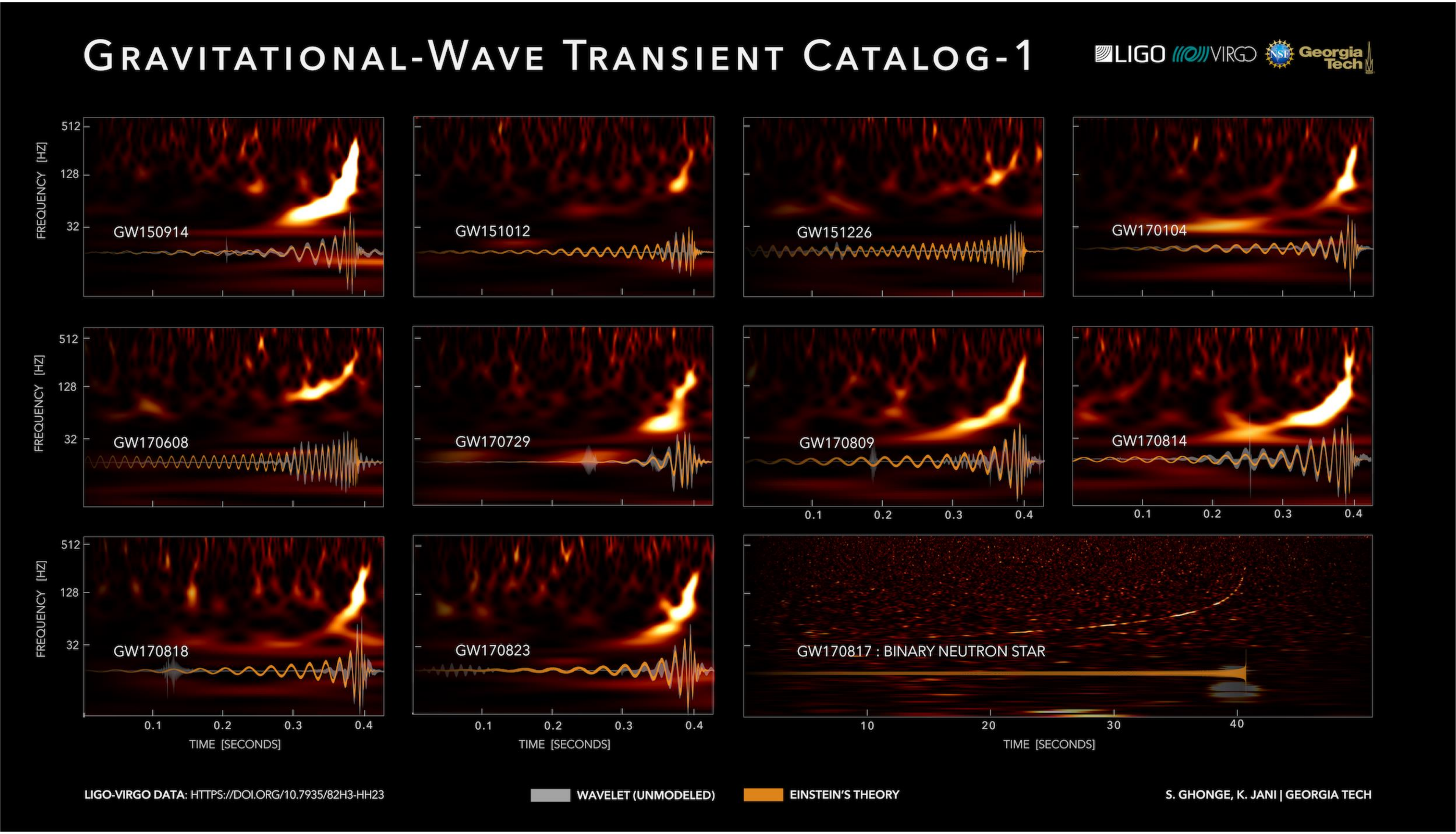
Less than two years after the debut of gravitational wave astronomy, GW170817 marks the beginning of a new era of discovery.

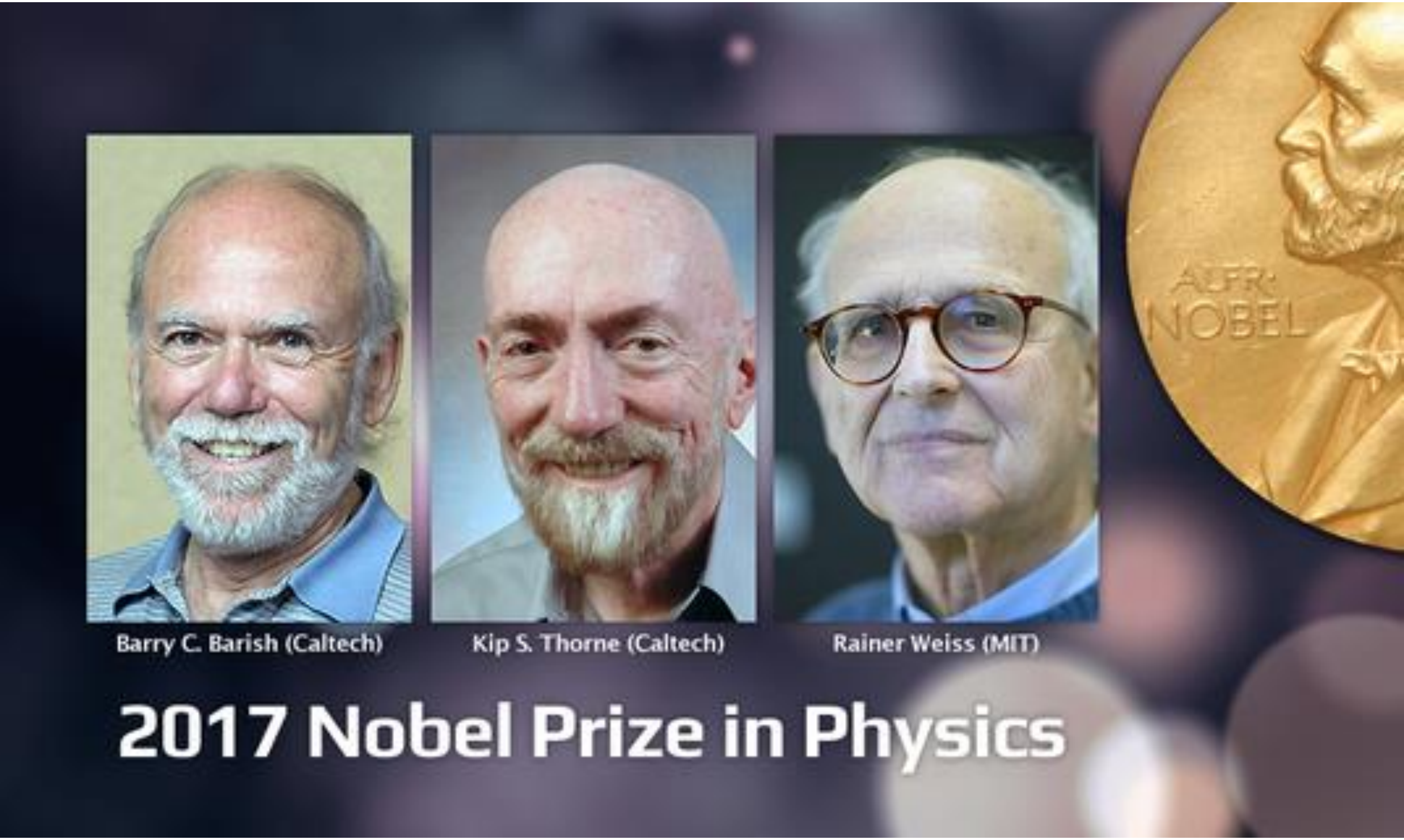
LSC LIGO Scientific Collaboration

VIRGO

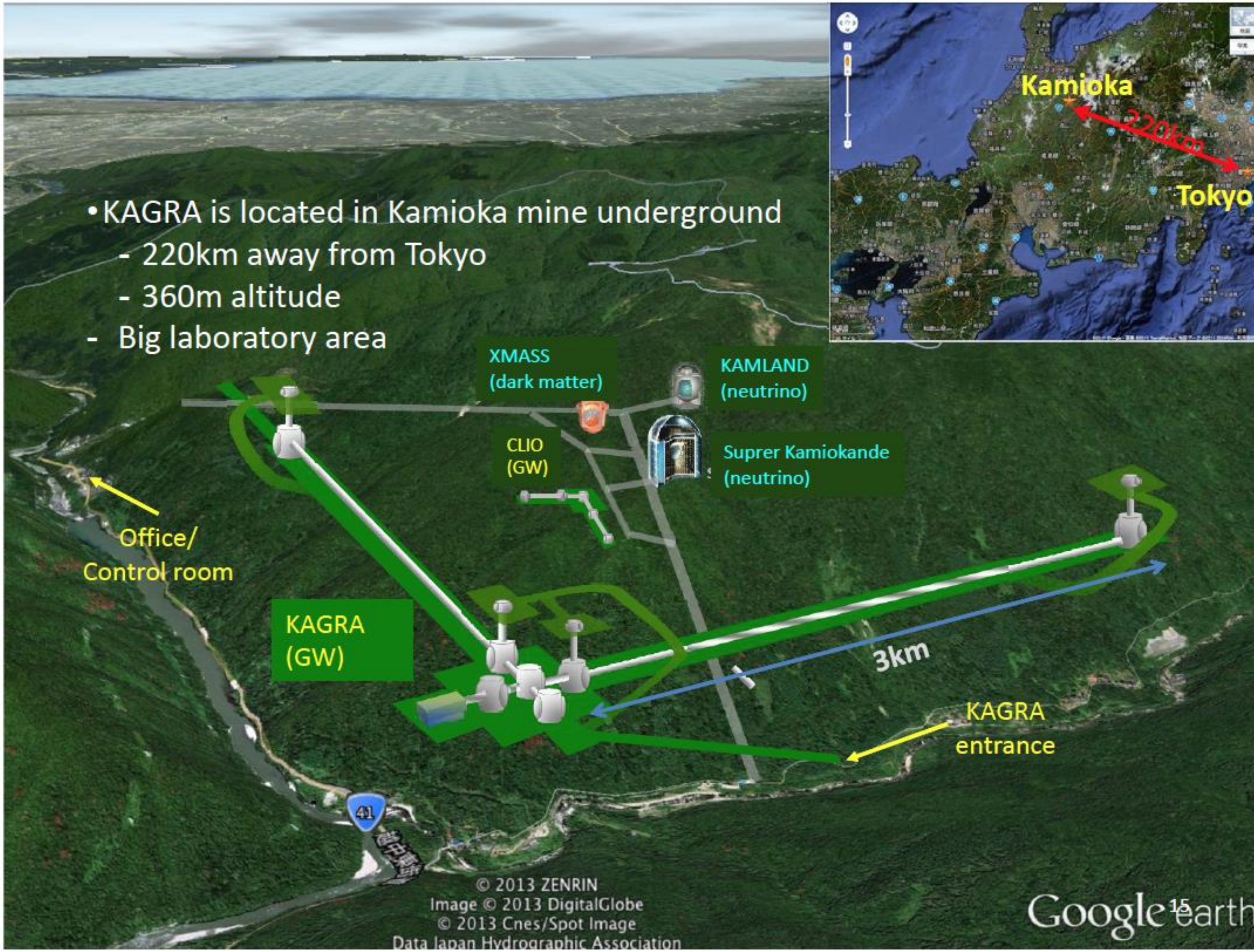


https://ligo.northwestern.edu/media/mass-plot/index.html https://ligo.org/detections/images/GWTC1-poster.png




Barry C. Barish (Caltech)
Kip S. Thorne (Caltech)
Rainer Weiss (MIT)
2017 Nobel Prize in Physics
ALFR. NOBEL

crédito: LIGO lab



Presented at Amaldi12 by Sheila Rowan
http://www.amaldi12.org/talks

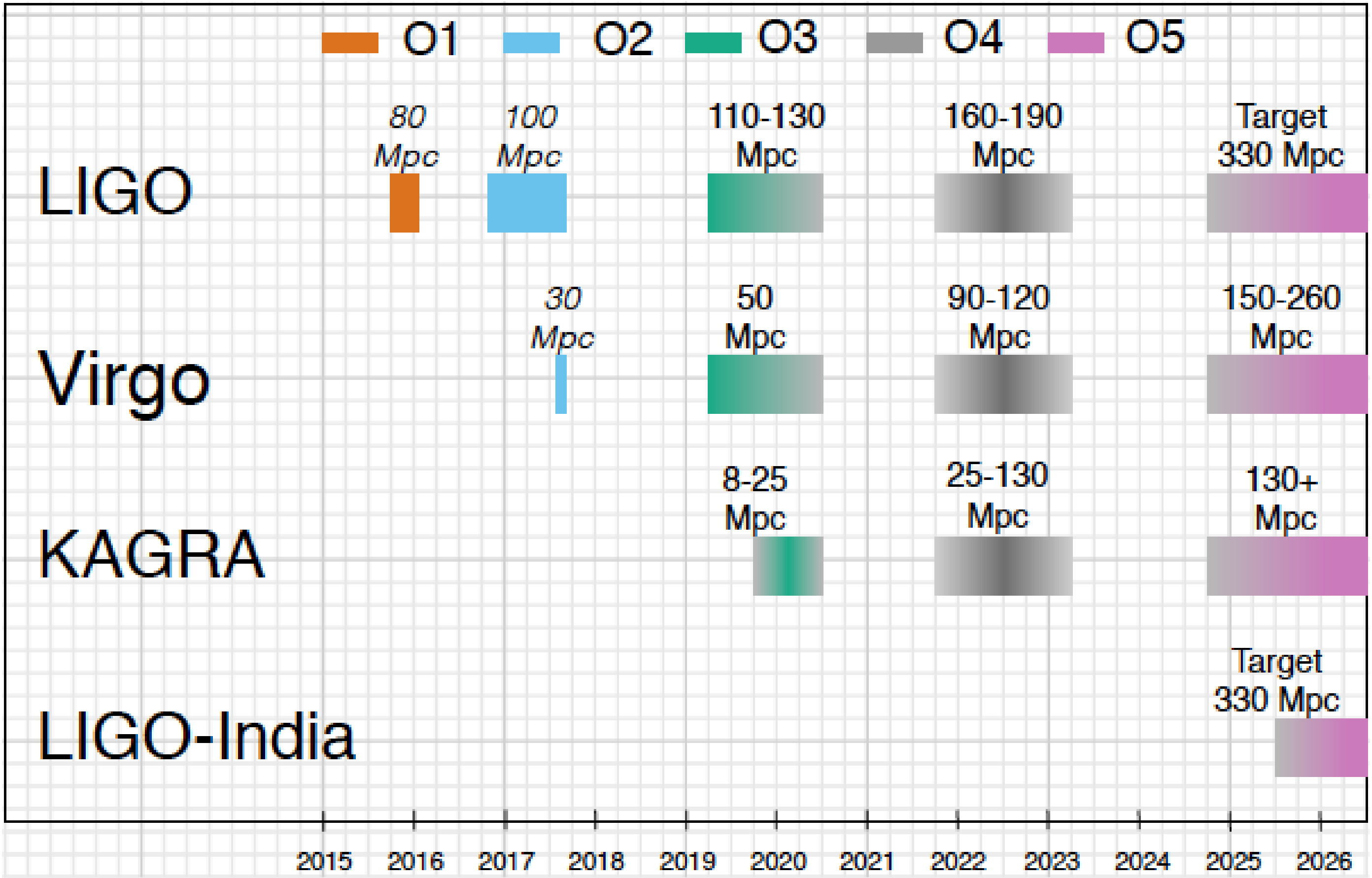


Fig. 2 The planned sensitivity evolution and observing runs of the aLIGO, AdV and KAGRA detectors over the coming years. The colored bars show the observing runs, with achieved sensitivities in O1, O2 and O3, and the expected sensitivities given by the data in Fig. 1 for future runs. There is significant uncertainty in the start and end times of the planned observing runs, especially for those further in the future, and these could move forward or backwards relative to what is shown above. Uncertainty in start or finish dates is represented by shading. The break between O3 and O4 will last at least 18 months. O3 is expected to finish by June 30, 2020 at the latest. The O4 run is planned to last for one calendar year. We indicate a range of potential sensitivities for aLIGO during O4 depending on which upgrades and improvements are made after O3. The most significant driver of the aLIGO range in O4 is from the implementation of frequency-dependent squeezing. The observing plan is summarised in Sect. 2.5

Third-generation gravitational-wave detectors

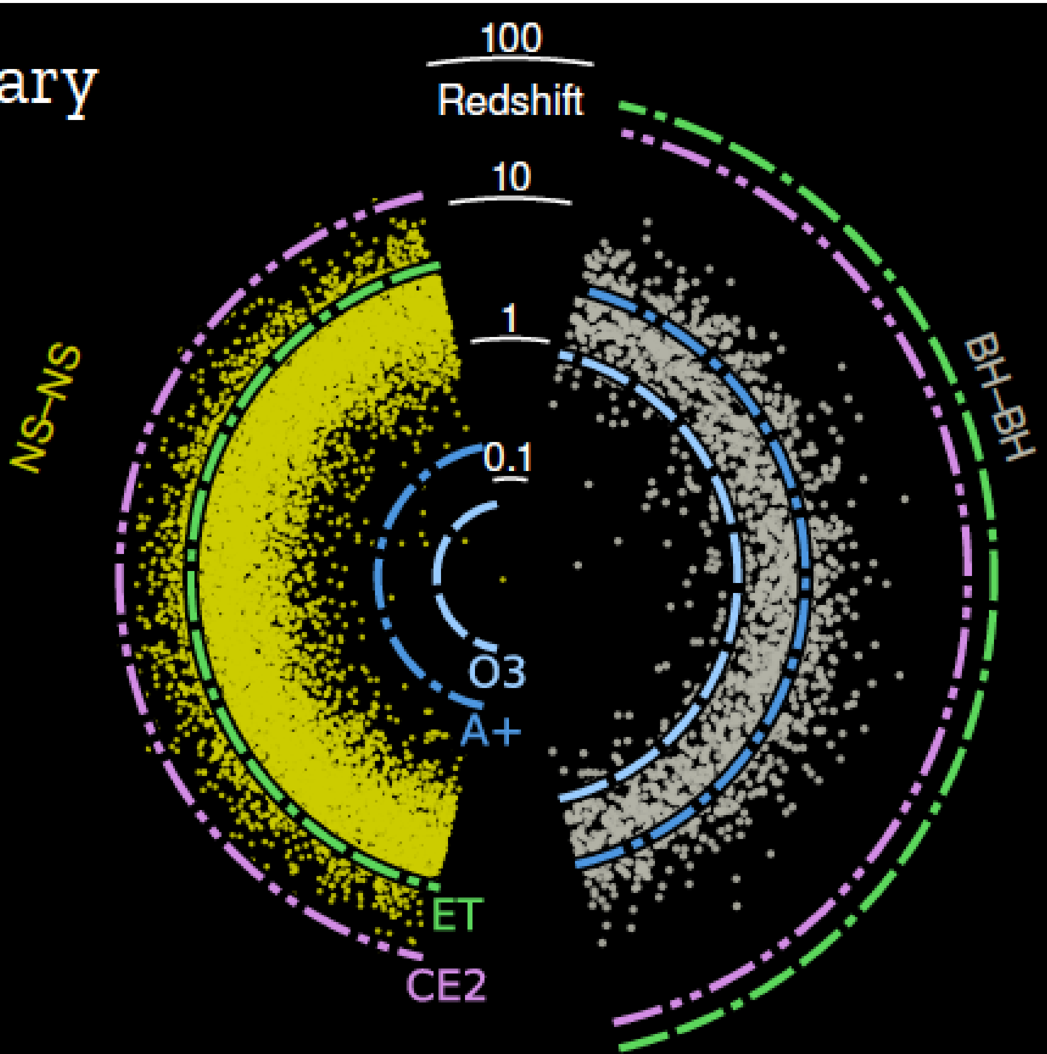
Status and Plans

Evan Hall
LIGO MIT

5 September 2019

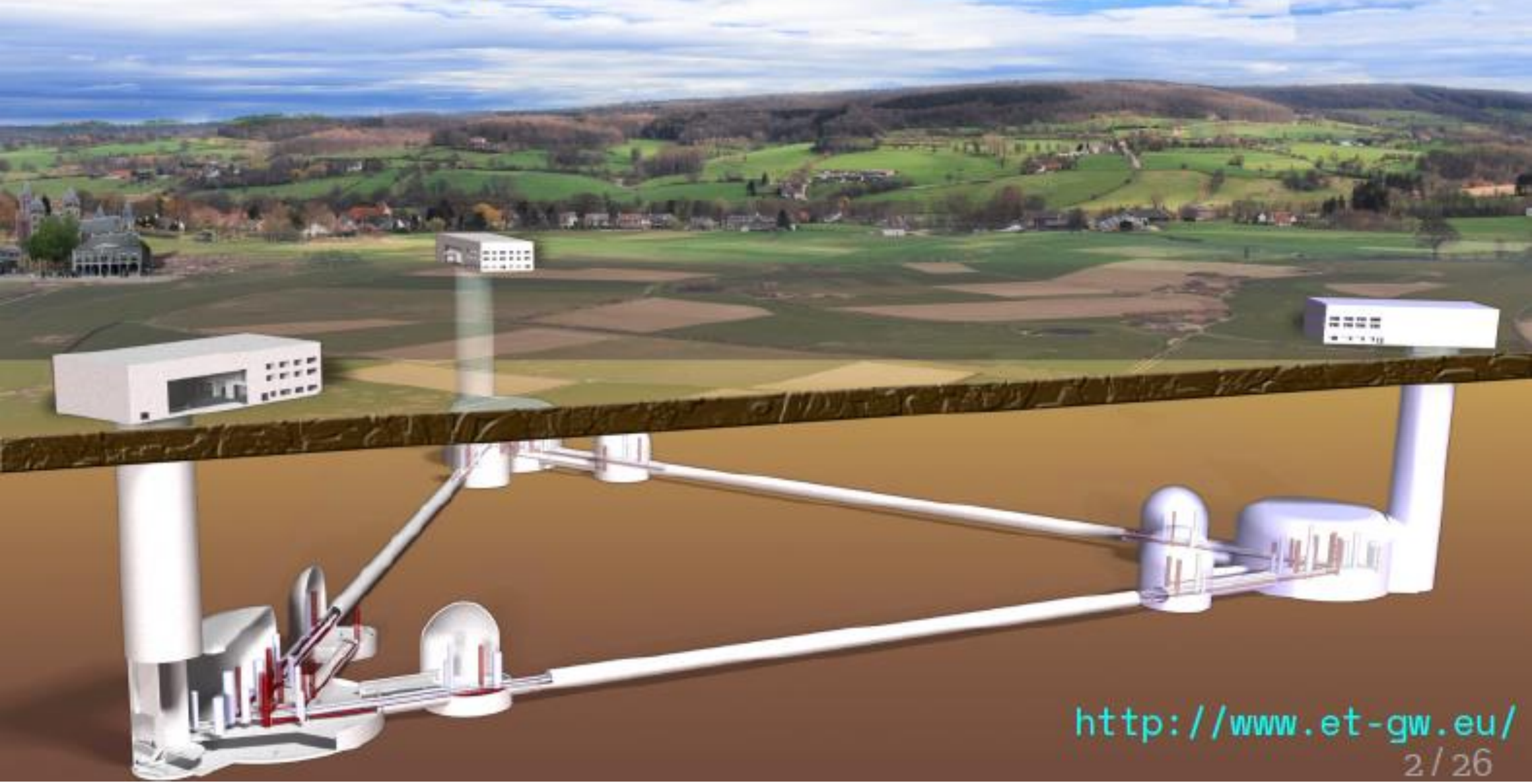
G1901746

Compact binary horizons

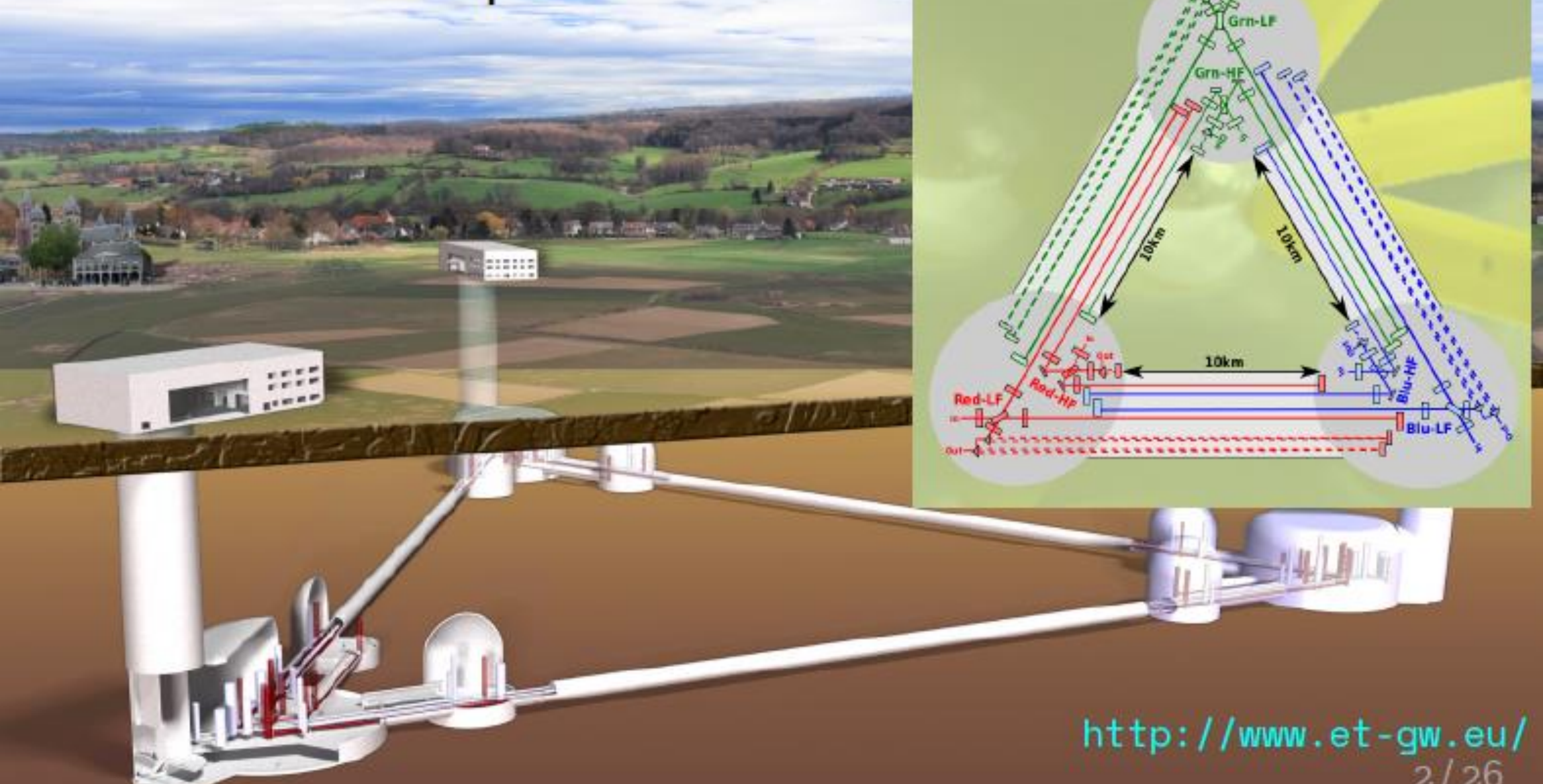


Hall/Vitale, G1900803

Einstein Telescope



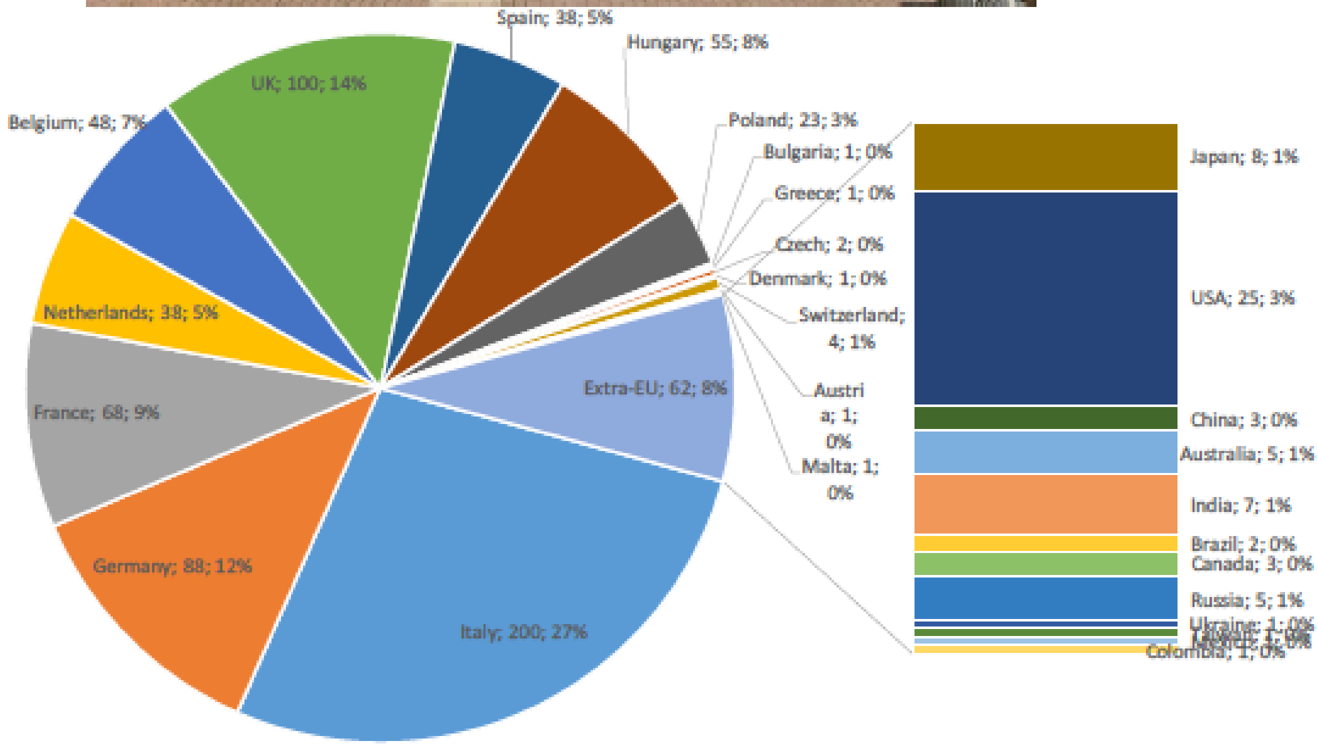
Einstein Telescope



http://www.et-gw.eu/

ET collaboration

- Launched the ET letter of intent @ the 9th ET symposium (April 2018)
- At the 10th ET symposium, April 2019, we collected more than 730 signatories

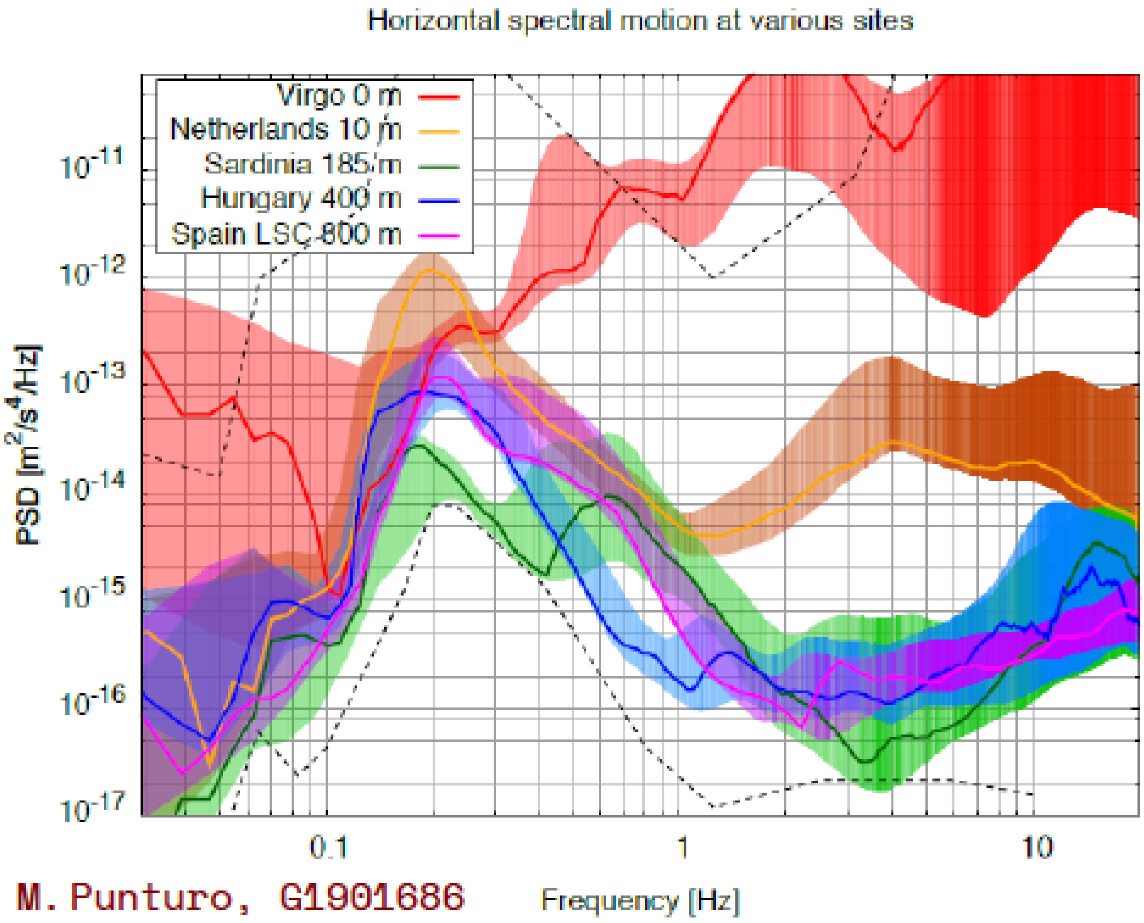


http://www.et-gw.eu/index.php/letter-of-intent

M. Punturo, G1901686

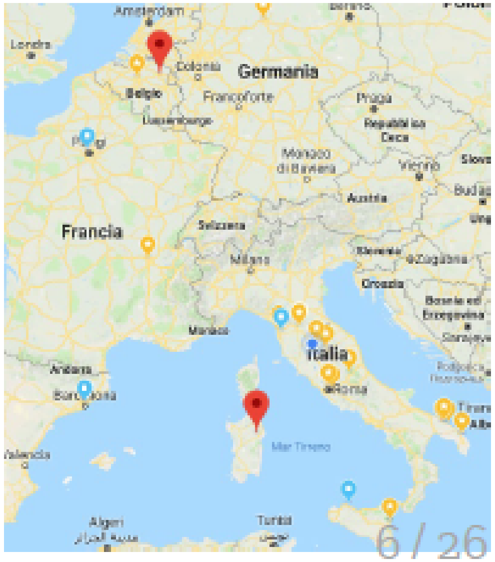
ET EINSTEIN TELESCOPE

ET site: 2 candidates



M. Punturo, G1901686

- 3 borders site (NL-B-DE)
- Sardinia site (IT)




Cosmic Explorer
https://www.cosmicexplorer.org/

Credit: Evan Hall (LIGO, MIT)

Who and what is Cosmic Explorer?

- A 40 km L-shaped facility on the Earth's surface
  - 2030s: room-temperature glass detector
  - 2040s: cryogenic silicon detector

Credit: Evan Hall (LIGO, MIT)

Who and what is Cosmic Explorer?

A 40 km L-shaped facility on the Earth's surface

- 2030s: room-temperature glass detector
- 2040s: cryogenic silicon detector

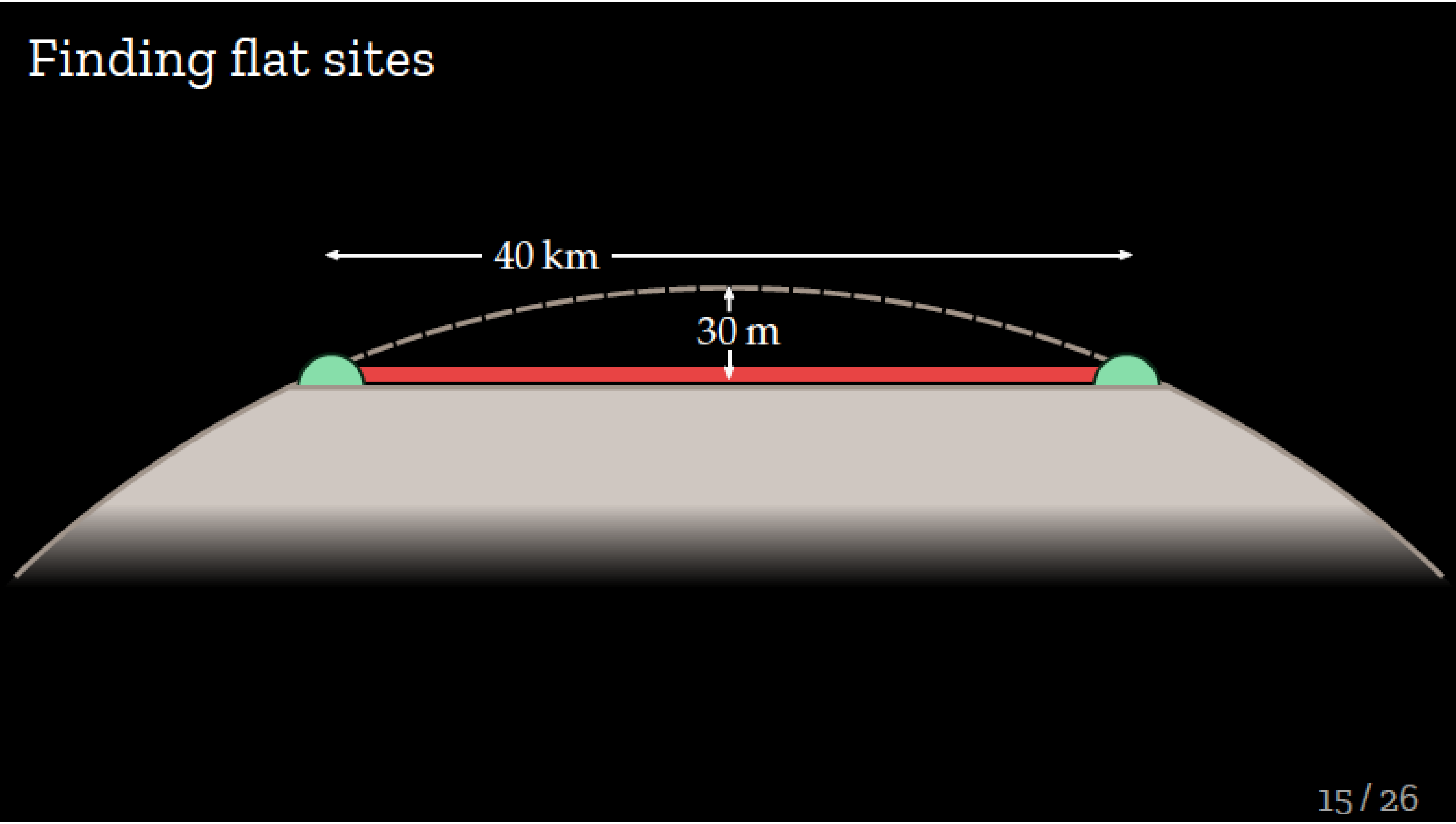
Collaborating institutions in the US:

Caltech: R. Adhikari, Y. Chen[1]; *Cal State Fullerton*: G. Lovelace[1], J. Read, J. Smith; *Penn State*: B. Sathyaprakash[1]; *Syracuse*: S. Ballmer[1], D. Brown; *MIT*: M. Evans[1,2], S. Vitale.

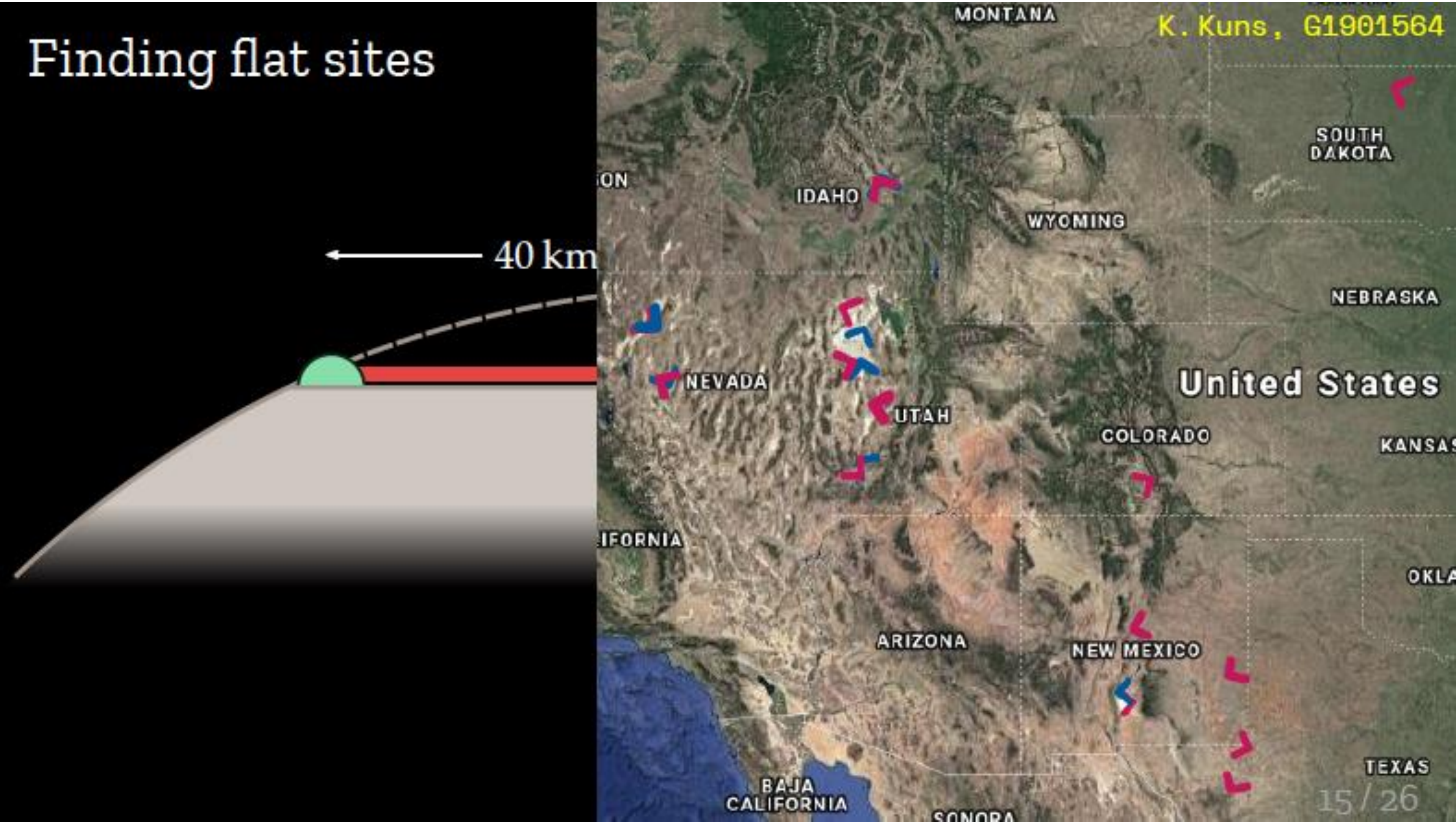
Three-year horizon study funded by the NSF, 2018–2021

[1]PI
[2]Lead PI

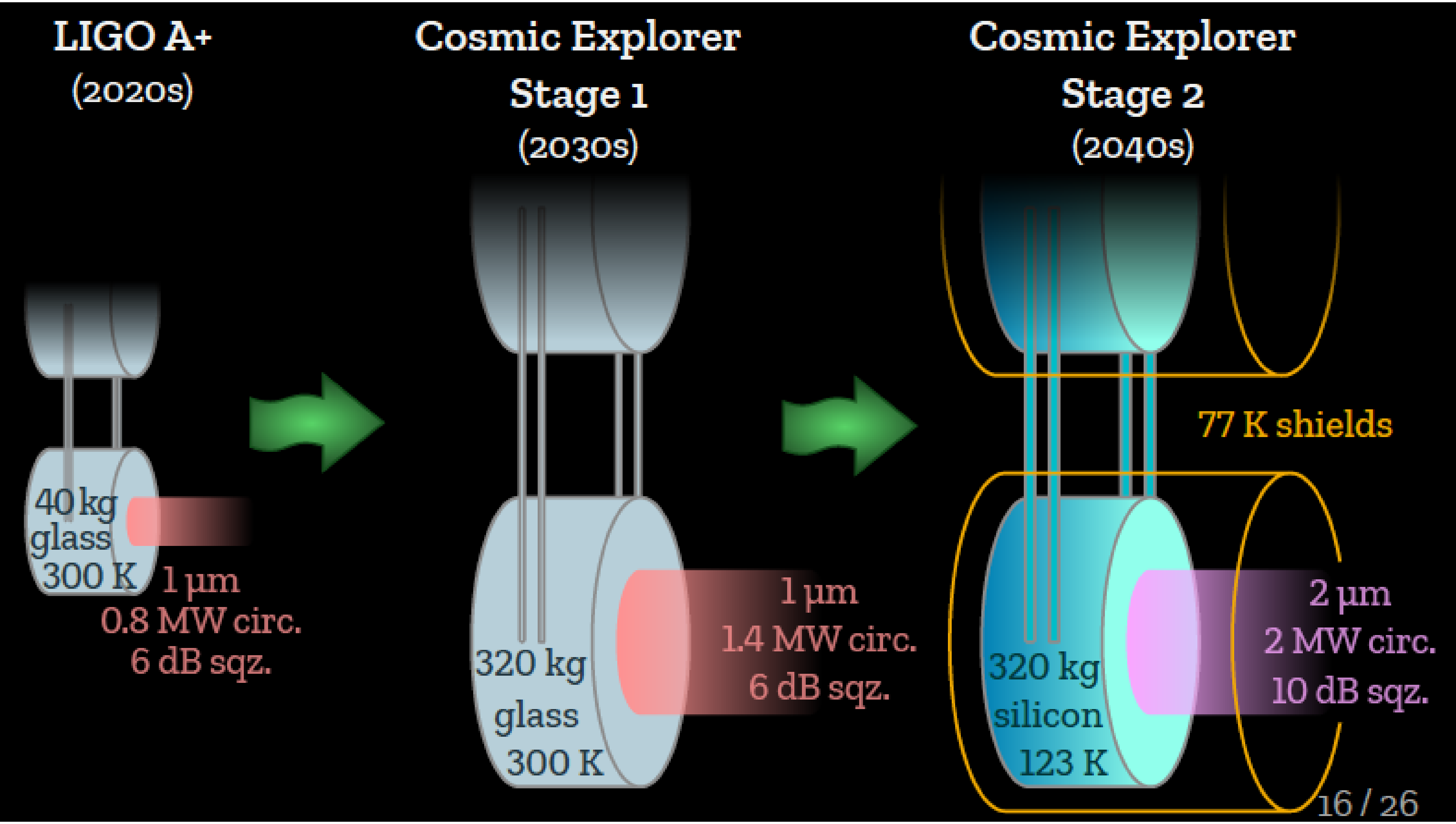
Credit: Evan Hall (LIGO, MIT)



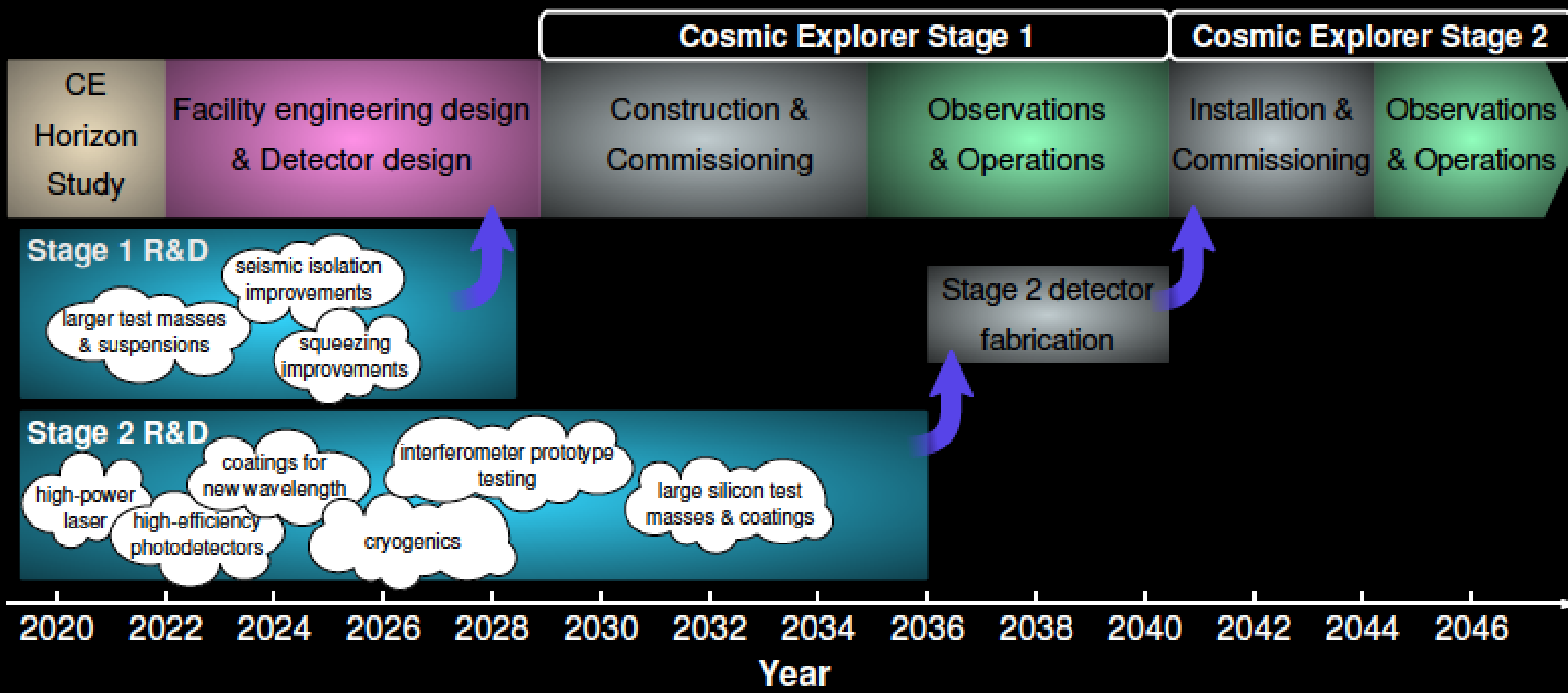
Credit: Evan Hall (LIGO, MIT)



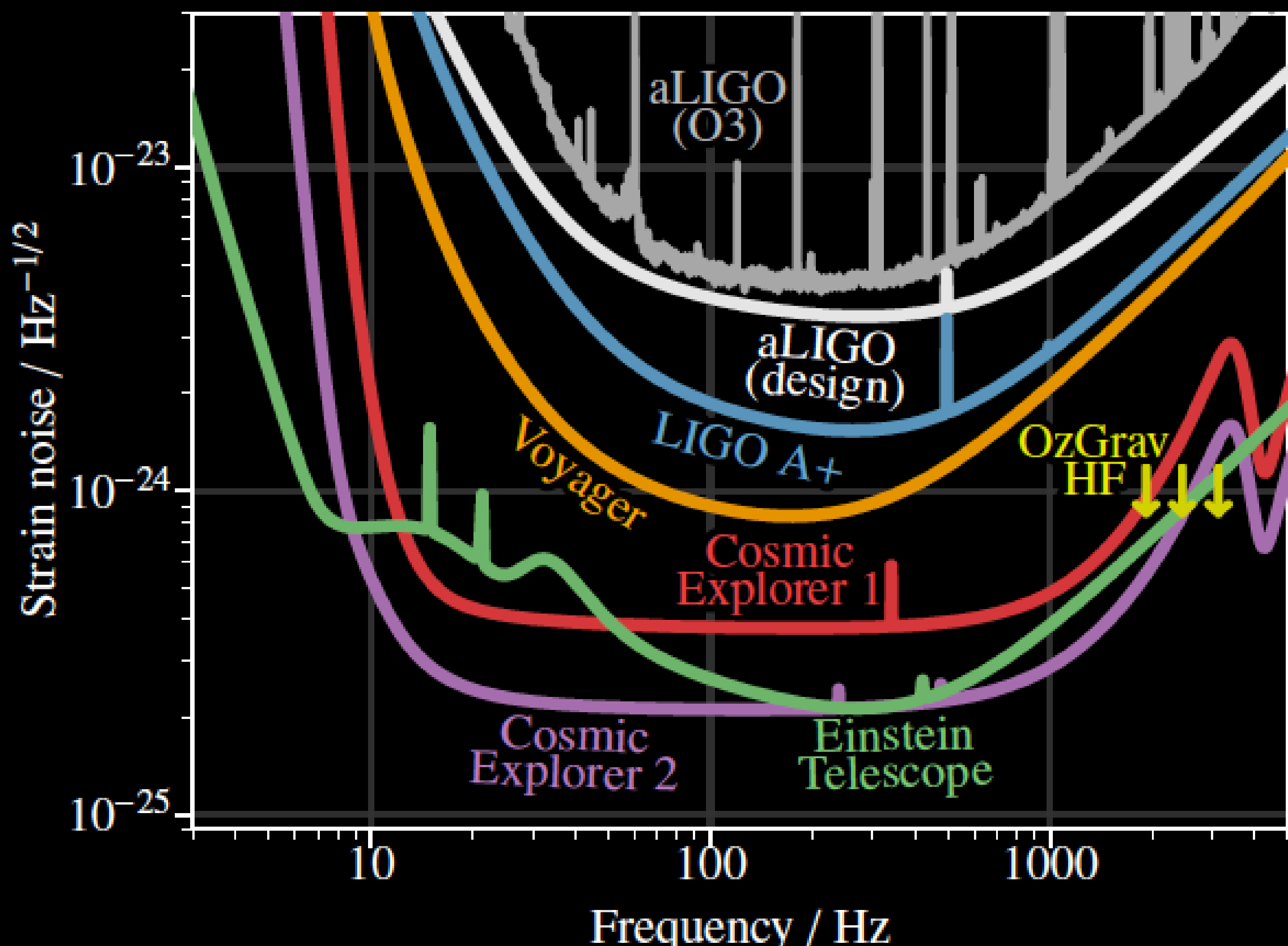
Credit: Evan Hall (LIGO, MIT)



Credit: Evan Hall (LIGO, MIT)



Credit: Evan Hall (LIGO, MIT)



3G R&D

- the current status of R&D
- Foreseeable requirements
- Paths towards these goals
- Coordination requirements

R&D FOR THE NEXT GENERATION OF GROUND-BASED GRAVITATIONAL-WAVE DETECTORS

https://gwic.ligo.org/3Gsubcomm/documents/GWIC_3G_R_D_Subcommittee_report_July_2019.pdf

GWIC, GWIC-3G, GWIC-3G-R&D-Consortium

H. Lück, G1901698

Contents

- Facilities & Infrastructures
- Core Optics
- Coatings
- Cryogenics
- Newtonian Noise
- Light Sources
- Quantum Enhancements
- SAS & SUS
- Auxilliary Optics
- Simulation and Controls
- Calibration

https://gwic.ligo.org/3Gsubcomm/

Credit: Evan Hall (LIGO, MIT)

Summary

Einstein Telescope and Cosmic Explorer: different approaches, but many common technologies

Roadmaps for ET and CE are already taking shape, including R&D programs and prototypes for the 2020s

We are all looking forward to a global third-generation gravitational-wave detector network!

SAGO – South American Gravitational wave Observatory

sago - Google Search

Google

sago

Sago

Food

Sago is a starch extracted from the spongy centre, or pith, of various tropical palm stems, especially that of Metroxylon sagu. It is a major staple food for the lowland peoples of New Guinea and the Moluccas, where it is called saksak, rabia and sagu.

Wikipedia

People also search for

View 15+

Tapioca

Sago pudding

Sabudana Khichadi

Feedback

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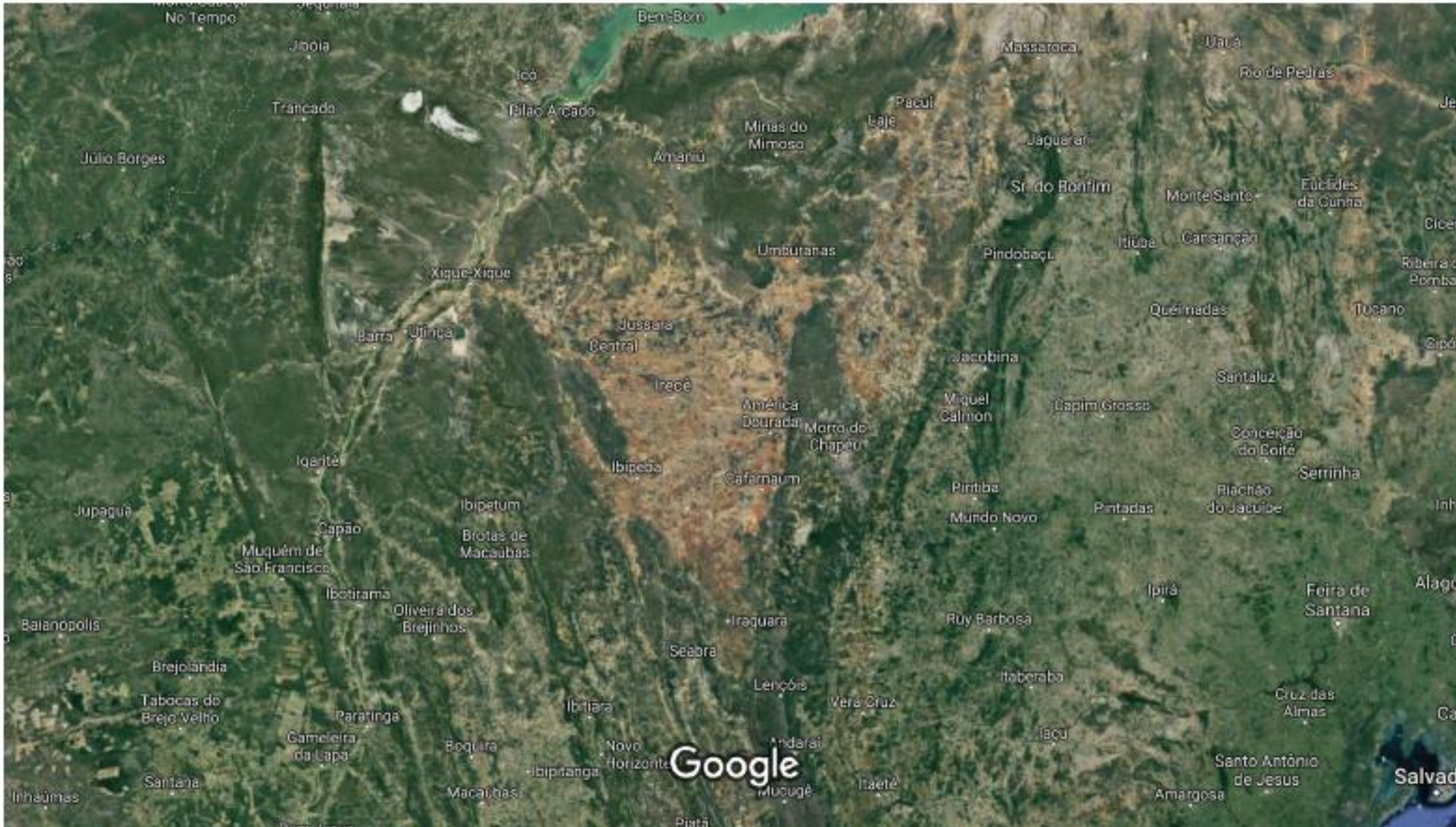
Imagens ©2019 Landsat / Copernicus, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Imagens ©2019 NASA, TerraMetrics, Dados do mapa ©2019 500 km

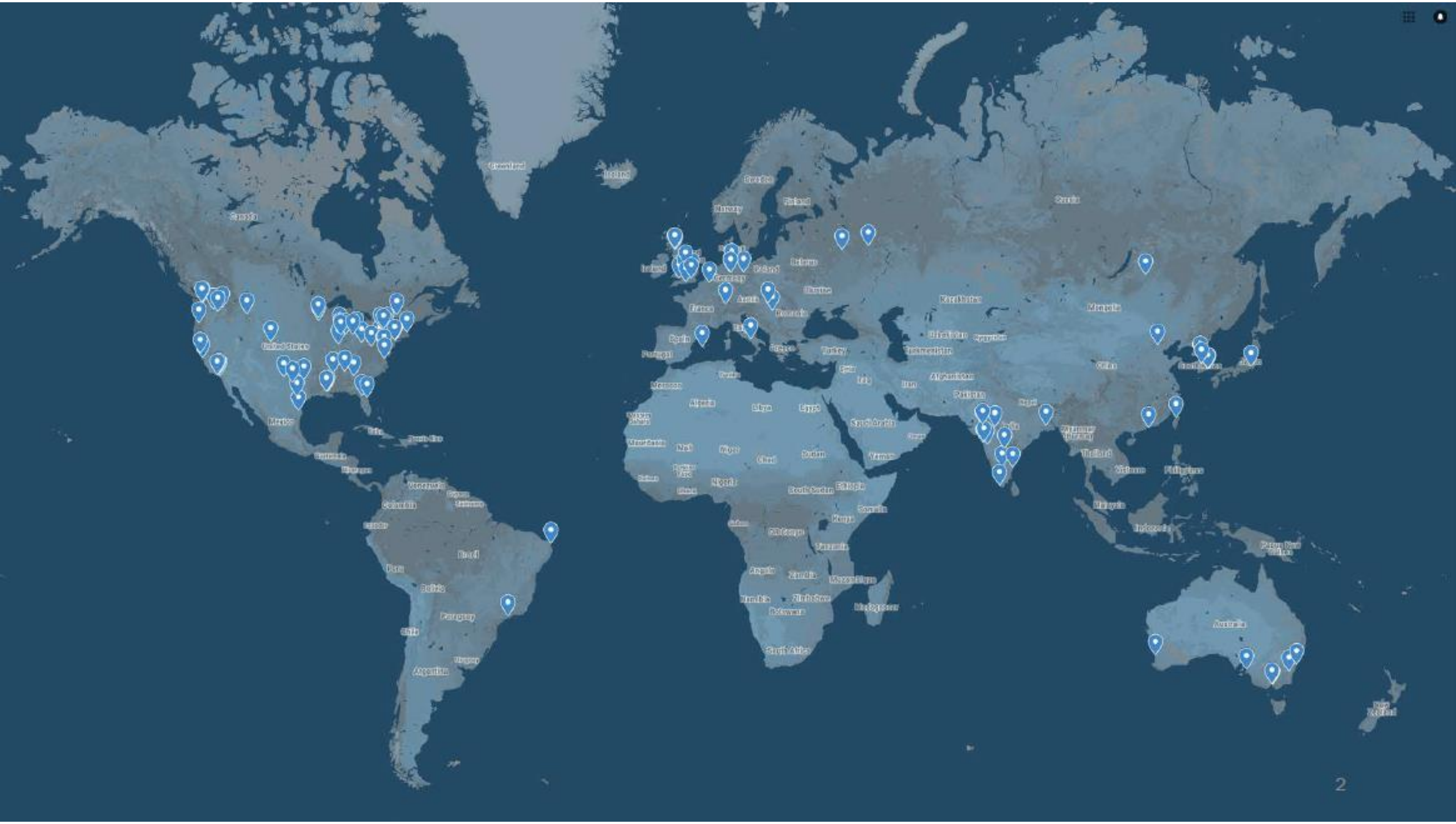
Google Maps

 100 km

Google Maps



Imagens ©2019 Landsat / Copernicus, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Imagens ©2019 TerraMetrics, Dados do mapa ©2019 Google 100 km



+ two south American researchers collaborating in the KAGRA project:
Fabian Peña Arellano (Peru) and Enzo Tapia (Chile)

Thematic Project Title: **Design, development of instrumentation and data analysis of detectors and observatories for gravitational wave astronomy/astrophysics.**

V.5 – STAFF INVOLVED IN THIS PROPOSAL (28 people)

Responsible Researcher:
Prof. Odylio Denys de Aguiar (INPE, SP);
Principal Researchers:
Prof. Nei Fernandes de Oliveira Jr. (IF-USP, SP),
Prof. German Lugones (UFABC, SP),
Prof. Riccardo Sturani (IIP/UFRN, RN),
Prof. Cesar Augusto Costa (CGEE, DF);
Associate Researchers:
Prof. Anderson Campos Fauth (UNICAMP, SP),
Prof. José Carlos Neves Araújo (INPE, SP),
Prof. Joaquim José Barroso (ITA, SP),
Prof. Rubens de Melo Marinho Júnior (ITA, SP),
Prof. Samuel Rocha de Oliveira (UNICAMP, SP),
Prof. Márcio E. S. Alves (UNESP São José dos Campos, SP),
Prof. Rogério Moraes Oliveira (INPE, SP),
Prof. Carlos Frajuca (IF-SP, SP),
Prof. Kilder Leite Ribeiro (UFRB, BA),
Prof. Fábio da Silva Bortoli (IF-SP, SP),
Prof. César H. Lenzi (ITA, SP),
Prof. Dr. Sérgio Turano de Souza (FATEC Itaquera, SP),
Dr. Xavier Gratens (IFUSP, SP),
Dr. Elvis Camilo Ferreira (Editora Poliedro, SP)
Dr. Carlos Filipe da Silva Costa;
Fellowship holders:
Dr. Márcio Constâncio Júnior (PCI/INPE, SP),
MSc. Tábata Aira Ferreira (CAPES/INPE, SP),
Ana Beatriz Cordeiro Costa (FAPESP/INPE, SP),
Dr. Vincenzo Liccardo (FAPESP/INPE, SP);
Technical support:
Engineer Dr. Cesar Strauss (INPE, SP),
Technician Marcos André Okada (INPE, SP),
Technician Lázaro Aparecido Pires de Camargo (INPE, SP),
Technician Alan Braga Cassiano (INPE, SP).

We are proposing a thematic project

12) Search for sites with adequate area, with low seismic activity in South America: With the help of the seismology group of IAG-USP and using two seismometers acquired by our group, we will do seismic measurements in some sites.

Before asking money for a proposal, we need to ask fellowships and research money for creating a critical mass of researchers in Latin America
with knowledge on the 3G technology. So, we need to involve Latin American students and post-docs in the present projects (LIGO, Virgo, KAGRA, LIGO India, ET, and Cosmic Explorer) and attract them and foreign post-docs with knowledge on 3G to form groups in Latin America.

Thanks
for your attention !