NEWS

H2020-MSCA-RISE-2016 – Grant Agreement N° 734303

GW Physics

Massimiliano Razzano – Ettore Majorana

General Meeting – October 30, 2018

NEWS from GW Physics

- Now moving toward O3 LIGO-Virgo joint run (start in 2019)
- Improving detectors and data analysis infrastructures
- Aiming at lowest latency possible

The era of Advanced detectors

- Abbott et al. 2017, “observing scenario” paper, arxiv:1304.0670

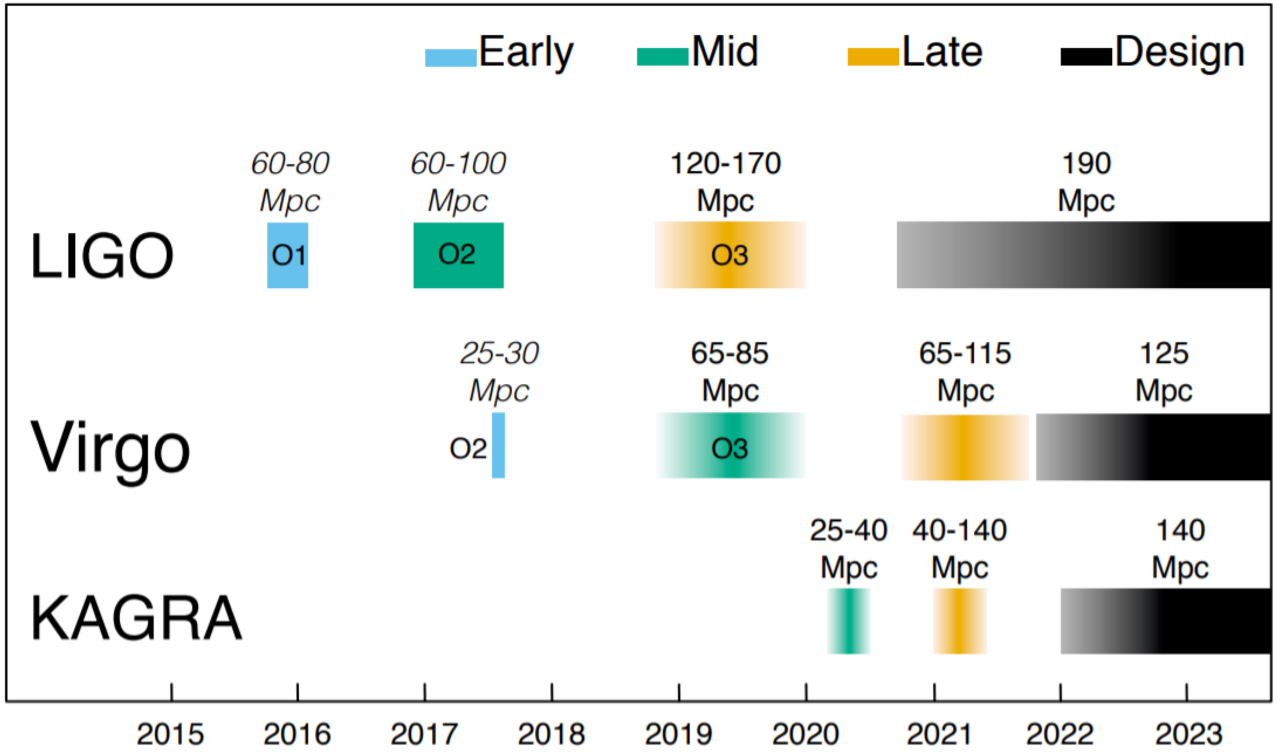


Fig. 2 The planned sensitivity evolution and observing runs of the aLIGO, AdV and KAGRA detectors over the coming years. The colored bars show the observing runs, with the expected sensitivities given by the data in Figure 1 for future runs, and the achieved sensitivities in O1 and in O2. There is significant uncertainty in the start and end times of planned the observing runs, especially for those further in the future, and these could move forward or backwards relative to what is shown above. The plan is summarised in

The era of Advanced detectors

- Abbott et al. 2017, “observing scenario” paper,
- arxiv:1304.0670

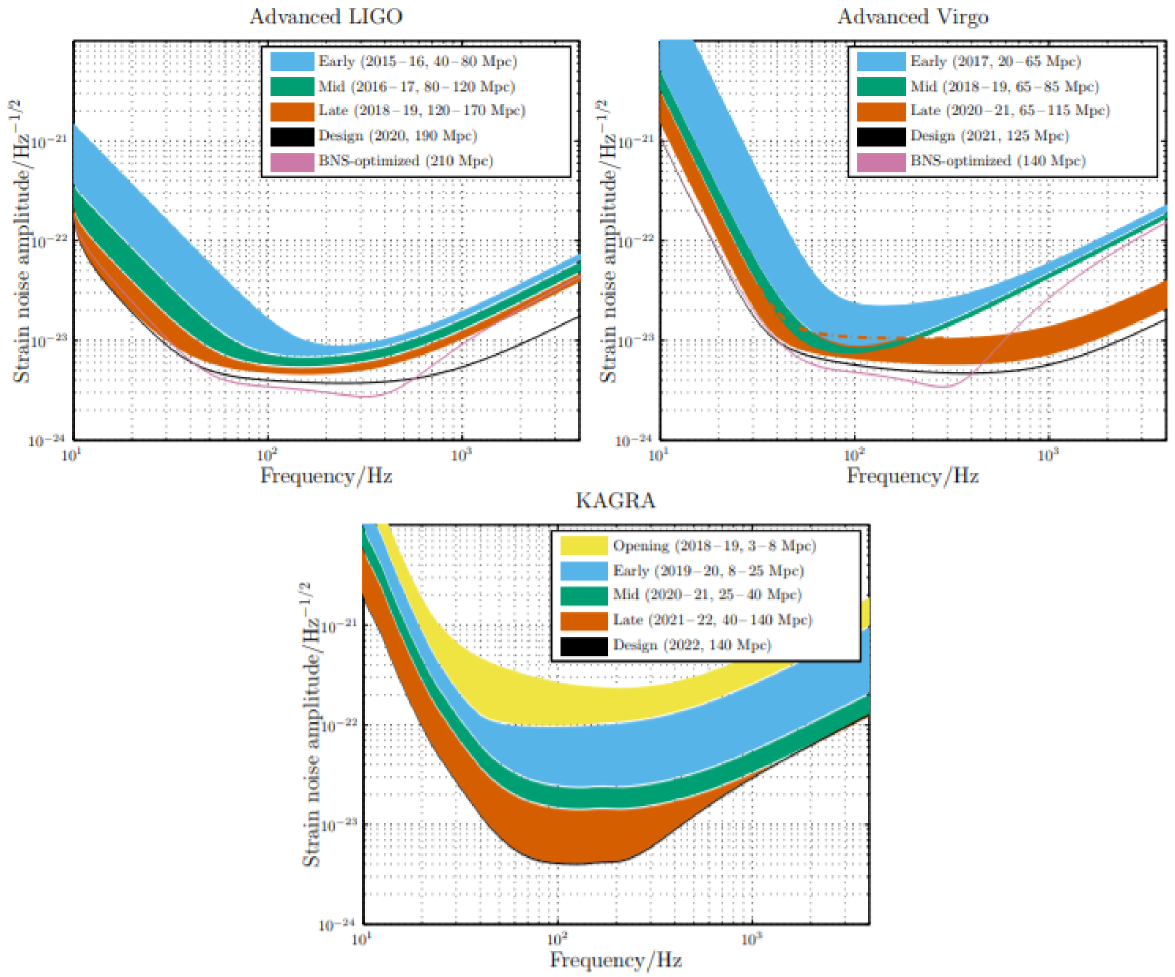
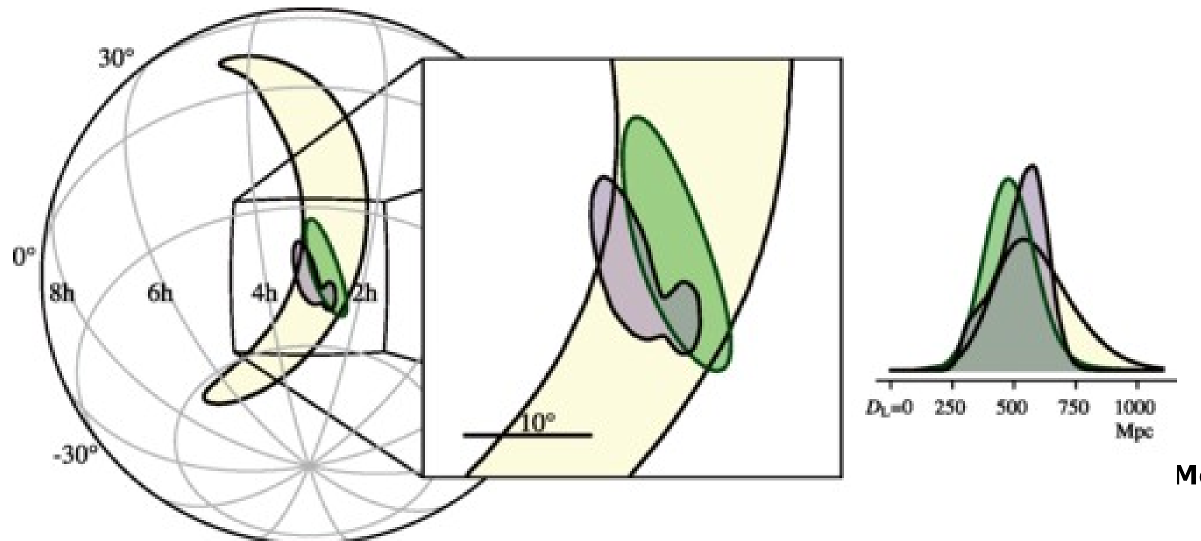


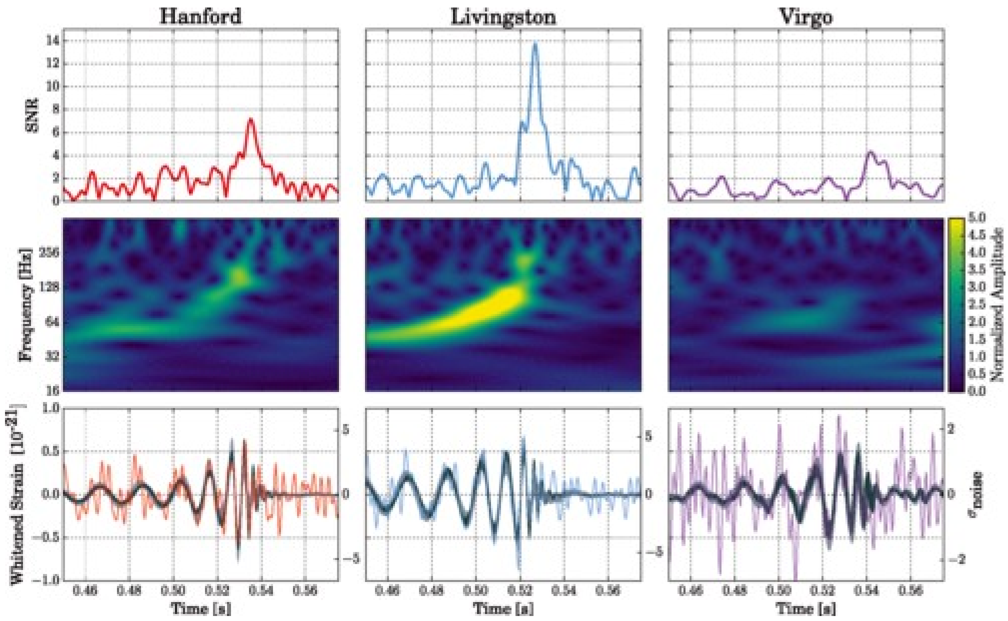
Fig. 1 Regions of aLIGO (*top left*), AdV (*top right*) and KAGRA (*bottom*) target strain sensitivities as a function of frequency. The binary neutron star (BNS) range, the average distance to which these signals could be detected, is given in megaparsec. Current notions of the progression of sensitivity are given for early, mid and late commissioning phases, as well as the final design sensitivity target and the BNS-optimized sensitivity. While both dates and sensitivity curves are subject to change, the overall progression represents our best current estimates.

NEWS from O2

- GW170814 was the first event observed by LIGO AND Virgo
- Binary black hole merger like the previous events
- Sky localization accuracy thanks to Virgo (from 1160 deg^2 to 60 deg^2)



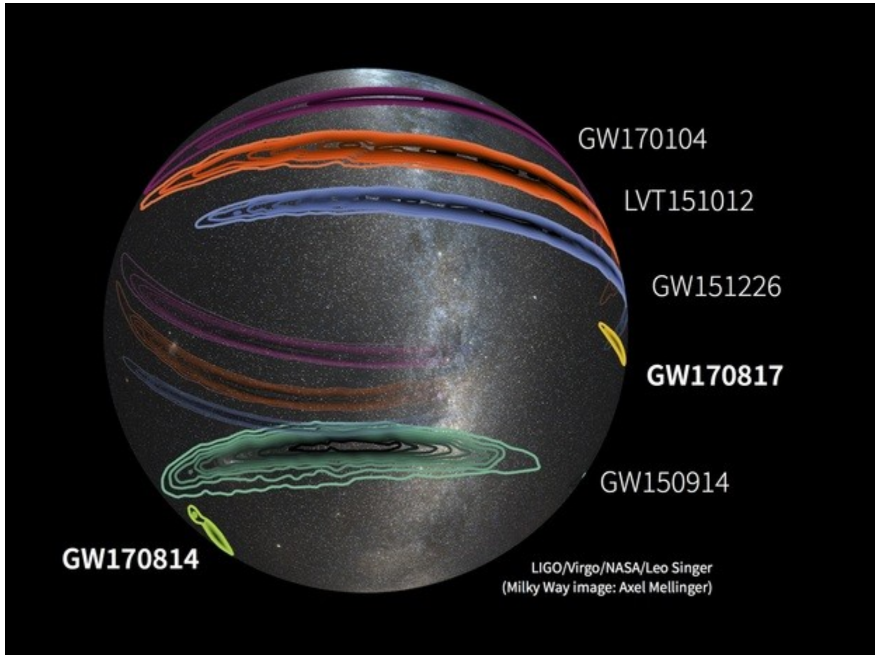
Meeting

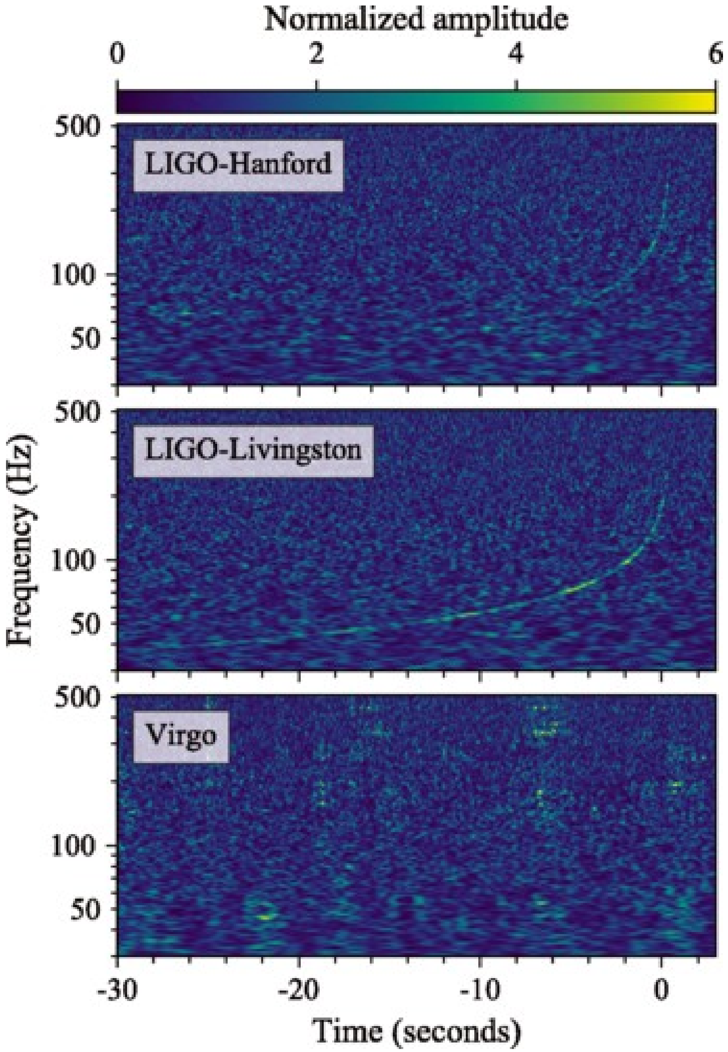


GW170817 detection by LIGO and Virgo

- **Highest combined SNR (32.4)**
- **Consistent with neutron star merger**

	Low-spin priors ($\|\chi\| \leq 0.05$)	High-spin priors ($\|\chi\| \leq 0.89$)
Primary mass m_1	1.36–$1.60\ M_\odot$	1.36–$2.26\ M_\odot$
Secondary mass m_2	1.17–$1.36\ M_\odot$	0.86–$1.36\ M_\odot$
Chirp mass $\mathscr{M}$	$1.188^{+0.004}_{-0.002} M_\odot$	$1.188^{+0.004}_{-0.002} M_\odot$
Mass ratio m_2/m_1	0.7–1.0	0.4–1.0
Total mass m_{tot}	$2.74^{+0.04}_{-0.01} M_\odot$	$2.82^{+0.47}_{-0.09} M_\odot$
Radiated energy E_{rad}	$> 0.025 M_\odot c^2$	$> 0.025 M_\odot c^2$
Luminosity distance D_L	40^{+8}_{-14} Mpc	40^{+8}_{-14} Mpc
Viewing angle Θ	$\leq 55^\circ$	$\leq 56^\circ$
Using NGC 4993 location	$\leq 28^\circ$	$\leq 28^\circ$
Combined dimensionless tidal deformability $\tilde{\Lambda}$	≤ 800	≤ 700
Dimensionless tidal deformability $\Lambda(1.4 M_\odot)$	≤ 800	≤ 1400





M. Razzano

Fast detector characterization & machine learning

- Noise in GW detector has a non-stationary components (glitches)
- Detecting and classifying glitches is one of the key aspects for detector characterization and data analysis
- Image-based technique tested
- Now moving toward an implementation on real data
- Also tested other deep learning approaches that use auxiliary channels

Open data release

- From LIGO Open Science Center (LOSC) to Gravitational Wave Open Science Center (GWOSC)
  - Extended upgrade of the background Python web engine
  - New material upgrade
  - Virgo contribution integrated in the portal

- Final checks and implementation at Caltech in July (MR secondment)
- Web portal has been tested and now is online

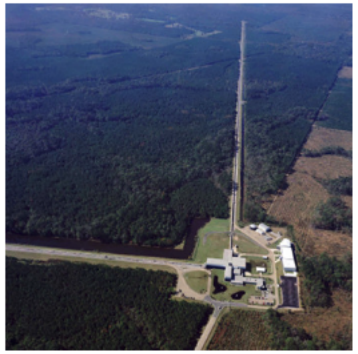
- Look at https://www.gw-openscience.org

GWOSC

Gravitational Wave Open Science Center

- Getting Started
- Data
  - Events
  - Bulk Data
- Tutorials
- Software
- Detector Status
- Timelines
- My Sources
- GPS ↔ UTC
- About the detectors
- Projects
- Acknowledge GWOSC


LIGO Hanford Observatory, Washington
(Credits: C. Gray)


LIGO Livingston Observatory, Louisiana
(Credits: J. Giaime)


Virgo detector, Italy
(Credits: Virgo Collaboration)

The Gravitational Wave Open Science Center provides data from gravitational-wave observatories, along with access to tutorials and software tools.

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Conclusions

- Dawn of multimessenger observations
- Preparaion for O3
- Analysis activities focus on developing new low-latency pipelines to enable multimessenger observations (e.g. detchar, localization)
- GWOSC released
- Collaboration with Pasadena (M. Isi) on GR physics (US)
- Collaboration with 3rd generation developments (US,Japan)