Gravitational wave observations

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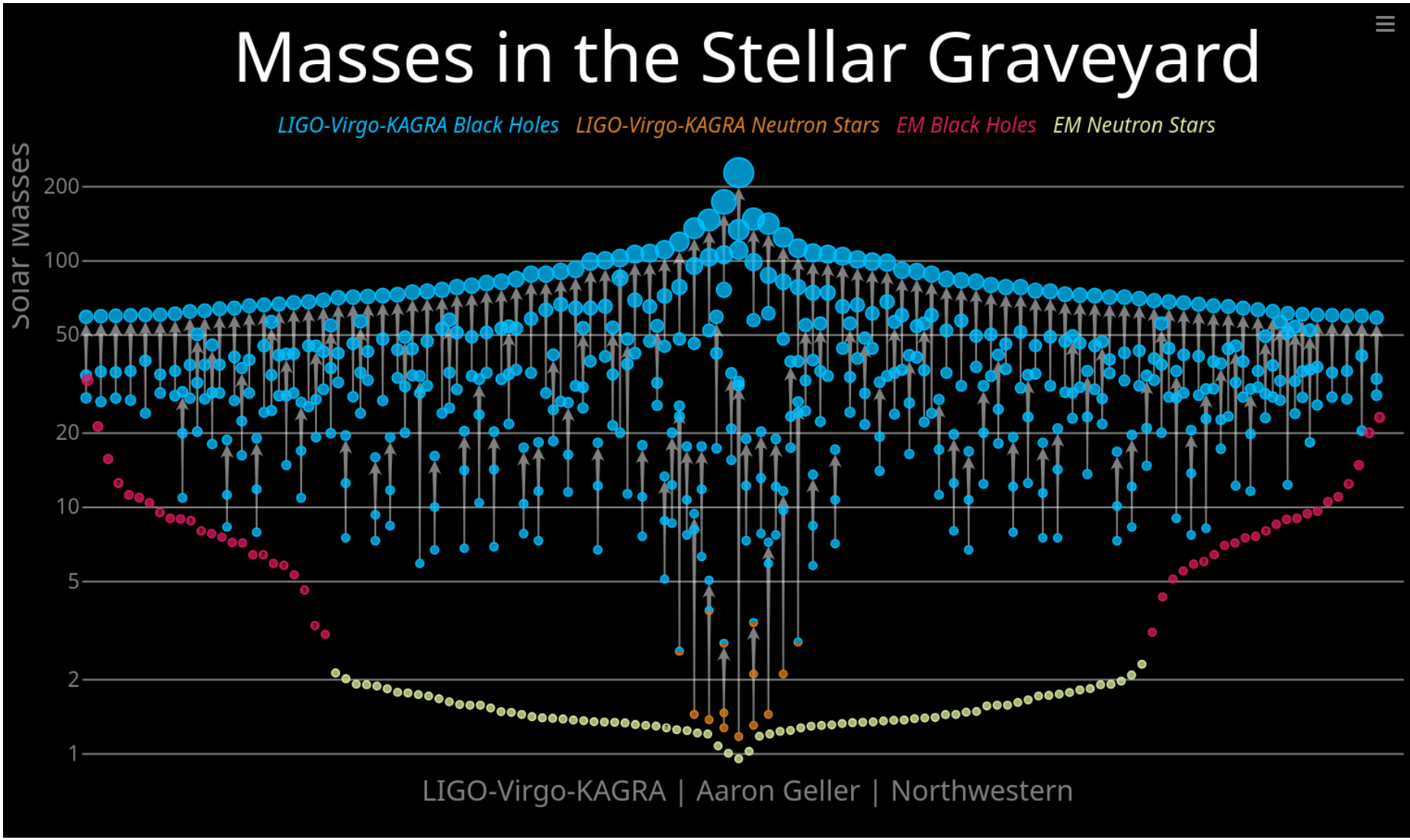
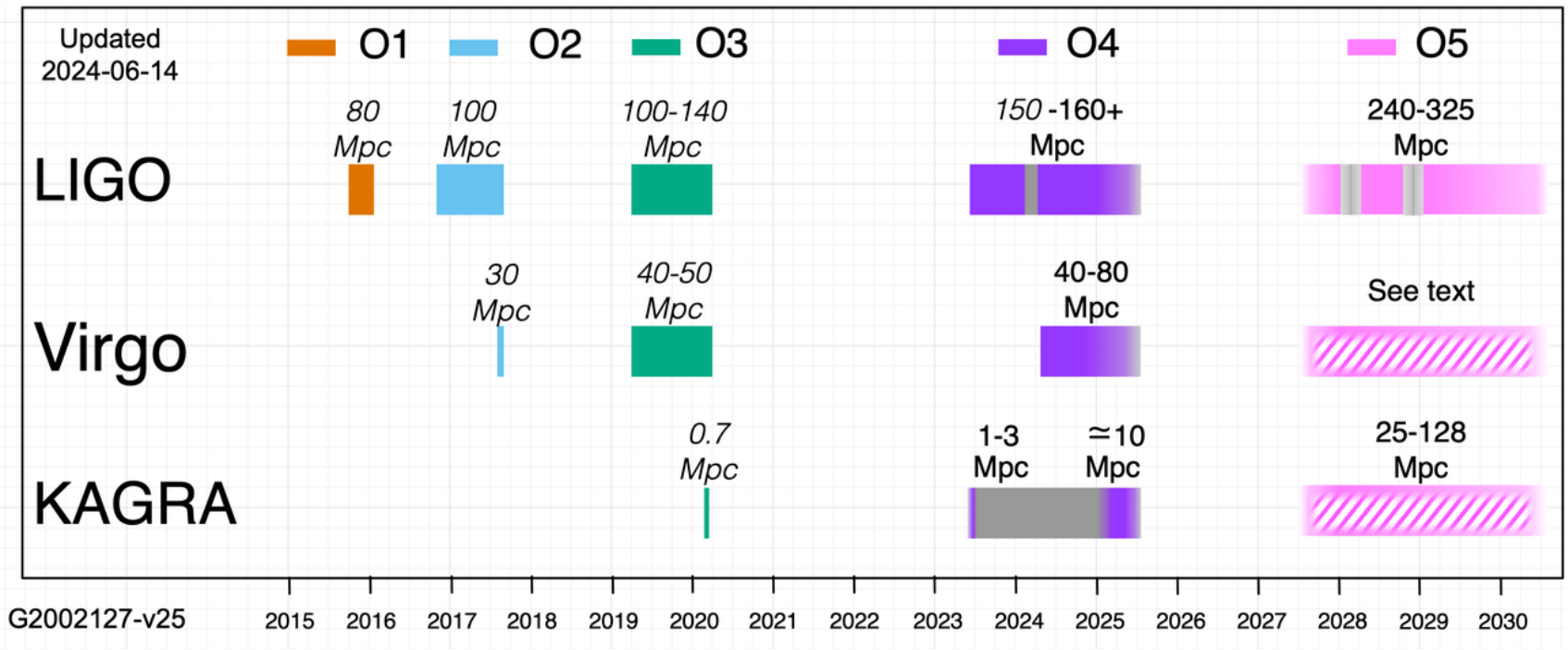
10 years since GW150914

- What have we learnt?

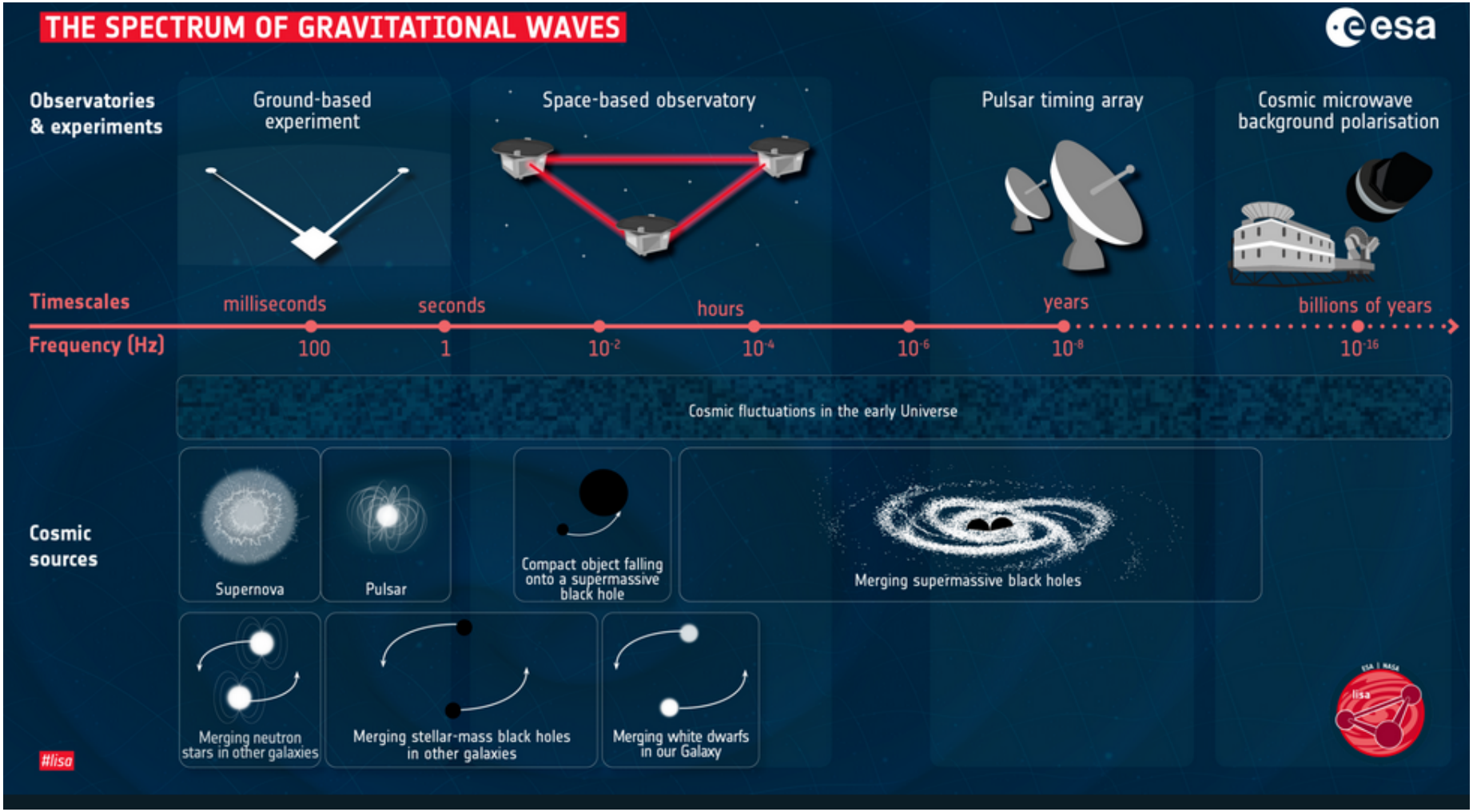
GW detection events so far



LIGO Scientific Collaboration: Observation runs



Spectrum of GW sources and detectors



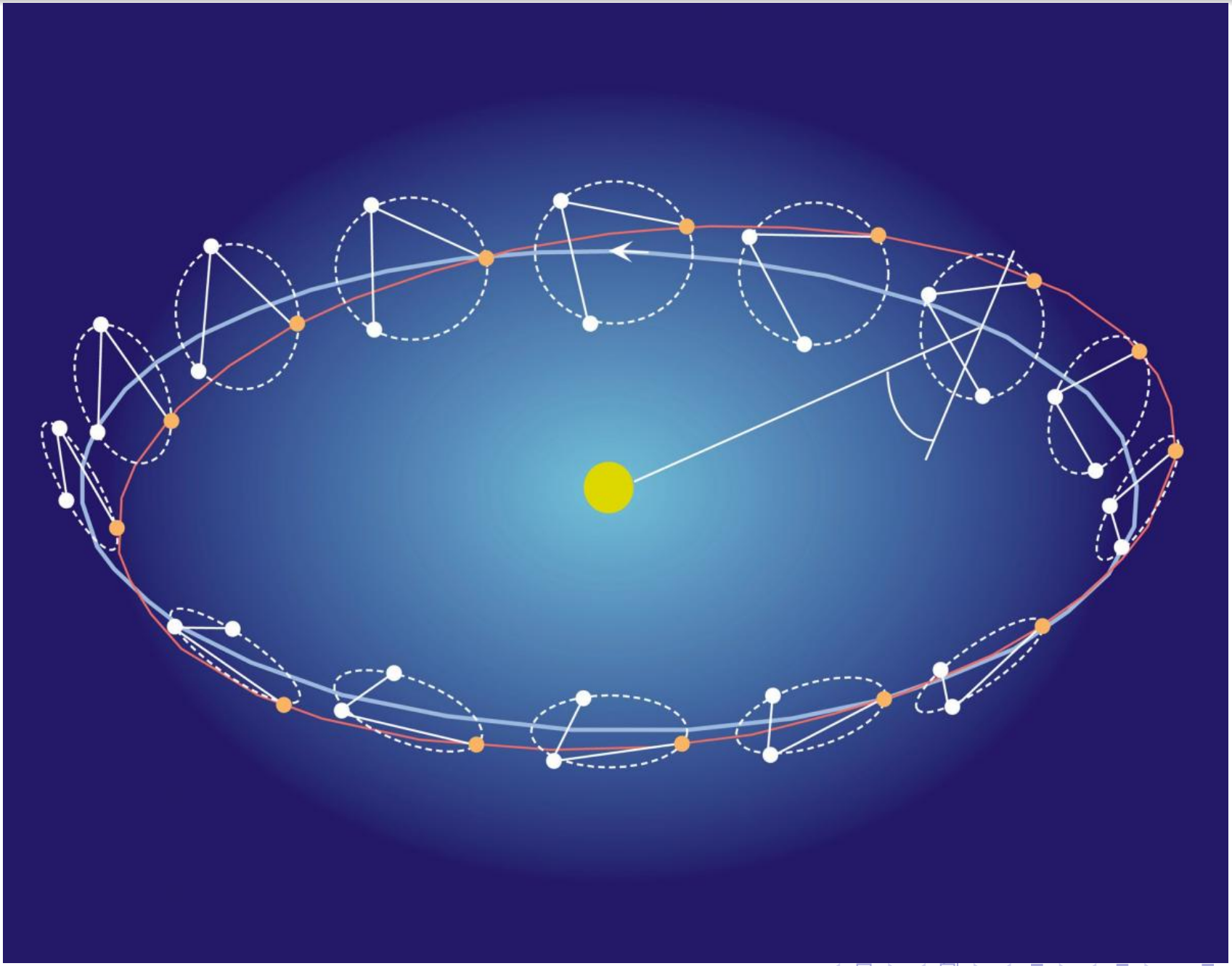
Future developments: LIGO India

- Current status: Site acquired, tenders for construction being evaluated.
- Observations expected from 2030.
- Important for source localization, and so for prospects of identifying an electromagnetic counterpart.

Future developments: LISA

- Current status: European Space Agency project with launch scheduled for 2035.
- 3 satellites forming an equilateral triangle with 2.5million km sides in orbit around Sun, about 50million km from Earth.
- Should detect: supermassive black hole mergers, as well as inspiral signatures of stellar-mass black holes or neutron stars, so enabling source localization of the subsequent merger.

LISA orbit



Future developments: Cosmic Explorer and Einstein telescope

- Proposed next generation terrestrial detectors: Cosmic Explorer in U.S.A. and Einstein Telescope in E.U.
- To date, funding only for feasibility studies.
- Frequency band will increase to between about 1Hz to 10kHz.
- Will be able to detect stellar-mass black hole mergers throughout the observable universe.