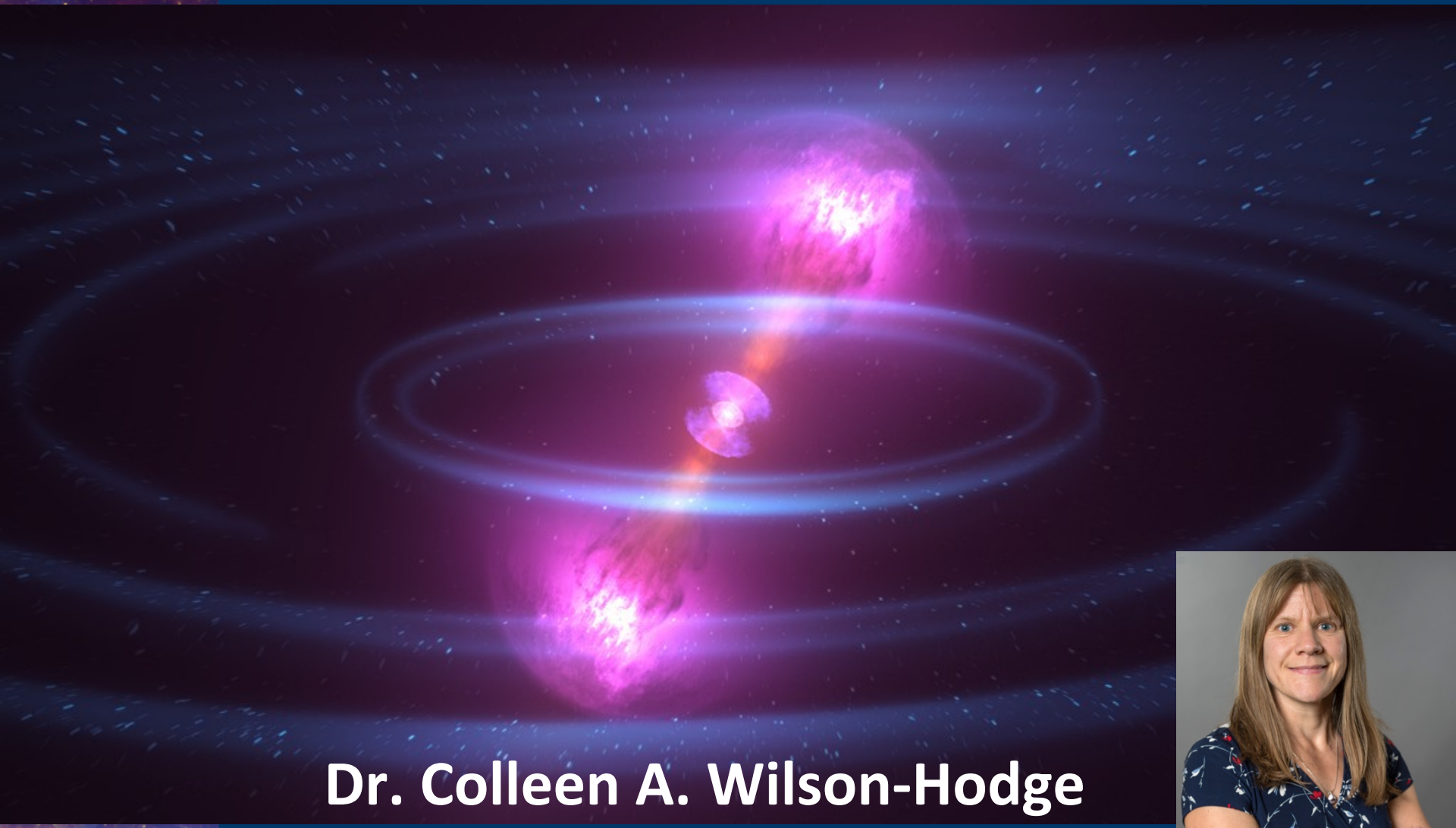
Light From merging neutron stars

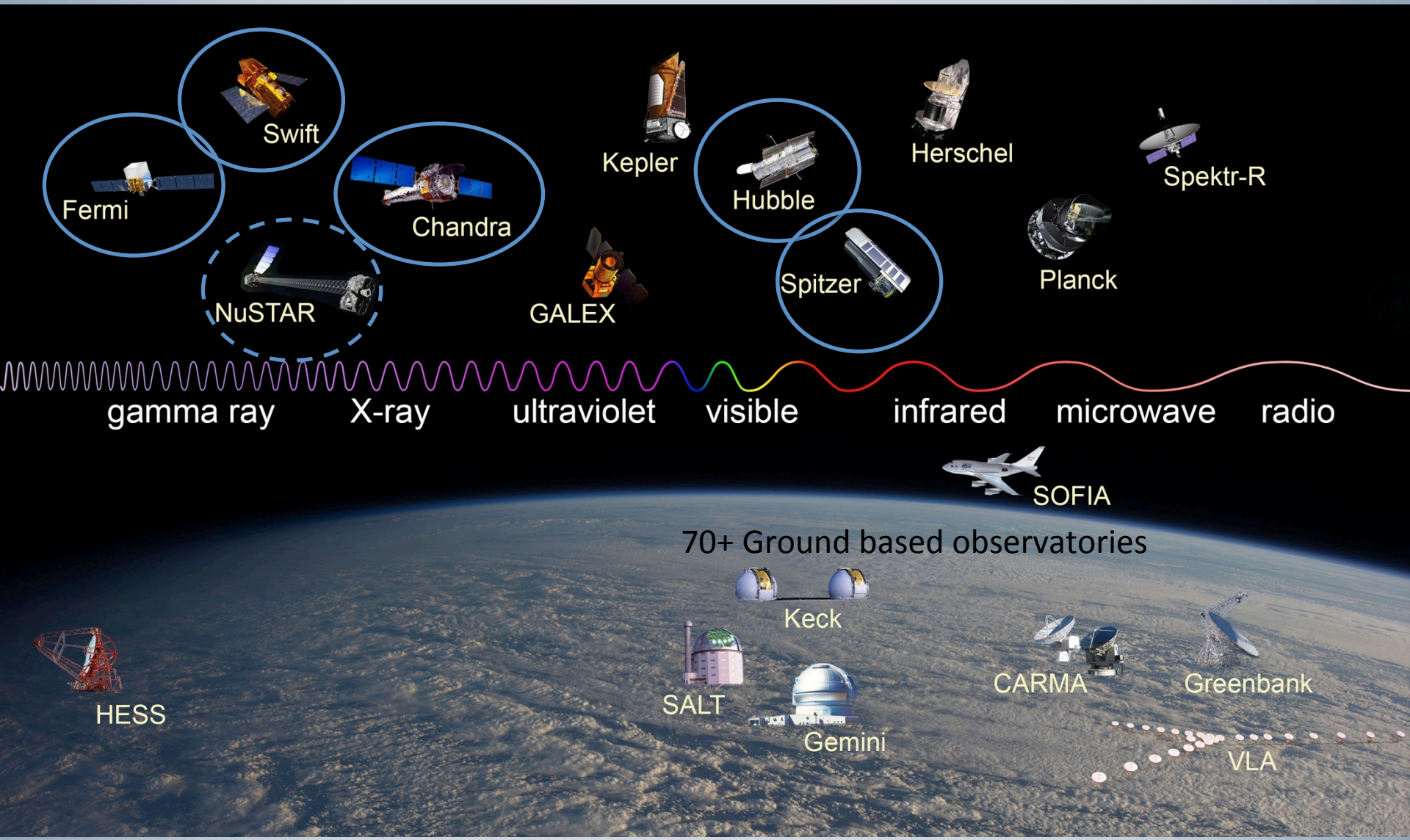


Dr. Colleen A. Wilson-Hodge
NASA MSFC

Image Credit: NASA/GSFC/CI Lab

UNIVERSE OF LEARNING

NASA Missions Observing GW170817/GRB 170817A



Credit: Observatory images from NASA, ESA (Herschel and Planck), Lavochkin Association (Specktr-R), HESS Collaboration (HESS), Salt Foundation (SALT), Rick Peterson/WMKO (Keck), Germini Observatory/AURA (Gemini), CARMA team (CARMA), and NRAO/AUI (Greenbank and VLA); background image from NASA)

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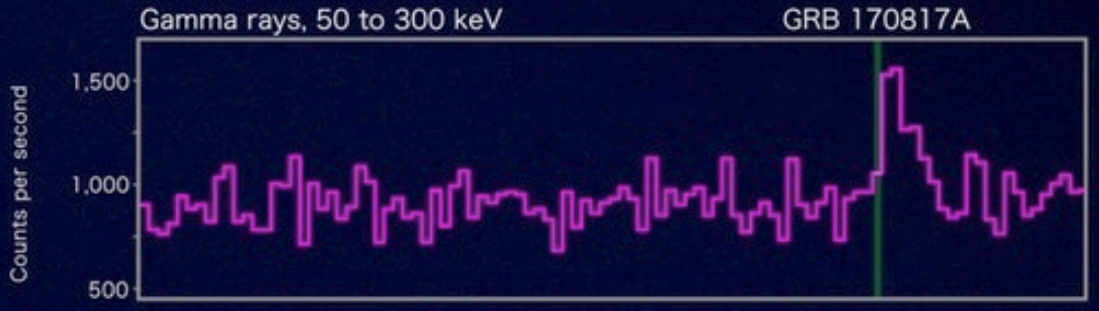
The morning of August 17, 2017

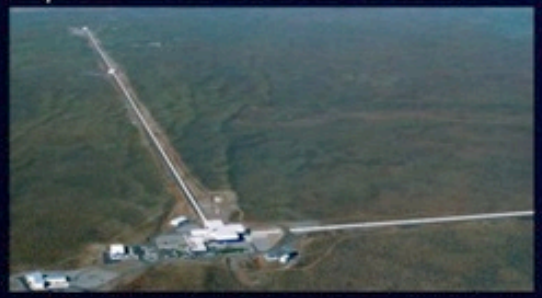
Fermi

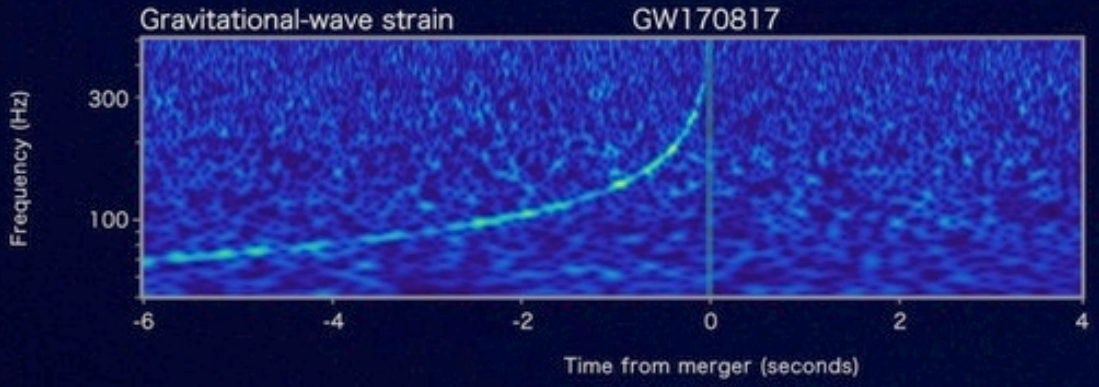
Reported 16 seconds after detection



LIGO-Virgo

Reported 27 minutes after detection





INTEGRAL

Reported 66 minutes after detection

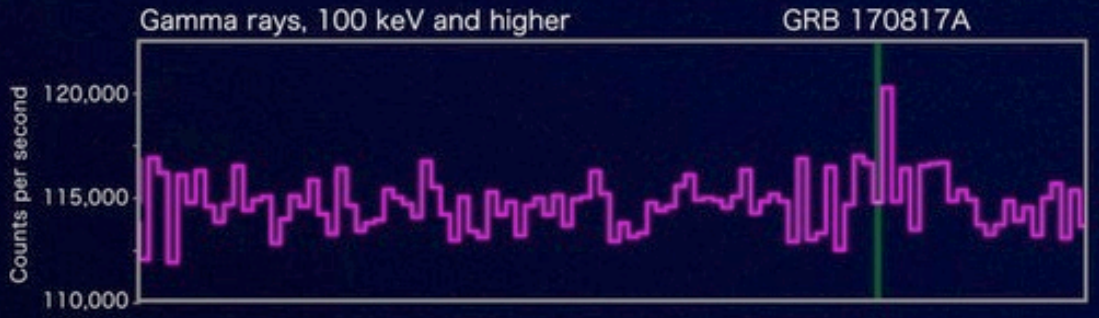
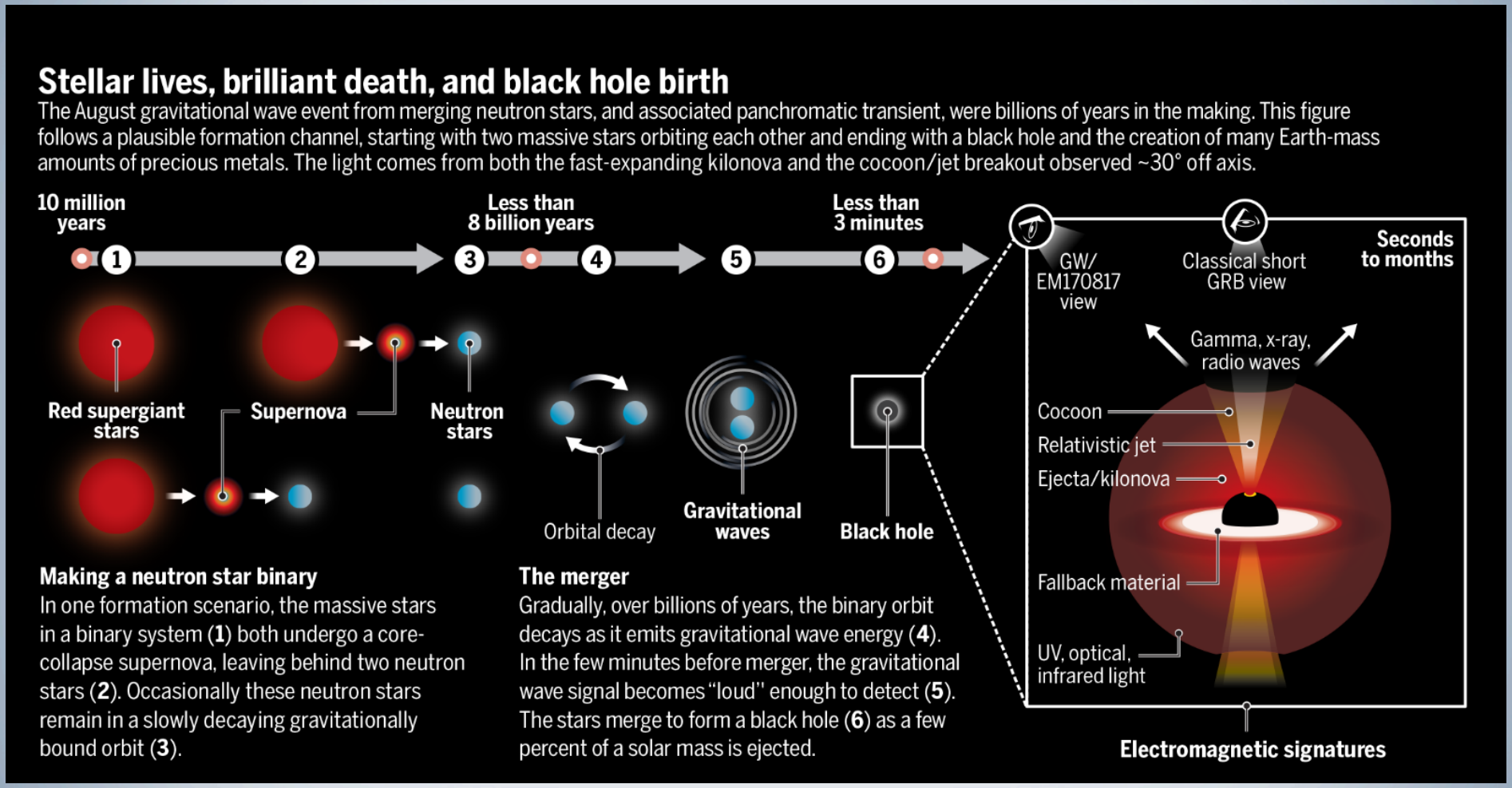


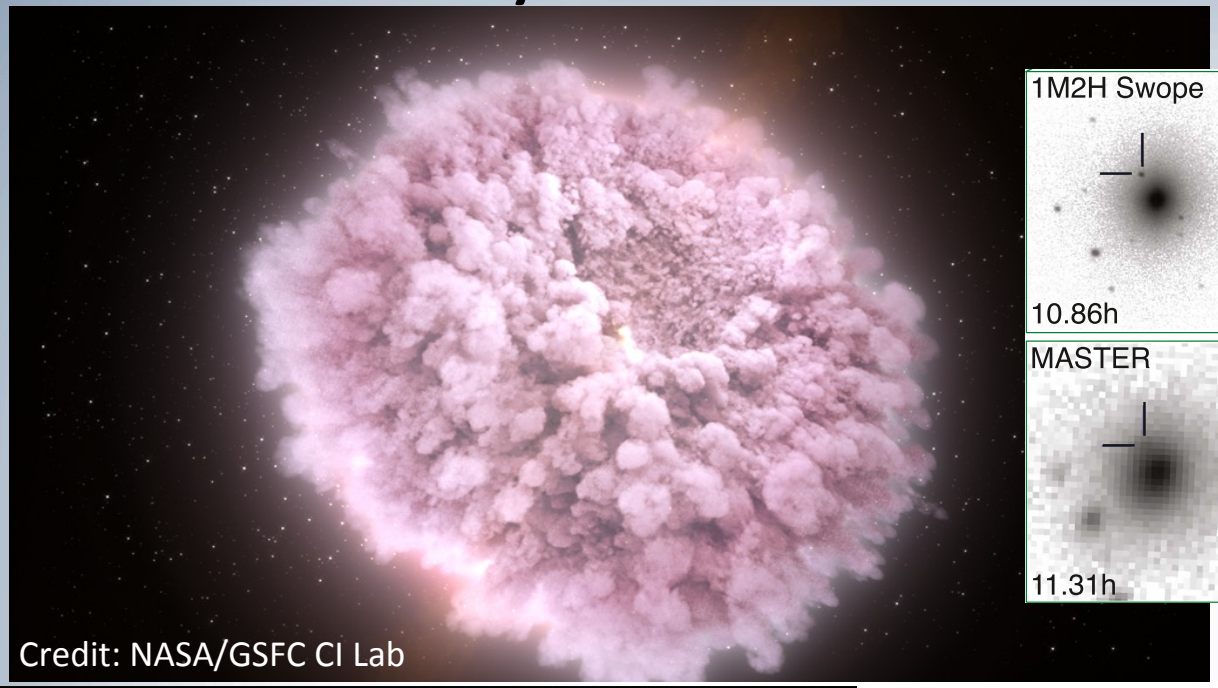
Image Credit: NASA GSFC, Caltech/MIT/LIGO Lab and ESA

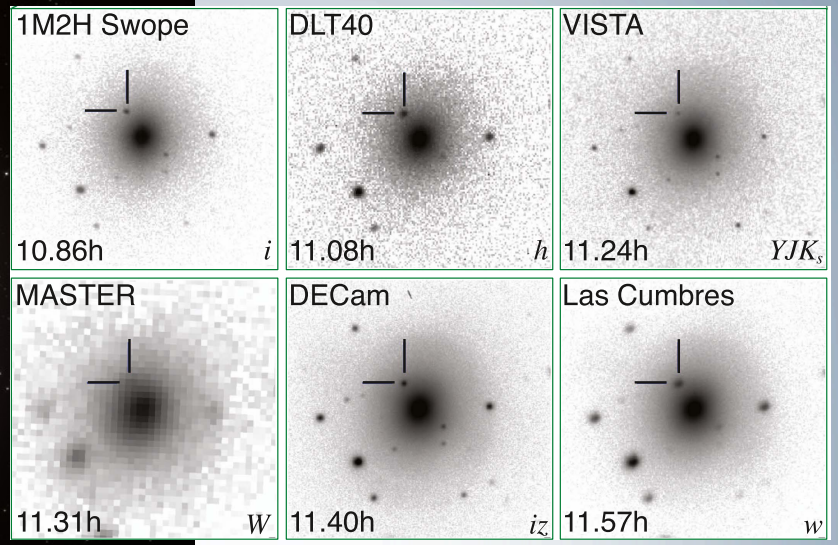
Electromagnetic signatures from the merger of two neutron stars



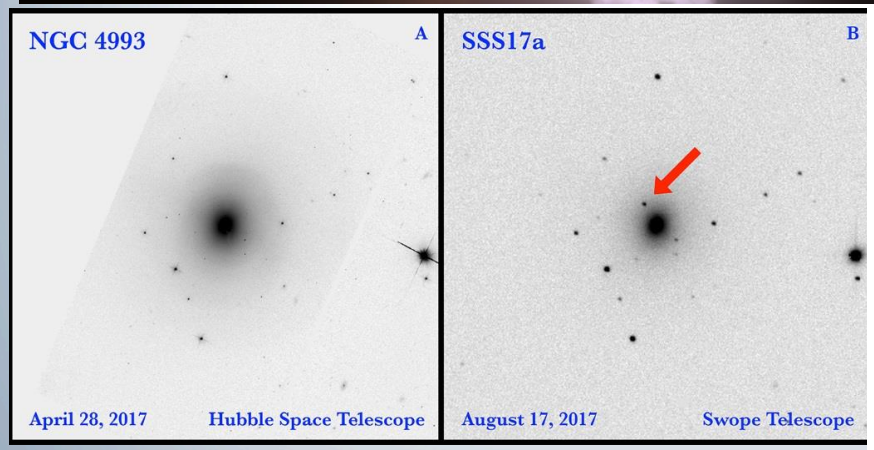
Science Magazine: Bloom & Sigurdsson Science 10.1126/science.aaq0321 (2017)

Discovery of a Kilonova 12 hours later

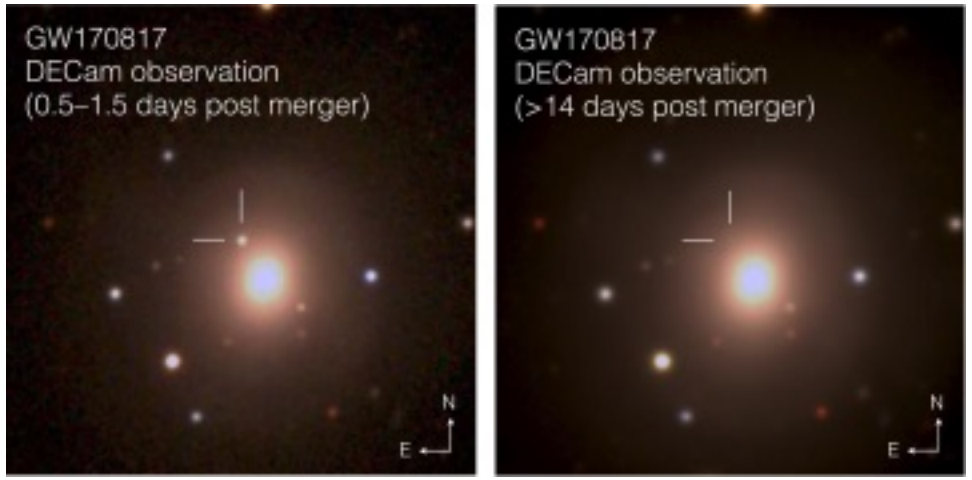




Abbot et al 2017, ApJL, 848, L12

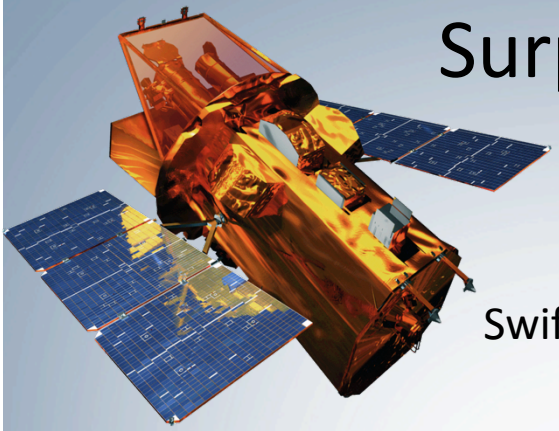


Coulter et al. 2017, 10.1126/scienceaap9811



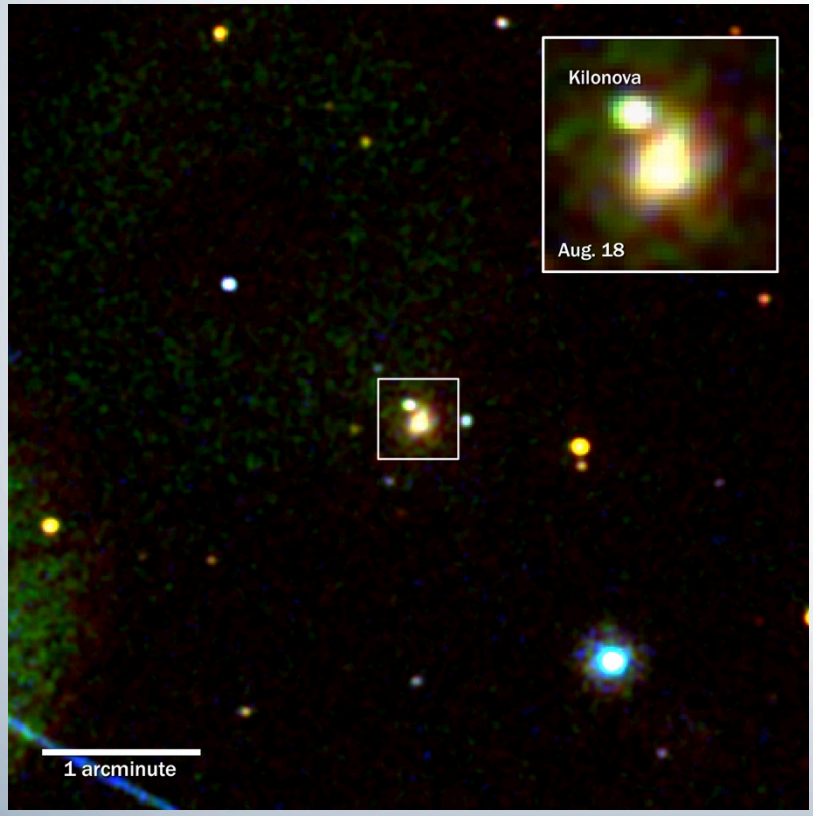
Soares-Santos et al. 2017, ApJ, 848, L16

Surprise! – a bright UV source with Swift

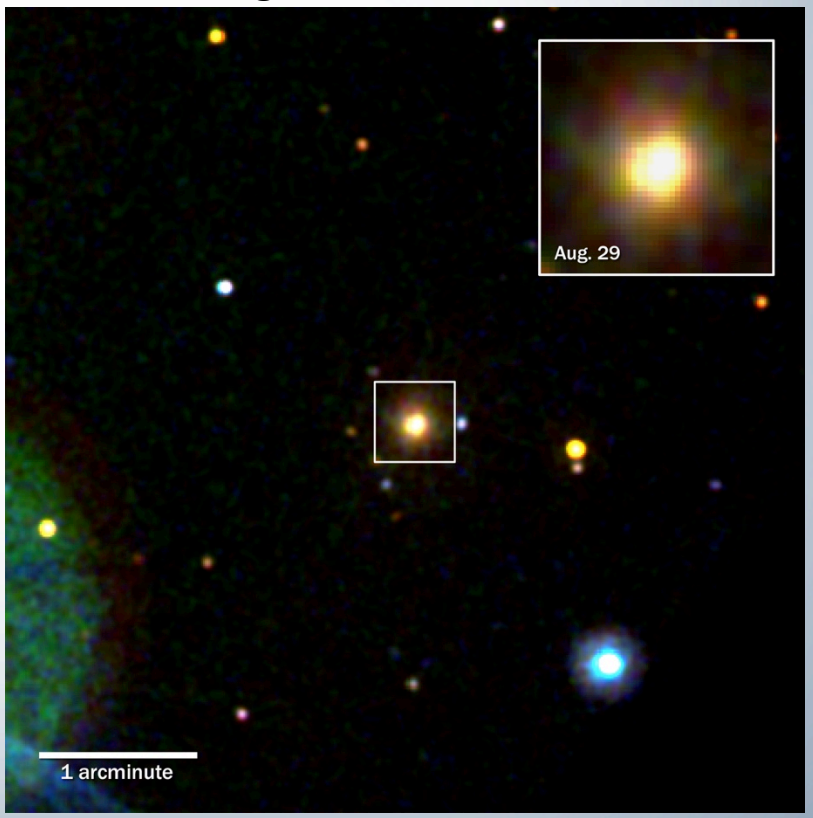


Swift

Aug 18

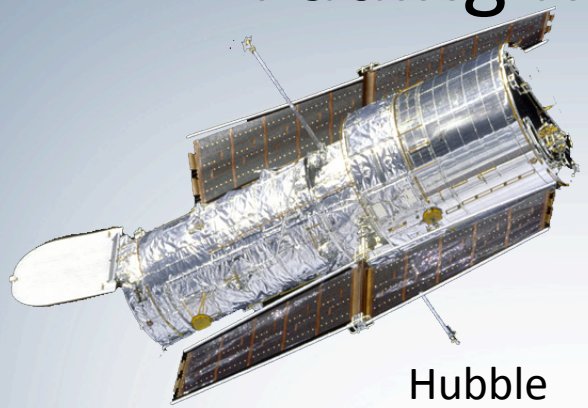


Aug 29



Credit: NASA/Swift

Fading Kilonova in Optical/IR



Hubble

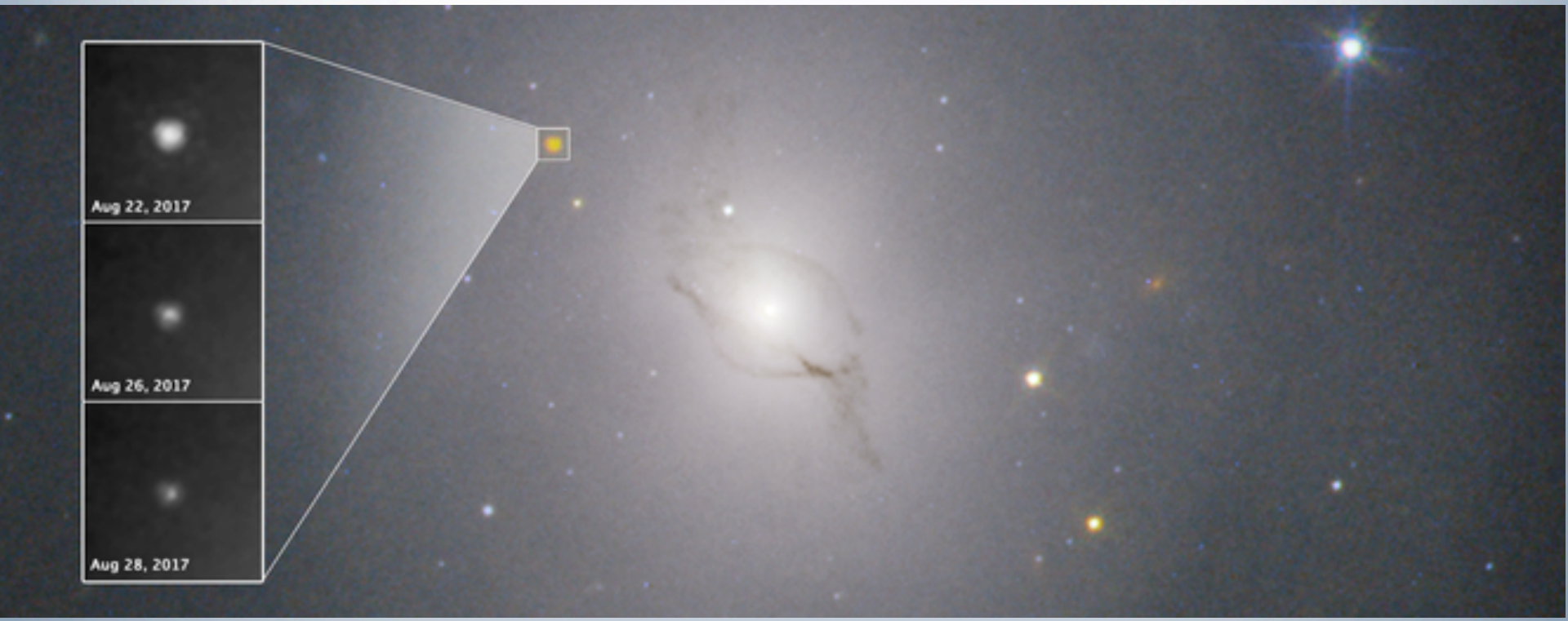


Image Credit: NASA and ESA, Acknowledgment: A. Levan (U. Warwick), N. Tanvir (U. Leicester), A. Fruchter and O. Fox (STScI)

Late time IR Observations – Sep 29, 2017

Spitzer

Composite image

Filtered Image

Host galaxy subtracted

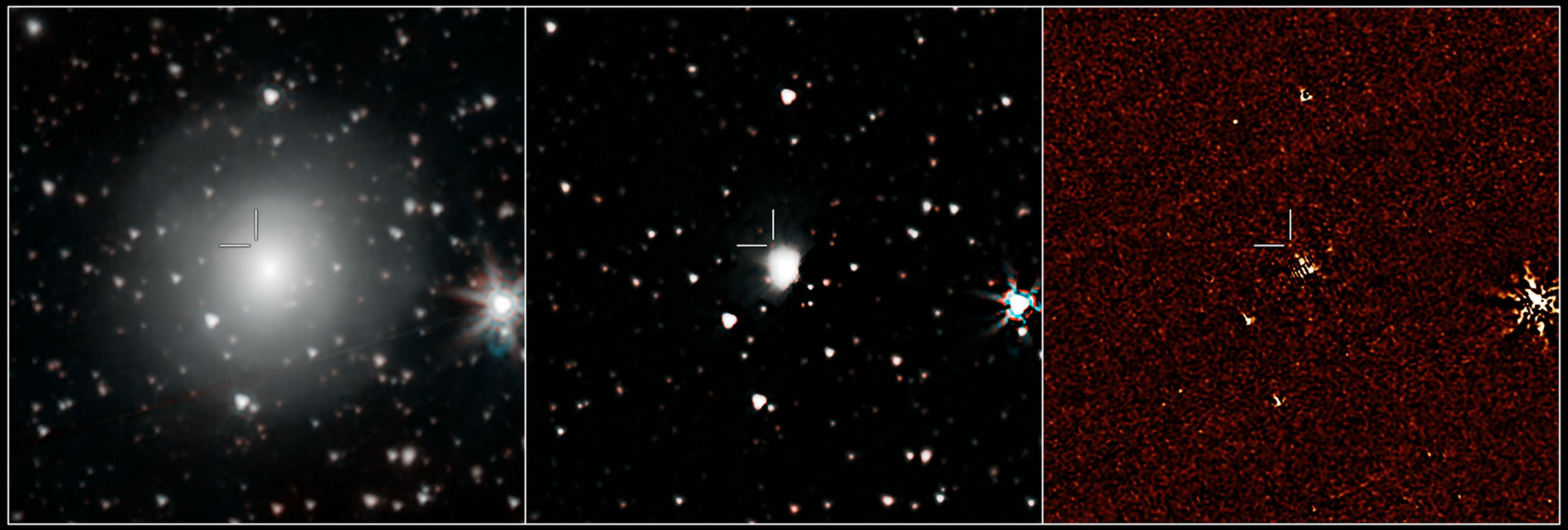
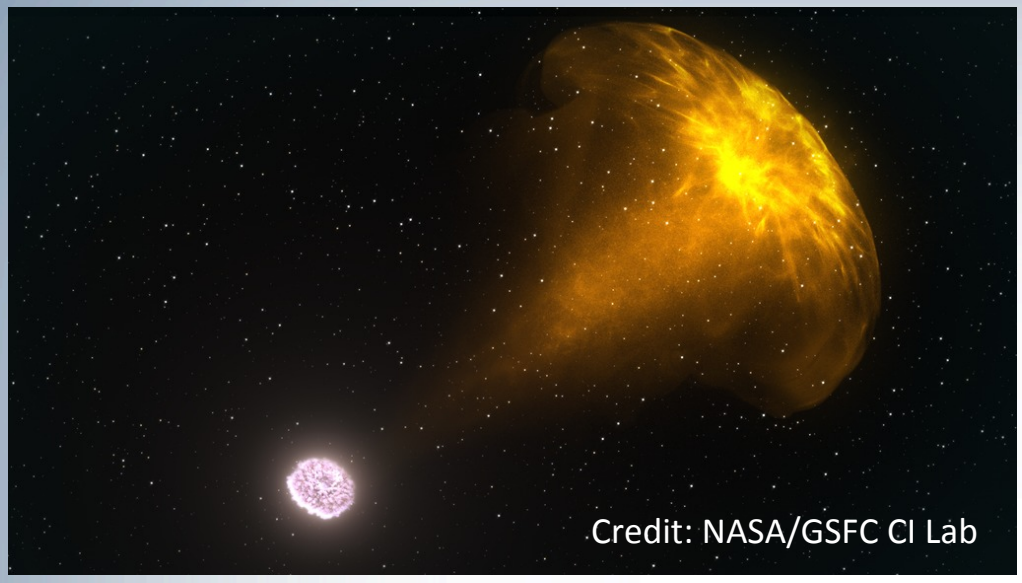
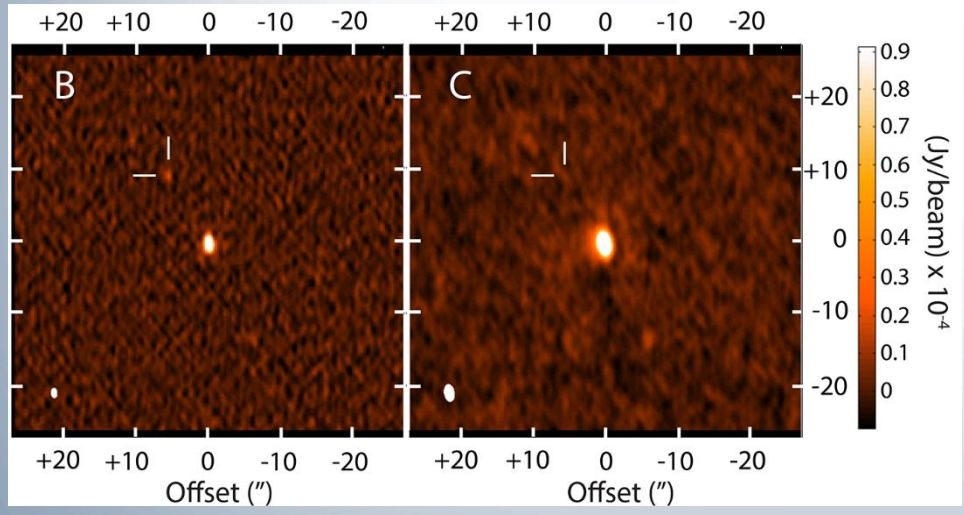


Image Credit: NASA/JPL-Caltech

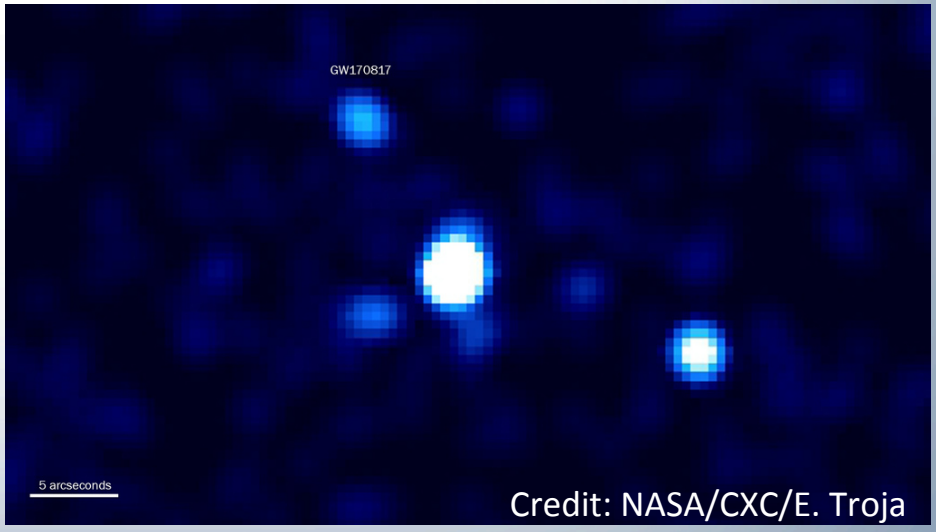
X-ray and Radio Observations



Radio VLA (B) Sep 9 (C) Aug 22-Sep1



X-ray Aug 26, 2017



Hallinan et al., Science 10.1126/science.aap9855 (2017)

Summary and Conclusions

- This event is the first unambiguous joint detection of gravitational waves and electromagnetic radiation
- The unprecedented range of electromagnetic fireworks included the entire spectrum, from gamma-rays to radio waves.
- Combining these observations we can learn fundamental physics
  - the speed of gravity
  - the composition of the densest matter in the universe
  - the local expansion rate of the universe