GW170817:Observation of Gravitational Waves from Binary Neutron Star Merger

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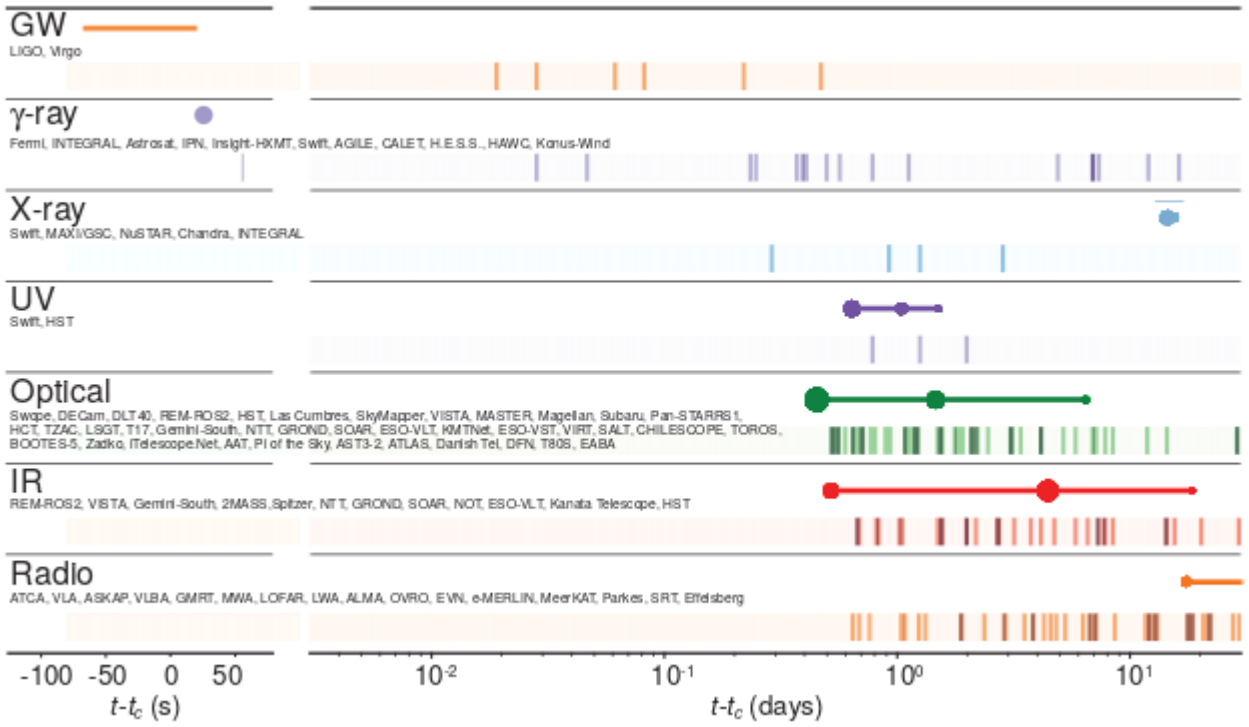
Время обнаружения сигналов гравитационного и электромагнитного излучения

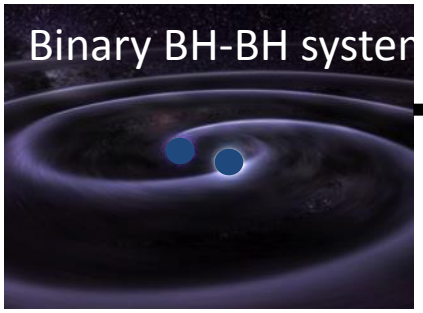


On August 17, 2017 a binary neutron star coalescence candidate (later designated GW170817) with merger time 12:41:04
UTC was observed through gravitational waves by the Advanced LIGO and Advanced Virgo detectors.

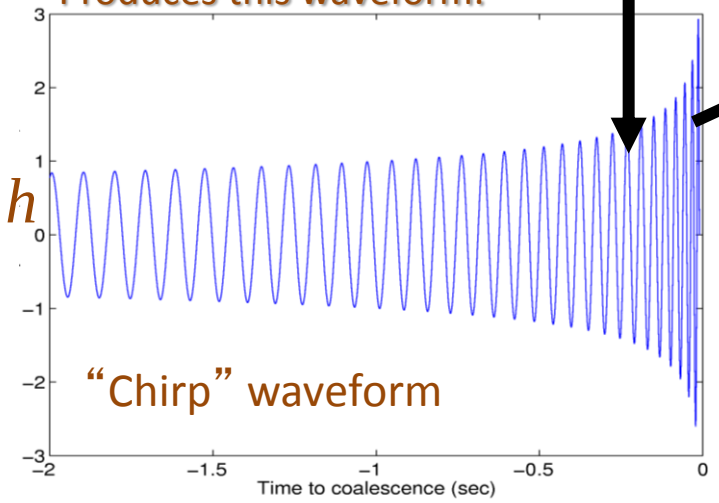
LIGO-P1700294

Исследование слияния компактных двойных объектов

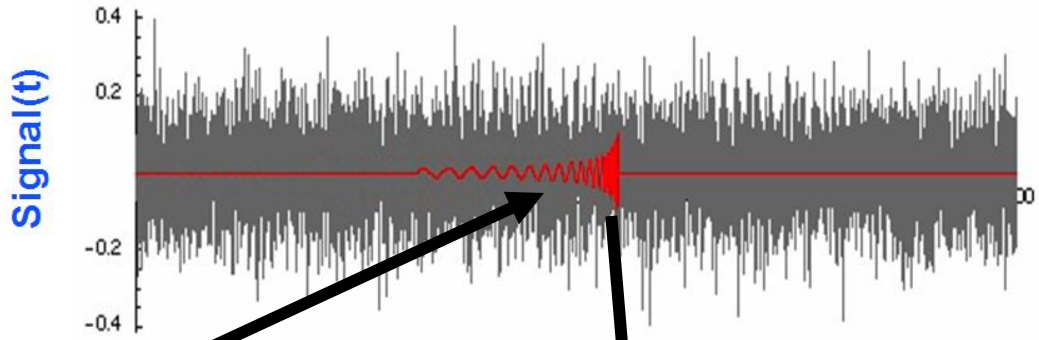
This source:



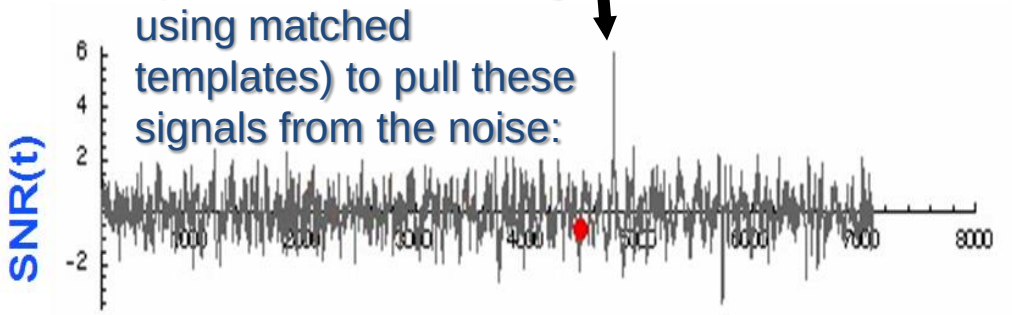
Produces this waveform:



Buried in this noise stream:

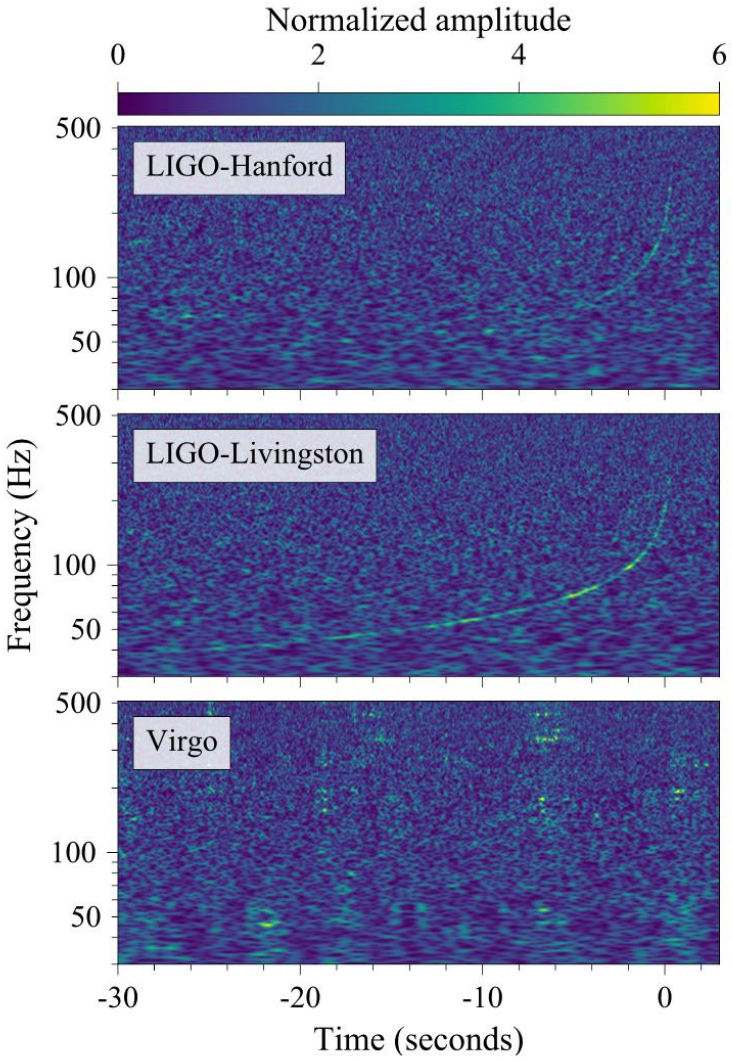


We use different methods (in this case optimal Wiener filtering using matched templates) to pull these signals from the noise:



D. Reitze LIGO-G1602173-v1

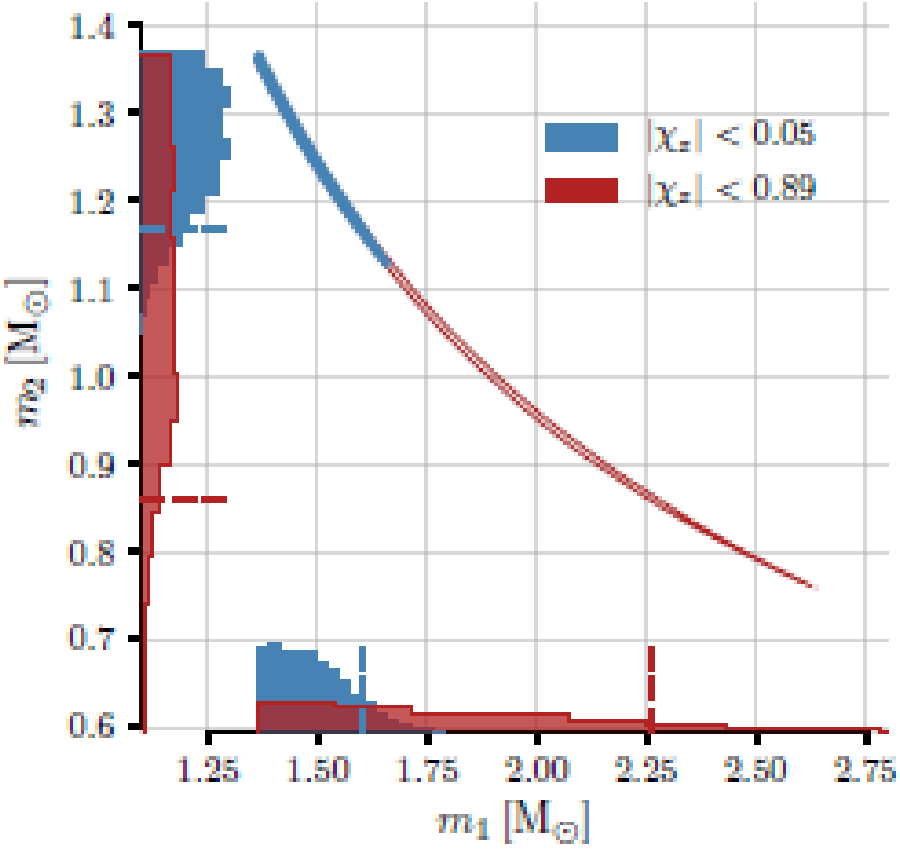
Спектрограммы GW170817 сигнала в детекторах LIGO и Virgo



Figures show the spectrograms of the GW170817 signal in each of the LIGO and Virgo detectors. Time runs horizontally, and frequency runs vertically. The binary signal "chirps", starting low on the left side, then ramping up into a steep curve on the right side. The "glitch" has been mitigated in the LIGO-Livingston spectrogram and is not seen here.

B.P.Abbott et al, PHYSICAL REVIEW LETTERS 119, 161101 (2017)

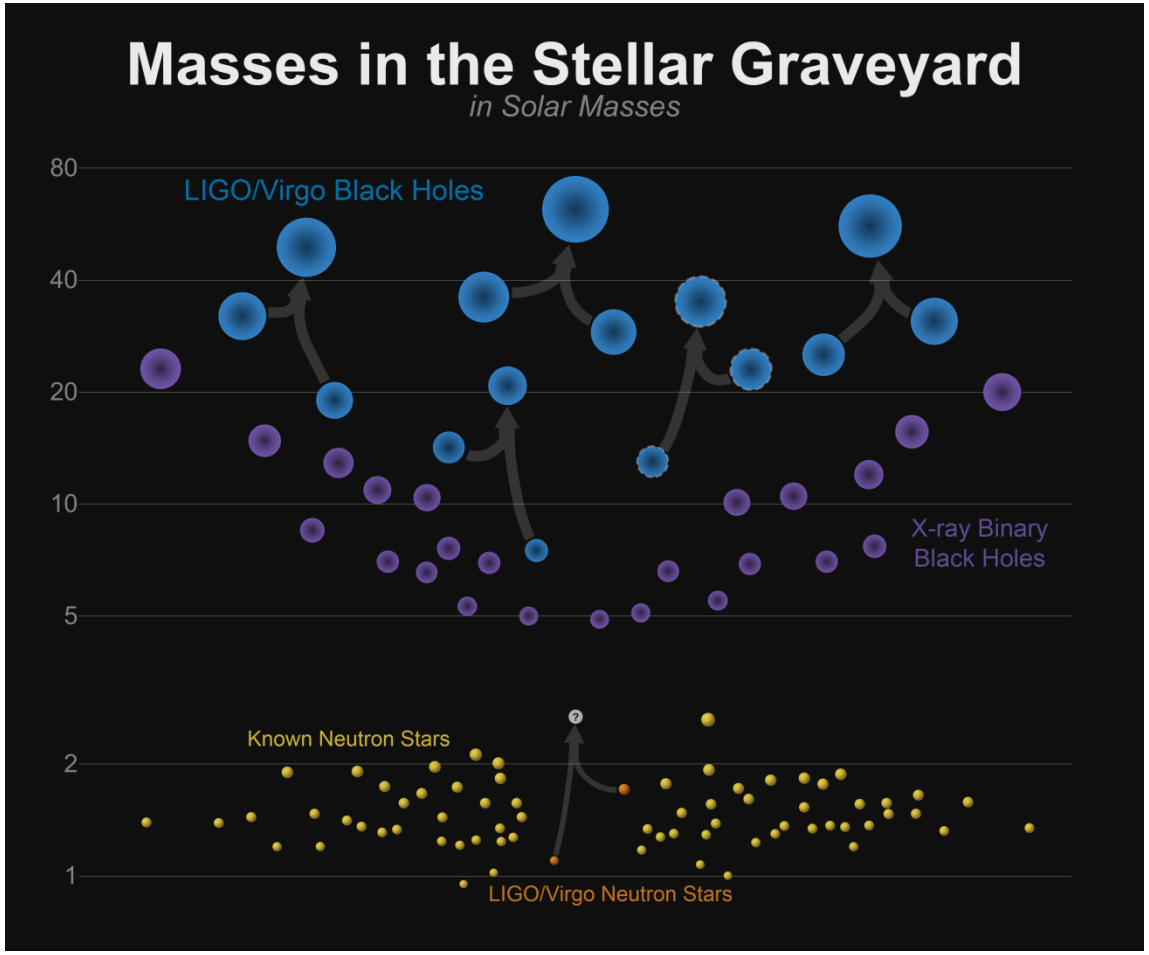
Распределение масс компонентов двойной системы



Two-dimensional posterior distribution for the component masses m_1 and m_2 in the rest frame of the source for the low-spin scenario and the high-spin scenario.

B.P.Abbott et al, PHYSICAL REVIEW LETTERS 119, 161101 (2017)

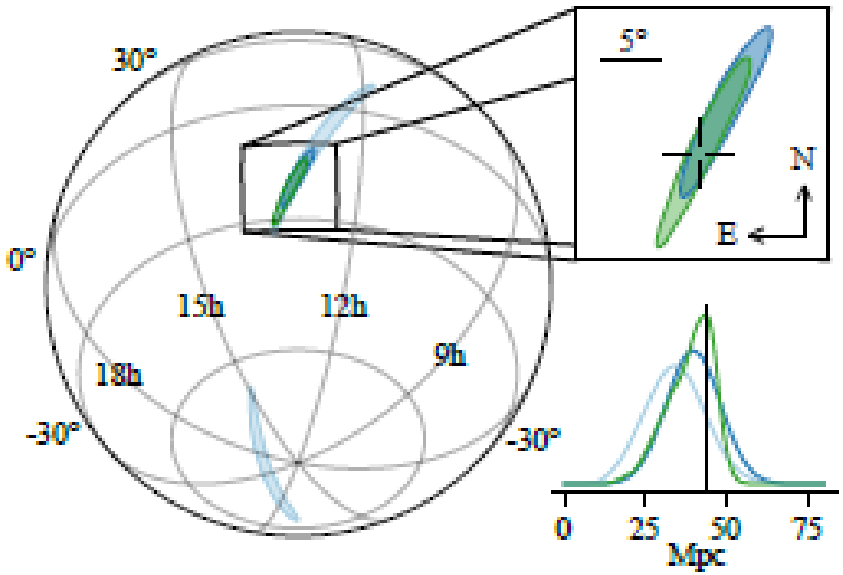
Массы известных черных дыр и нейтронных звезд



Masses of known black holes, the LIGO detected black hole systems (up through GW170814), known neutron stars, and now the first LIGO detected neutron stars (GW170817). Neutron star data from [Ozel & Freire, 2016, ARAA].

Credit: LIGO/Virgo/Northwestern/Frank Elavsky

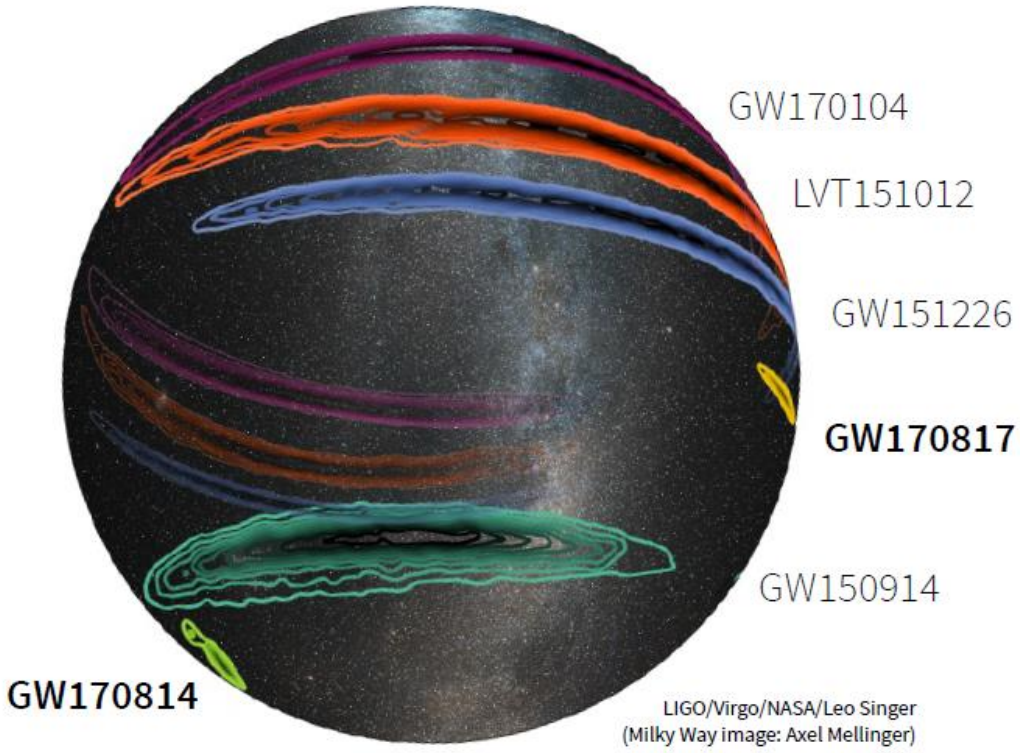
Локализация источника GW170817 на небесной сфере



B.P.Abbott et al, PHYSICAL REVIEW LETTERS 119, 161101 (2017)

Sky location reconstructed for GW170817 by a rapid localization algorithm from a Hanford-Livingston (190 deg^2, light blue contours) and Hanford-Livingston-Virgo (31 deg^2, dark blue contours) analysis. A higher latency Hanford-Livingston-Virgo analysis improved the localization (28 deg^2, green contours).
In the top-right inset panel - the reticle marks the position of the apparent host galaxy NGC 4993.
The bottom-right panel - posteriori luminosity distance distribution from the three gravitational-wave localization analyses. Vertical line - distance of NGC 4993, assuming the redshift from the NASA/IPAC Extragalactic Database parameters

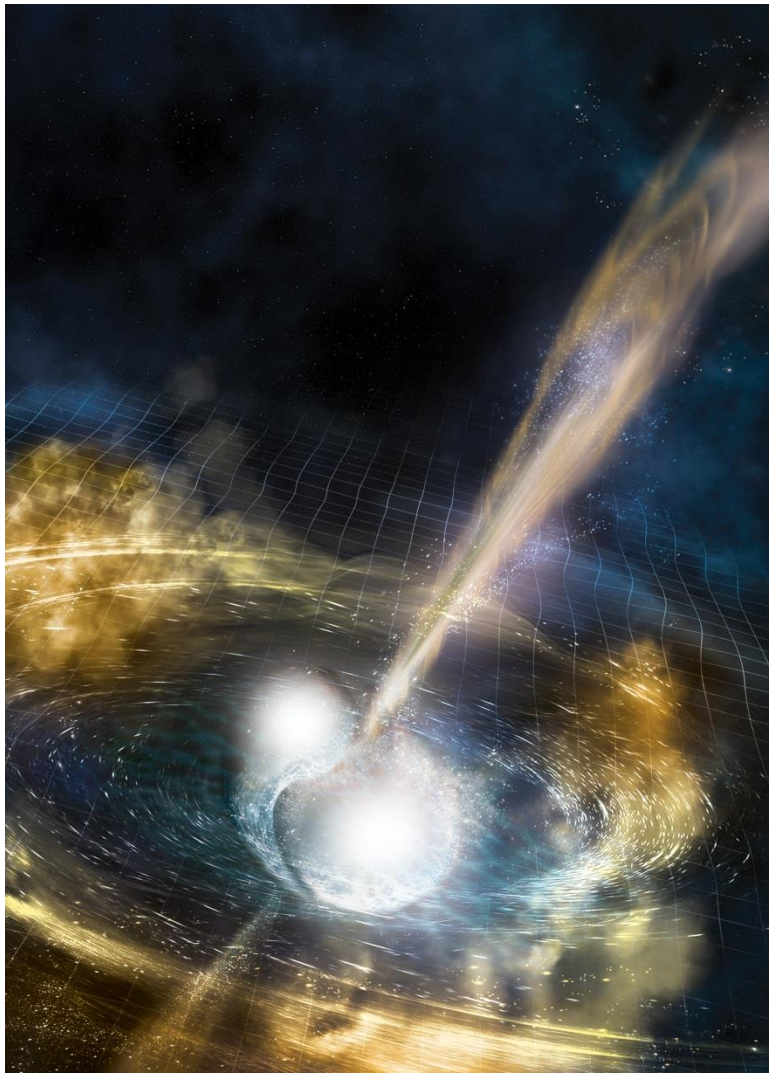
Локализация источников всех обнаруженных сигналов гравитационных волн



Sky localizations of detected compact binary coalescence signals: GW150914, LVT151012, GW151226, GW170104, GW170814, GW170817.

Credit: LIGO/Virgo/NASA/Leo Singer (Milky Way image: Axel Mellinger)

Иллюстрация слияния двух нейтронных звезд и сопровождающих процессов



Artist’s illustration of two merging neutron stars. The narrow beams represent the gamma-ray burst while the rippling spacetime grid indicates the isotropic gravitational waves that characterize the merger. Swirling clouds of material ejected from the merging stars are a possible source of the light that was seen at lower energies.

Credit: National Science Foundation/LIGO/Sonoma State University/A. Simonnet.

Спасибо за внимание!