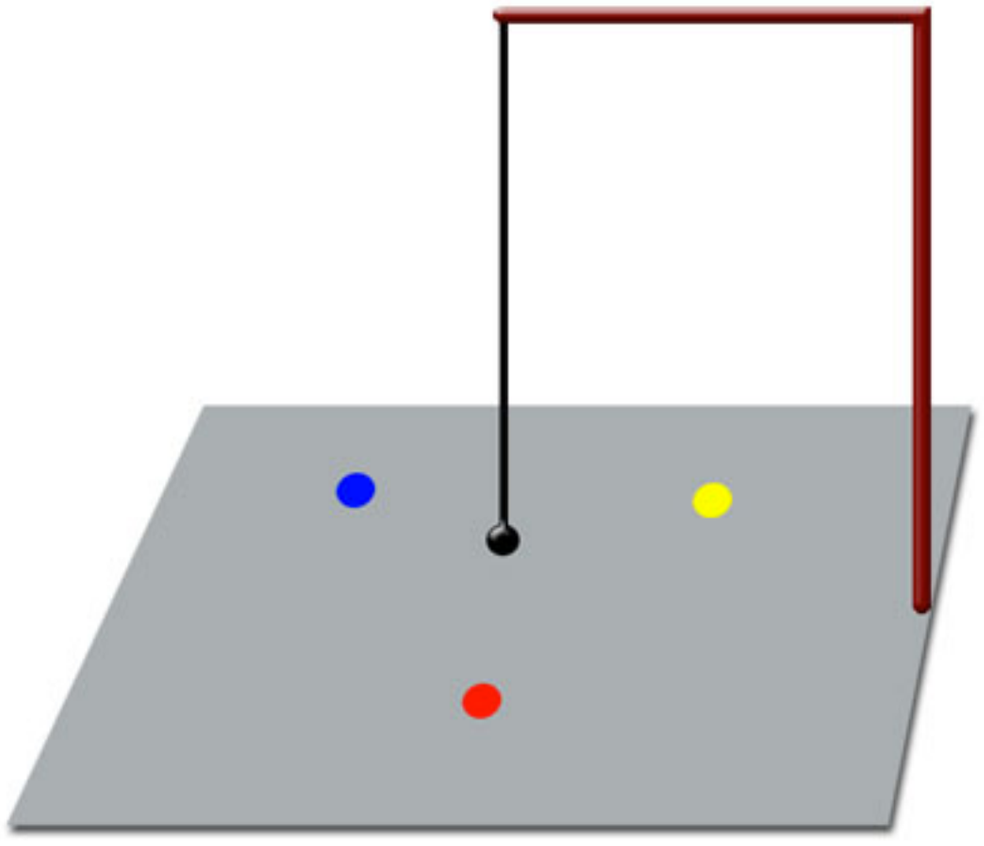
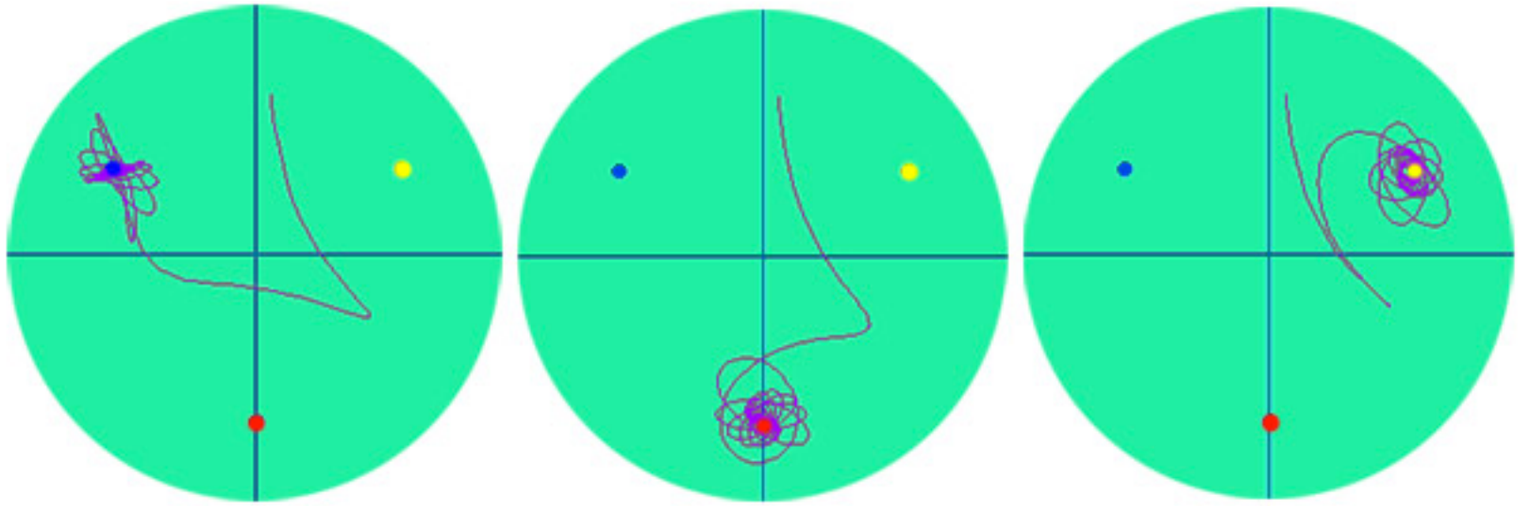
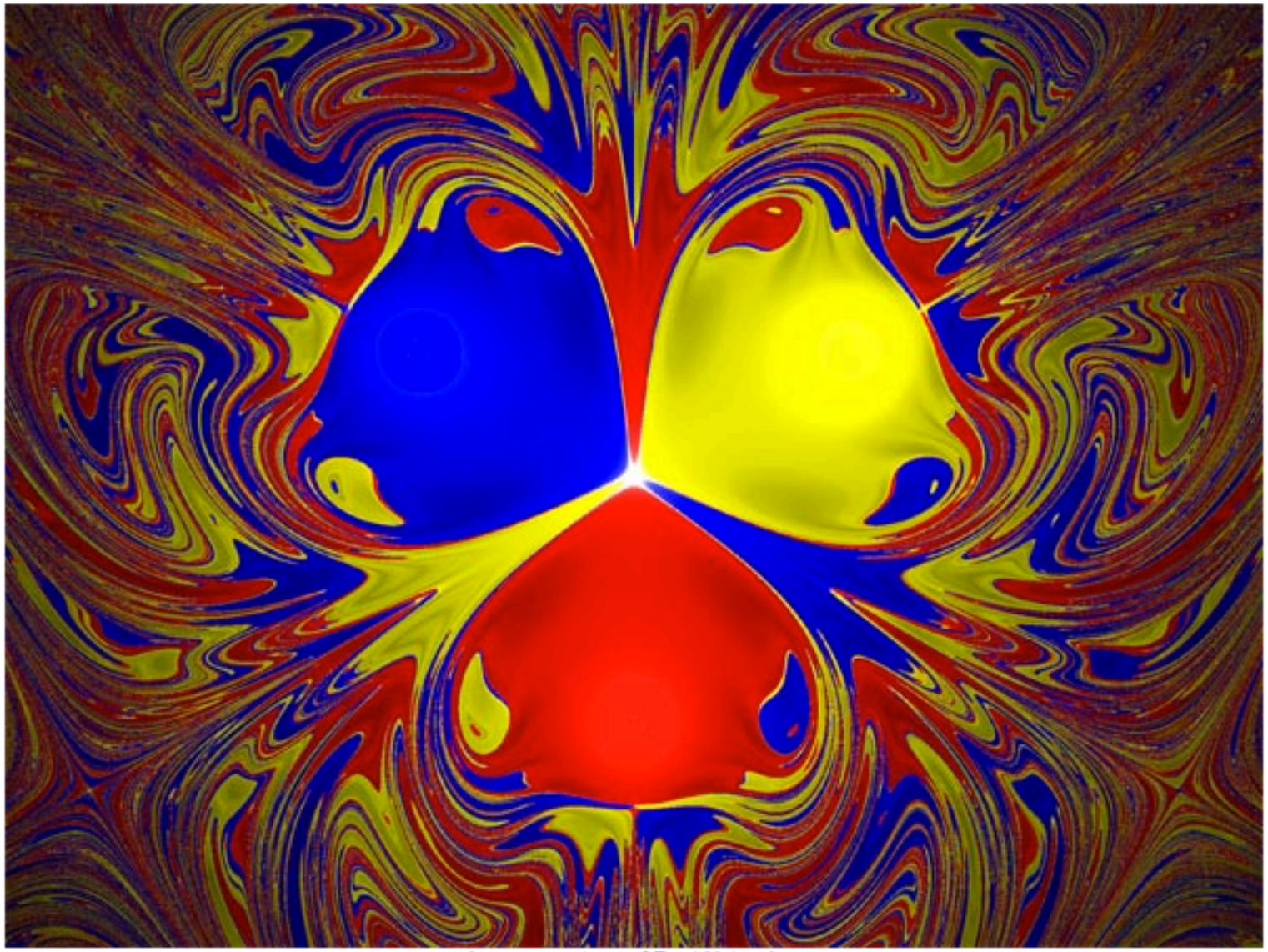




$$x'' + Rx' - \sum_{i=1}^{3} \frac{x_i - x}{\left(\sqrt{(x_1 - x)^2 + (y_1 - y)^2 + d^2}\right)^3} + Cx = 0$$

$$y'' + Ry' - \sum_{i=1}^{3} \frac{y_i - y}{\left(\sqrt{(x_1 - x)^2 + (y_1 - y)^2 + d^2}\right)^3} + Cy = 0$$



http://fractalfoundation.org/OFC/OFC-7-2.html

The Nobel Prize in Physics 2017

Photo: Bryce Vickmark
Rainer Weiss
Prize share: 1/2

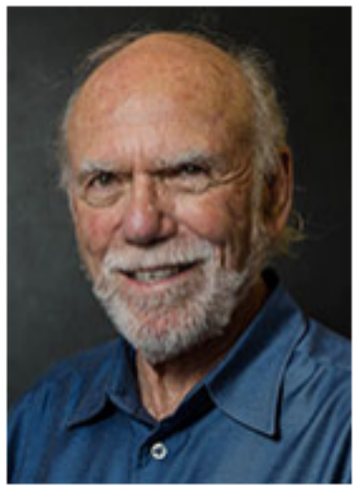


Photo: Caltech
Barry C. Barish
Prize share: 1/4

Photo: Caltech Alumni Association
Kip S. Thorne
Prize share: 1/4

The Nobel Prize in Physics 2017 was divided, one half awarded to Rainer Weiss, the other half jointly to Barry C. Barish and Kip S. Thorne *"for decisive contributions to the LIGO detector and the observation of gravitational waves"*.

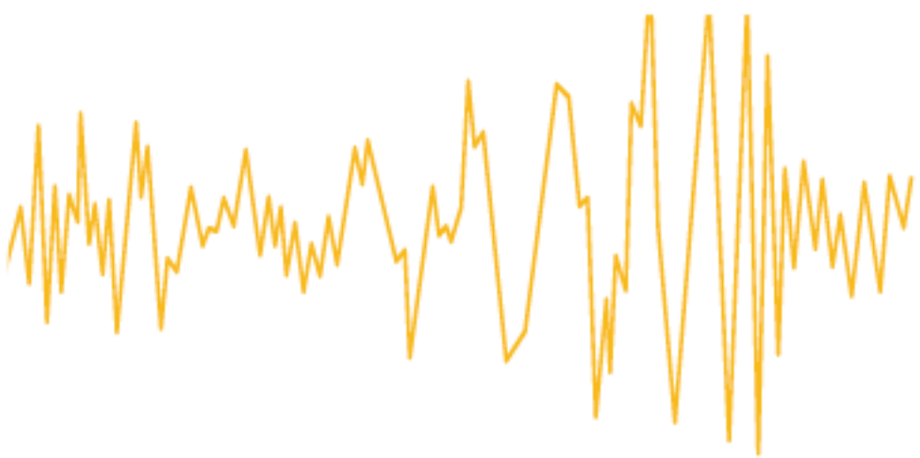


Figure 1. The first gravitational wave ever detected.

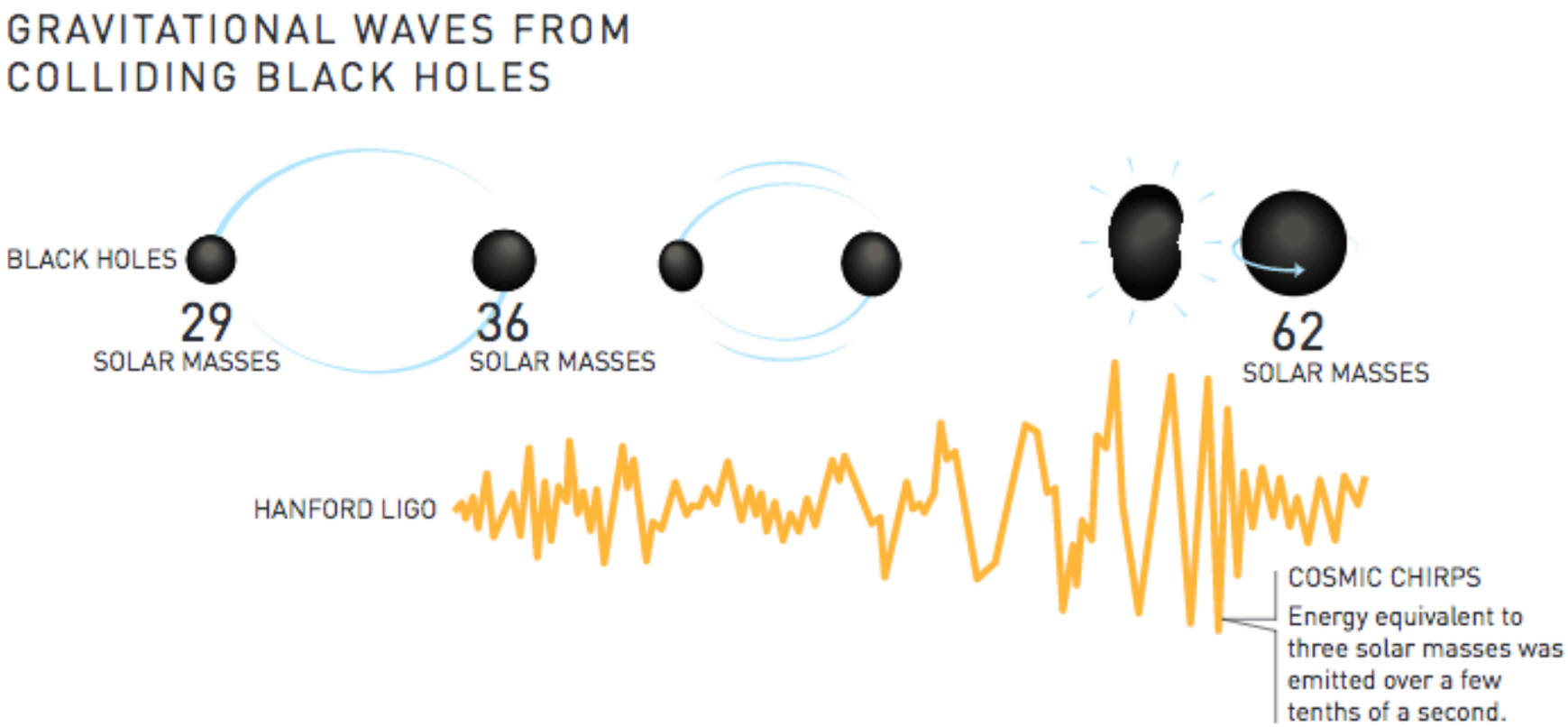
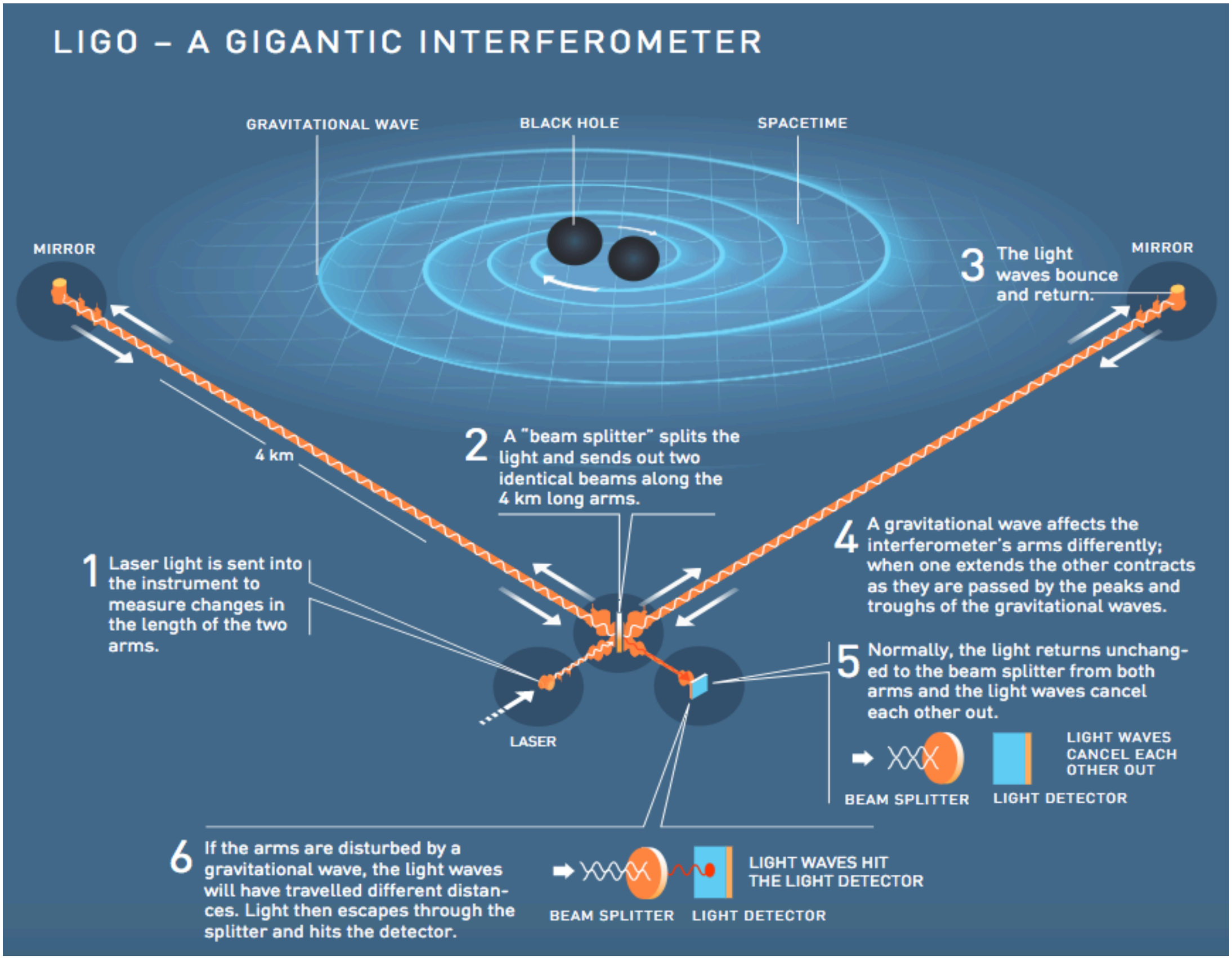
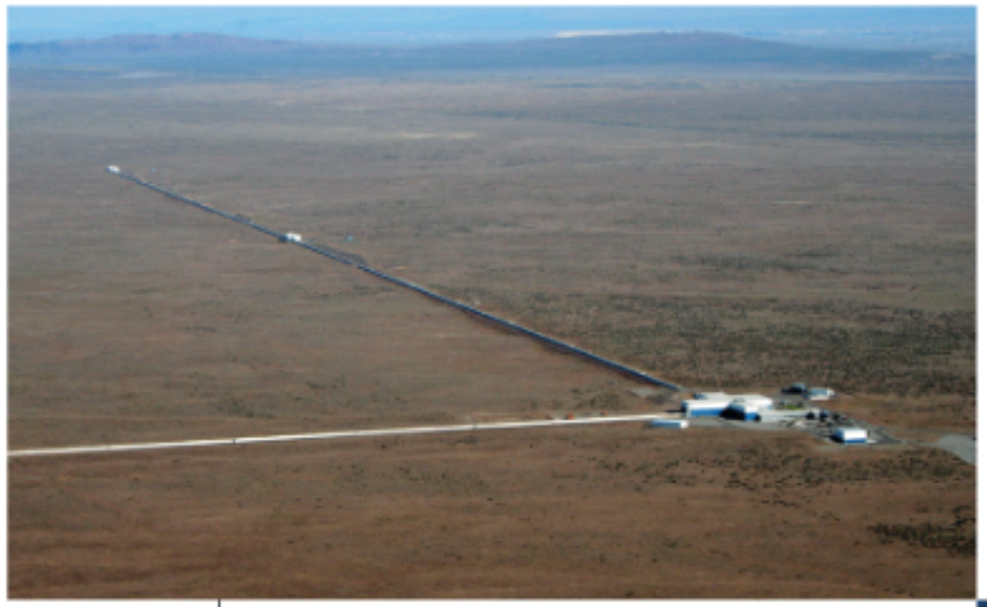


Figure 2. The two black holes emitted gravitational waves for many million years as they rotated around each other. They got closer and closer, before merging to become one black hole in a few tenths of a second. The waves then reached a crescendo which, to us on Earth, 1.3 billion lightyears away, sounded like cosmic chirps that came to an abrupt stop.

LIGO – A GIGANTIC INTERFEROMETER





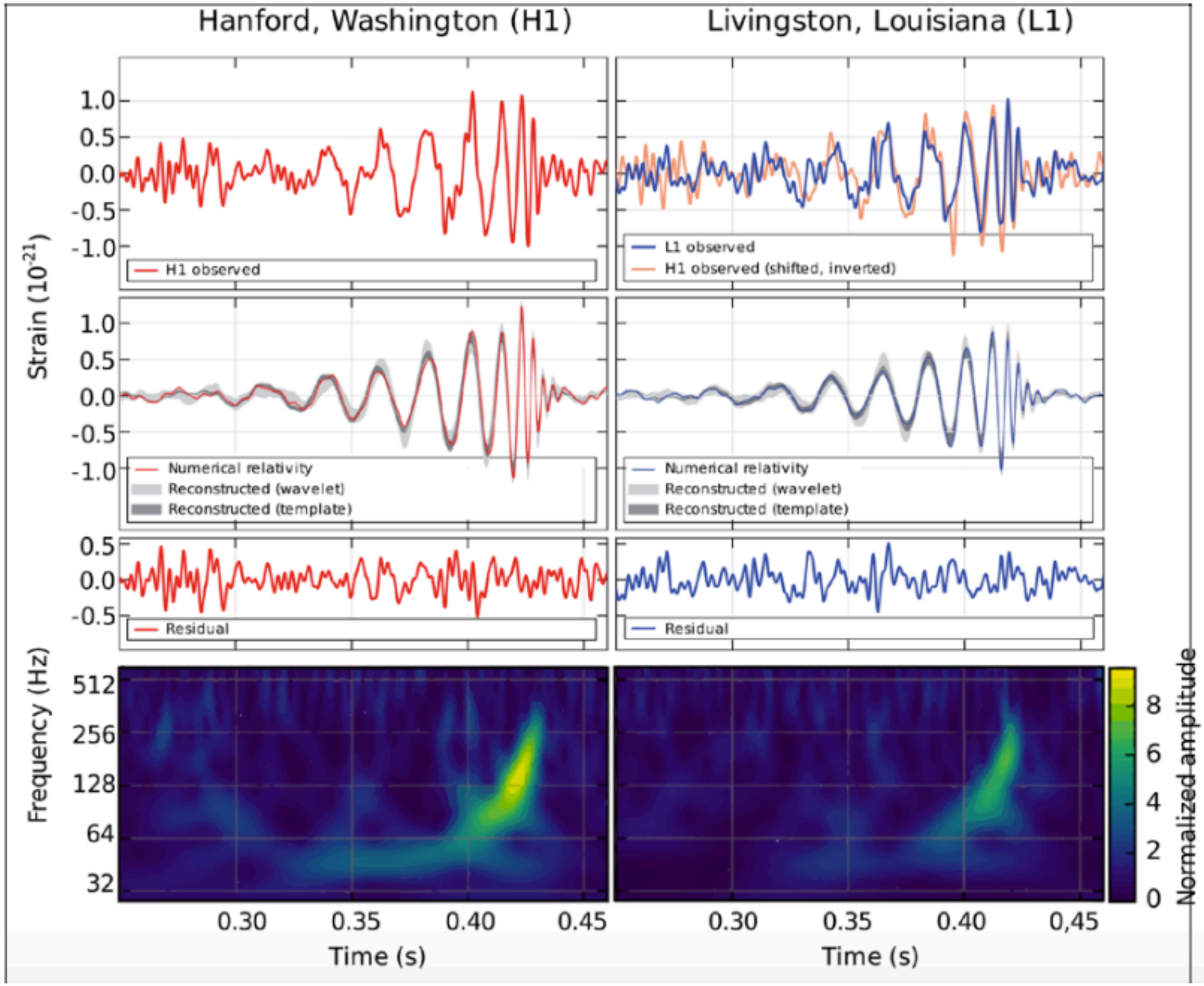
The Hanford facility is on the steppes of the northwest USA, outside Hanford.

Courtesy Caltech MIT/Ligo Laboratory

The Livingston facility is in Livingston in the southern swampland of Louisiana.

Courtesy Caltech MIT/Ligo Laboratory

Figure 4. LIGO consists of two gigantic identical interferometers. The gravitational wave first hit the interferometer in Livingston and then passed its twin in Hanford, just over 3,000 km away, 7 milliseconds later. The signals were almost identical, and were a good match with the predicted signal for a gravitational wave. Using the signals, an area in the southern skies could also be identified as the area the waves came from.


Hanford, Washington (H1)
Livingston, Louisiana (L1)
Strain (10^{-21})
H1 observed
L1 observed
H1 observed (shifted, inverted)
Numerical relativity
Reconstructed (wavelet)
Reconstructed (template)
Residual
Frequency (Hz)
512
256
128
64
32
0.30
0.35
0.40
0.45
0,45
Time (s)
Normalized amplitude
8
6
4
2
0