

A visualization of gravitational waves, showing concentric ripples of light and dark blue and purple, with a central dark spot representing the source of the waves.

Einstein, Black Holes, Gravitational Wave Detection and Art

Gregory Harry

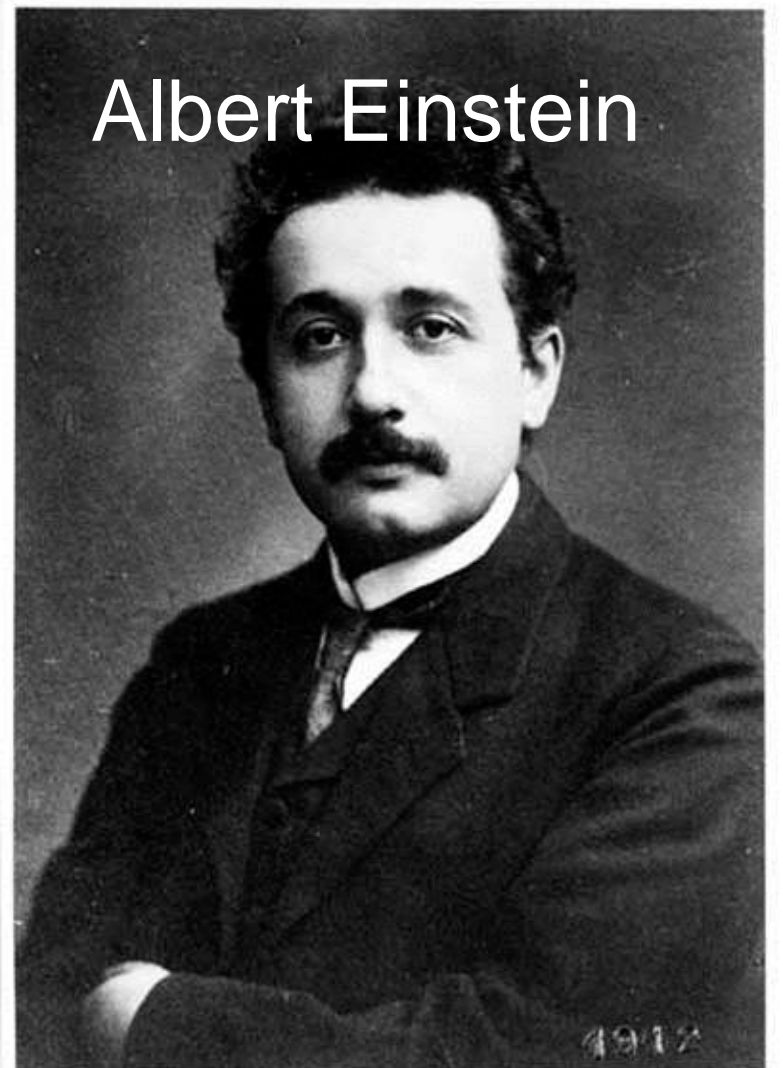
Department of Physics, American University

September 3, 2016



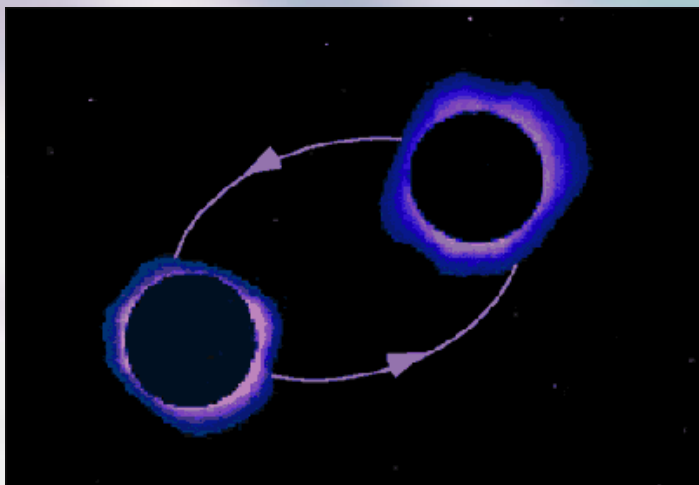
LIGO

History of Gravity



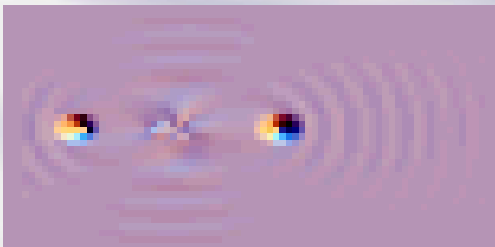
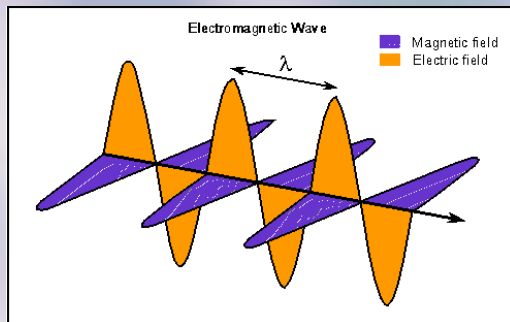
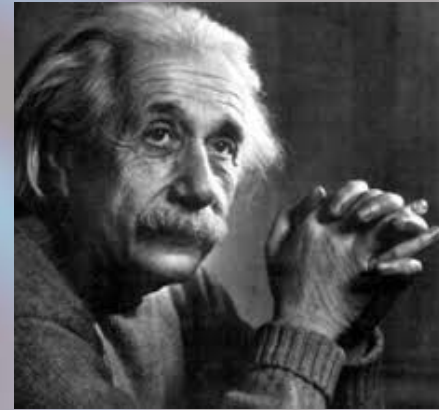
Black Holes

- Gravity so strong speed greater than speed of light needed to escape
- Called **Black Holes**
- Two orbiting black holes create waves in space



- Knew black holes exist
- Unknown whether black holes form in pairs ???
- Unknown what mass range black holes can have ???

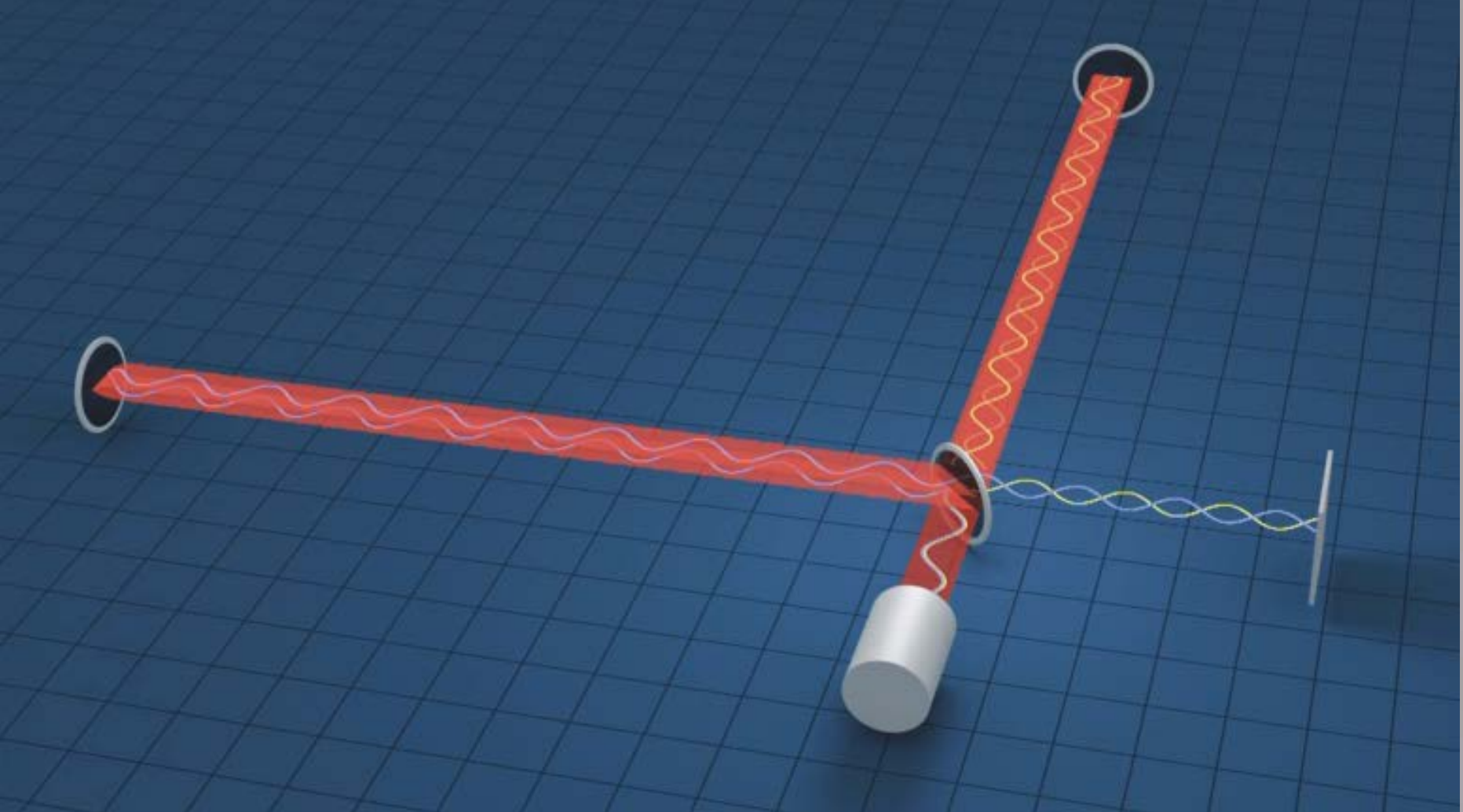
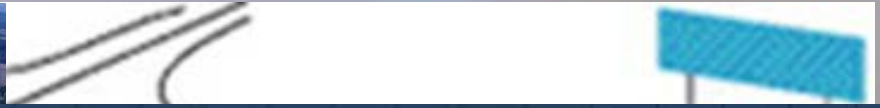
- Einstein's theory of gravity is called the General Theory of Relativity
- Gravity can not travel faster than the speed of light



- Predicts waves of gravity
 - Similar to light waves
- Much smaller amplitude
 - Smaller than atomic nucleus
 - Very difficult to detect
 - Noise reduction important



LIGO Observatories

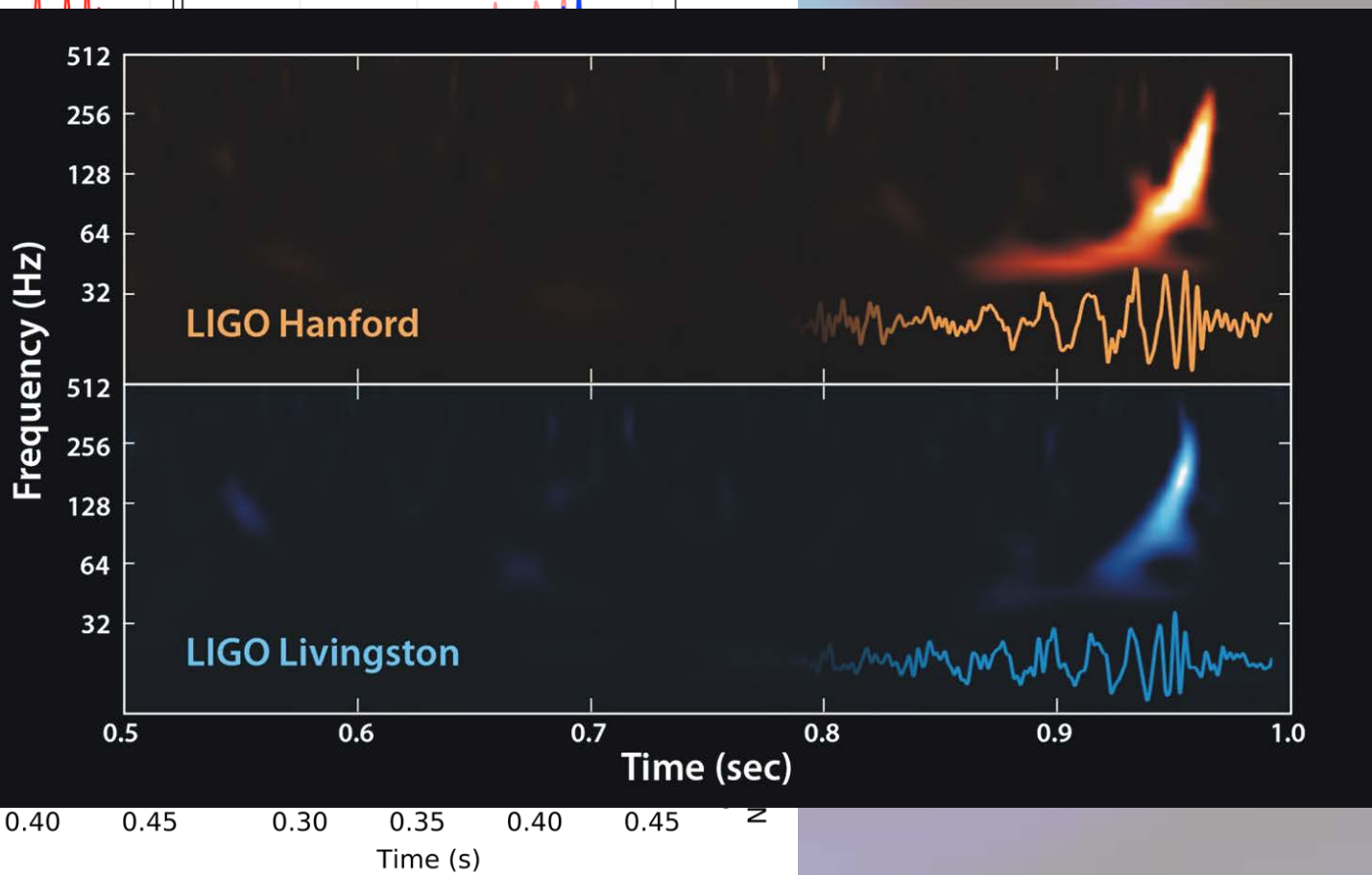
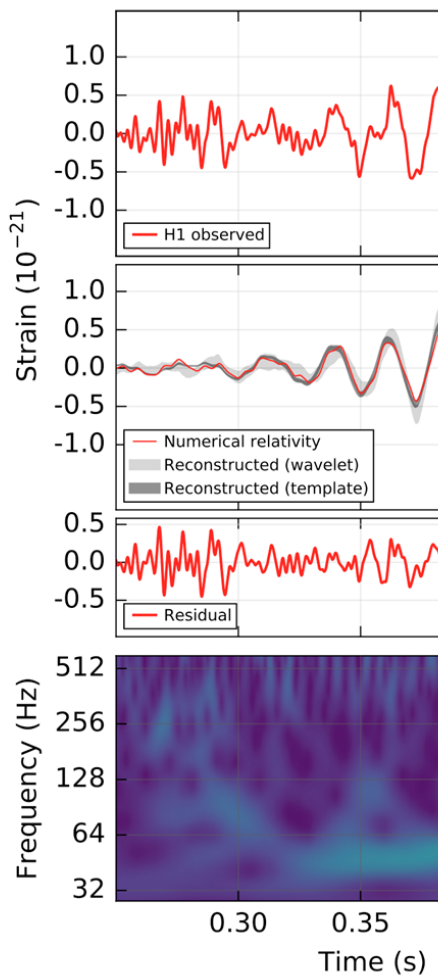




Gravitational Waves from Black Holes

Hanford, Washington (H1)

Livingston, Louisiana (L1)

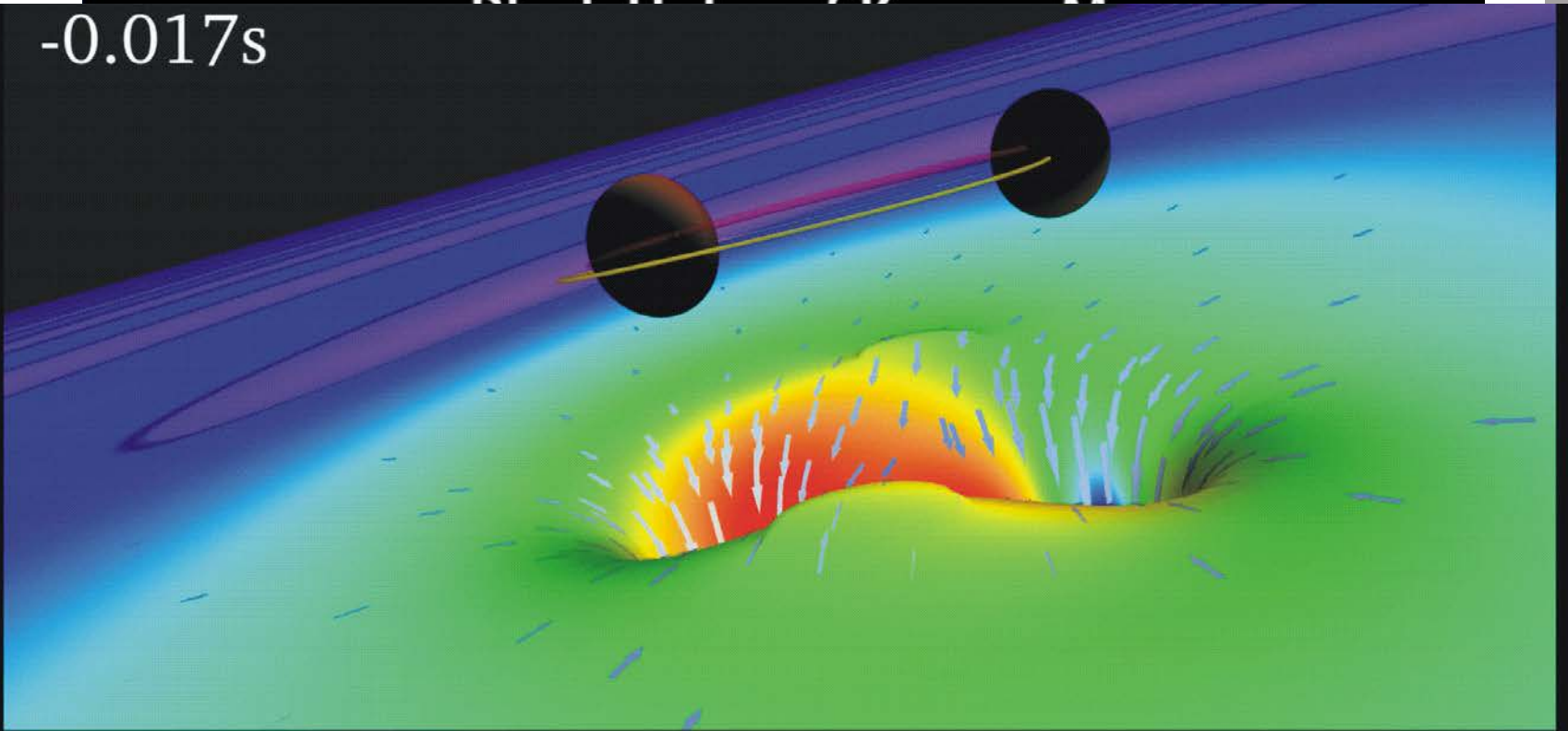




LIGO

Visual Representation of Black Hole Gravitational Waves

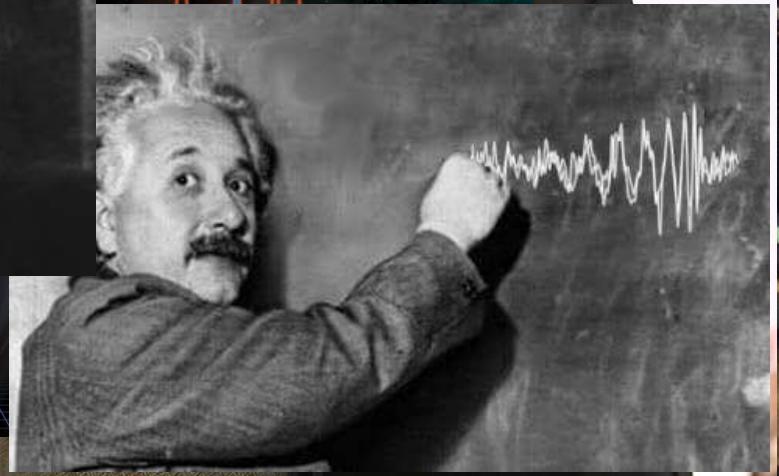
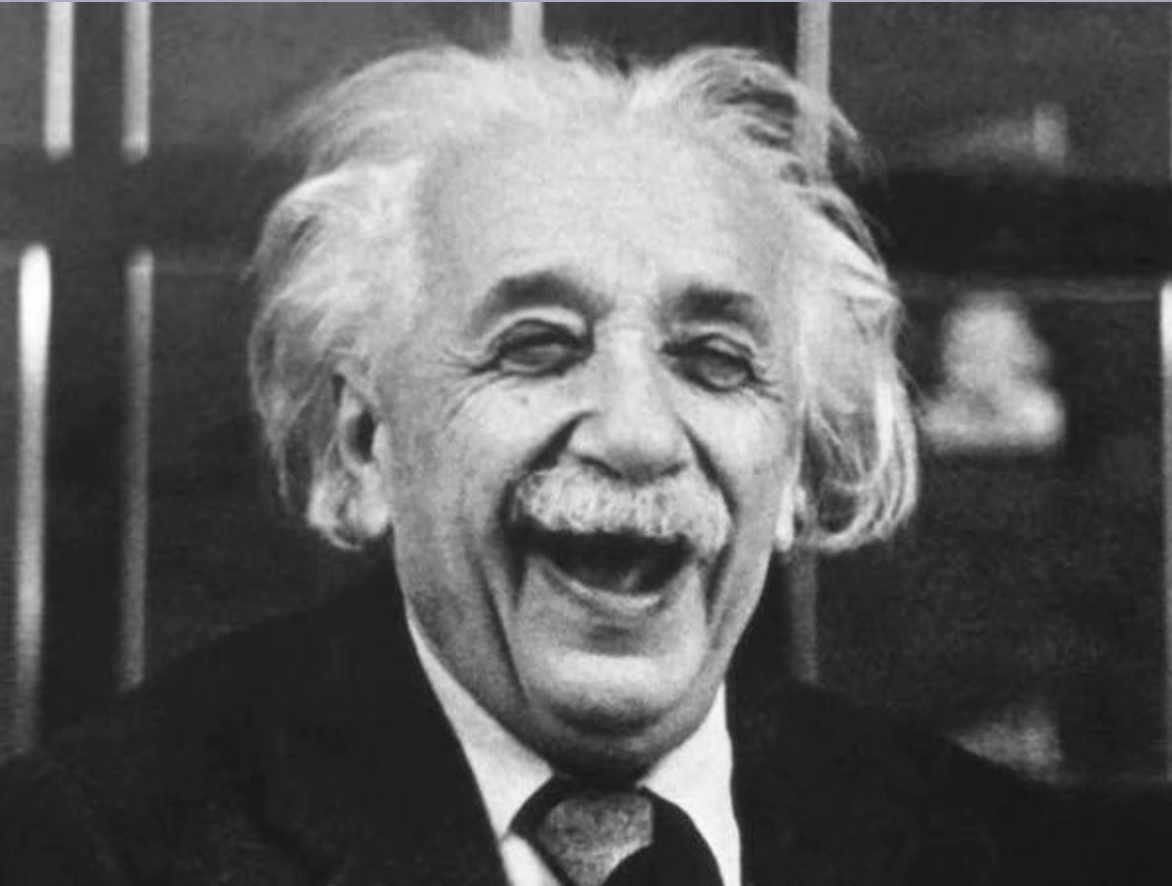
-0.017s





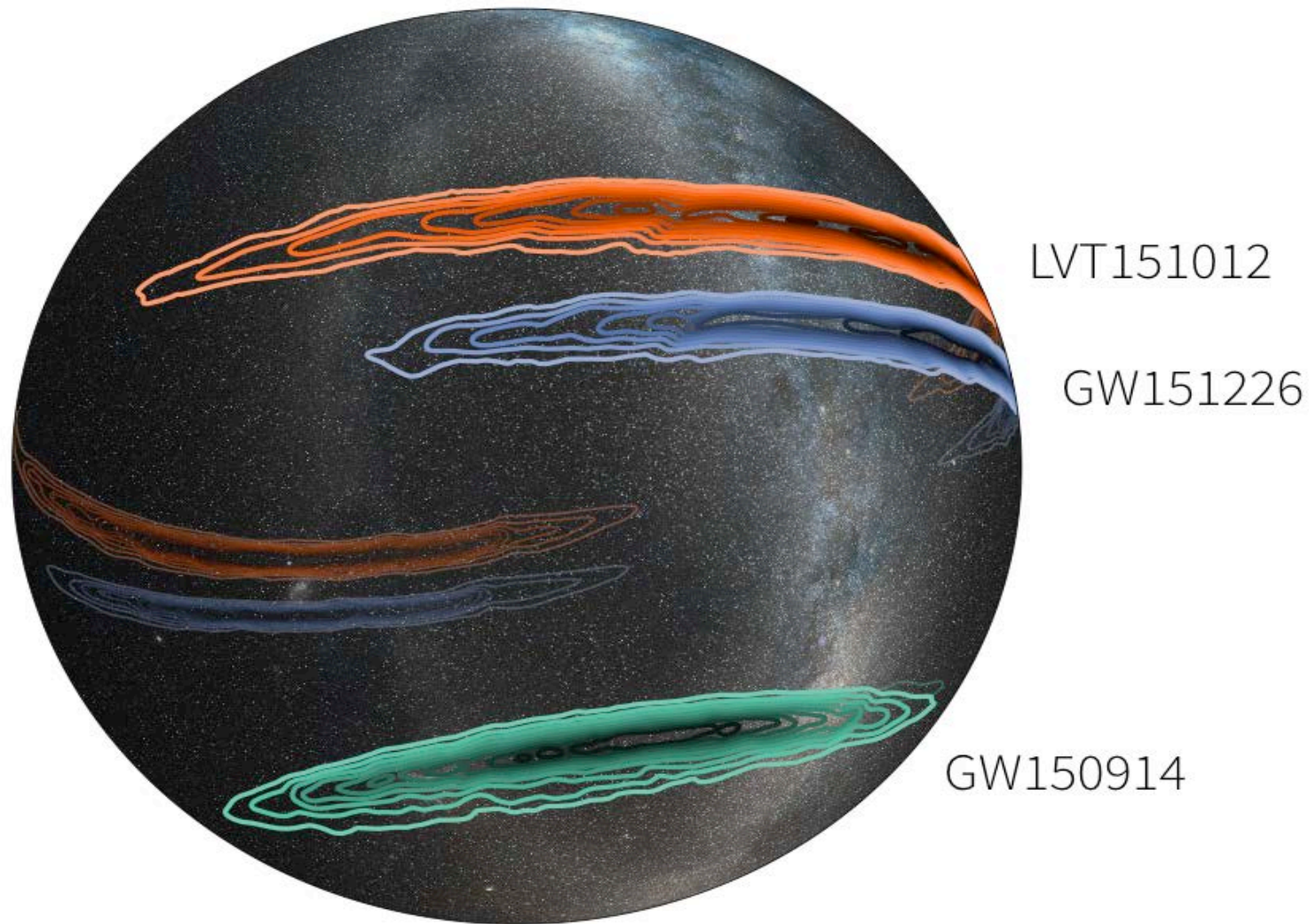
LIGO

Celebrate the Moment



t (ms)

Sky Position



LIGO

Cultural Impact





LIGO

International Network

