Gravitational Waves Visualization

Concept & Data Source

https://gwosc.org/eventapi/html/GWTC-2.1-confident/GW190814/v3/

- Physical visualization of gravitational wave detections from cosmic events
- Data source: Gravitational-wave Transient Catalog (GWTC)
- Represents real-time visualizations of:
    - Black hole merger events
    - Spacetime distortions
    - Wave patterns as detected by LIGO/Virgo observatories
- Each pattern corresponds to different frequencies in the gravitational wave data, revealing the dynamics of cosmic collisions

Physical Construction Display Assembly:

- 12" × 12" hot rolled black steel plate (0.06" thickness)
- Custom pine frame with plywood base:
    - Base unit sized larger than plate for stability
    - Raised edges to contain sand media
    - Under-mounting space for electronics
- Four Sorbothane hemisphere isolation mounts (1/2" diameter, 30 Duro)
- Leveling system for pattern clarity
- Concealed electronics housing

Vibration System Hardware:

- Dayton Audio DAEX25 exciter transducer
- TDA7498E amplifier board (160W×2 channels)
- 18-16 gauge speaker wire
- Isolation mounting system
- Temperature monitoring for electronics Pattern Media:
- Pewter-colored decorative sand
- Grain size optimized for pattern formation
- Low-contrast, reflective properties for subtle pattern visualization
- Even distribution characteristics

Electronics & Control Hardware:

- Arduino Nano 33 microcontroller

- Power supply: 15-36V DC for amplifier
- Subsonic frequency generation
- Pattern cycle timing: variable based on gravitational wave data Software:
- Low frequency waveform generation
- Pattern transition control
- Multiple visualization modes representing different cosmic events

Artistic Elements Material Symbolism:

- Black steel plate representing the fabric of spacetime
- Pewter sand creating subtle, starlike patterns
- Wood frame grounding the cosmic phenomena
- Natural material interactions echoing gravitational effects Visual Experience:
- Low-contrast, reflective patterns
- Shifting visibility based on viewing angle
- Subtle emergence and dissolution of forms
- Physical representation of usually imperceptible cosmic events

About the GW190814 Data

- First mass: 23.3 (±1.4) solar masses (definitely a black hole)
- Second mass: 2.6 (±0.1) solar masses (unidentified)
- Detected with very high confidence (SNR of 25.3)
- Relatively close: 230 (+40/-50) megaparsecs away
- Very precise measurements (small error bars compared to other events)
- Total mass: 25.9 solar masses

What makes this event of particular interest is the second object – at 2.6 solar masses, it sits in the "mass gap." It's either the heaviest neutron star ever discovered or the lightest black hole ever discovered. This "in-between" mass makes GW190814 particularly interesting because it challenges our understanding of what's possible in cosmic collisions. The mass ratio between the two objects (about 9:1) is also unusual, as most mergers we see are between objects of similar mass.