The Art Appreciation 101 STEAM Prize
for Artistic Beauty in Science, Technology, Engineering, or Mathematics

Assignment

There are Nobel Prizes for achievements in science and the arts, and other awards like the Fields Medal in mathematics, but how about a STEAM Prize for Artistic Beauty in a STEM field? Write an essay describing the criteria for such a prize, and make your own nomination for who should receive its first award, explaining the candidate's unique STEM achievement and its artistic merit.

The STEAM Prize

The Art Appreciation 101 STEAM Prize for Artistic Beauty in Science, Technology, Engineering, or Mathematics will be awarded annually. Nominations are accepted from January 1 to March 31, and the award committee will announce its decision by May 1. Nominations will be for a living individual or a collaborating team of no more than three persons, although other contributors may be acknowledged. The prize has no cash value, only the honor of its award.

Criteria for the award are as follows. Two factors will be considered in awarding the prize, its scientific merit and its intrinsic artistic beauty. Thus, the award is for the scientific achievement itself, not for artistic presentation about the science, although work showing that its authors appreciate the beauty and present it clearly will rank ahead of clumsy presentations that may indicate its authors didn't appreciate the beauty implicit in their work. Originality is important, and new discoveries will be regarded more highly than work which presents prior discoveries more clearly. Work done or published during the preceding calendar year is favored for the award. The first award will be for 2016.

Anyone may submit a nomination to the committee, naming the candidate(s), describing the achievement and its publication, and explaining its artistic beauty. Submissions are limited to no more than 4 printed pages (Letter or A4) with legible-sized fonts for text and figures that do not need magnification. Nomination submissions that are themselves beautiful are preferred.

Nomination of Benjamin Peter Abbott

I nominate Benjamin Peter Abbott for the first annual STEAM Prize, for his work with colleagues published as "Observation of Gravitational Waves from a Binary Black Hole Merger" in 2016. This is the first experimental confirmation of a century-old prediction of General Relativity, widely acknowledged to be one of the most beautiful discoveries of theoretical physics. It is the culmination of a decades-long effort to build sufficiently sensitive detectors, yet when the first detection came it was unambiguous and easily appreciated by a worldwide audience of ordinary people, audible as a sharp chirp widely played on radio and television. Many science magazines and websites ranked it as the #1 science story of 2016.

Beauty was a guiding light for Albert Einstein a century ago, in discovering first Special Relativity (published 1905) and then going on to General Relativity (published 1915). He was quite aware of the aesthetic incentive, saying “The ideals which have lighted my way, and time after time have given me new courage to face life cheerfully, have been Kindness, Beauty, and Truth.” He was sole author of the papers publishing both facets of Relativity, a singular human achievement beyond the bounds of STEM to STEAM.

While this STEAM nomination for 2016 can’t claim the originality of Einstein’s discovery of Relativity, it is no mere derivative work and not just an artistic embellishment of settled science. Gravitational waves were a clear prediction of General Relativity, but actually observing them was important enough to warrant the multi-million-dollar investment in the Laser Interferometer Gravitational-Wave Observatory (LIGO) project that progressed over decades, the largest and most ambitious project ever funded by the NSF (US National Science Foundation). The first detection, dubbed GW150914, at 09:50:45 UTC on 2015-Sep-14, had a statistical significance of over 5.1 sigma or a confidence level of 99.99994%. Careful analysis and interpretation led to formal publication as:

> Abbott, Benjamin P.; et al. (LIGO Scientific Collaboration and Virgo Collaboration) (2016). "Observation of Gravitational Waves from a Binary Black Hole Merger". Phys. Rev. Lett. 116 (6): 061102.

Attached as part of this nomination is one page of this article, which includes its Figure 1. The intrinsic beauty can be further appreciated by searching the internet and listening to the chirp heard around the world, the music of the spheres.

Unlike Einstein, Benjamin Peter Abbott is not the sole author of this publication. Indeed, he is one of over 1000 co-authors, so why is he the nominal lead author deserving the STEAM prize? Inspection of the author list shows it is alphabetical, and Abbott’s name appears first. This is not too surprising, since Abbott is a more common surname in the general population than any others that alphabetize before it. Statistically, an alphabetical list of 1000 randomly chosen people will be headed by an Abbott more often than by any other surname. And like the STEAM prize rules of at most 3 collaborators for the award, scientific journals also limit the number of headline authors. With a handful of co-authors, disagreements about priority in listing the names can be painful, but with so many the expedient of alphabetical listing could head off a very unbeautiful wrangle. So regardless the relative magnitude of his STEM contribution, Benjamin Peter Abbott represents the face of modern science, as the front man of a large and diverse collaboration. He deserves the STEAM prize for Artistic Beauty.

While this alone justifies the STEAM nomination for intrinsic artistic merit, Benjamin Peter Abbott stands out in more than the alphabet. He is not just an Electronic Engineer employed at Caltech, but has a separate life as an artist in metal, especially making swords and featured in the History Chanel series “Forged in Fire” with first place in Season 2 Episode 9 “The Khanda.” One of his photos of blades is attached as part of this nomination, to help make the point.

In fulfillment of the unassigned assignment in Art Appreciation, I make this nomination of Benjamin Peter Abbott for the nonexistent first annual (2016) Art Appreciation 101 STEAM Prize for Artistic Beauty in Science, Technology, Engineering, or Mathematics.

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Master of Science, http://persjohn.net/GoldenLogo.htm

properties of space-time in the strong-field, high-velocity regime and confirm predictions of general relativity for the nonlinear dynamics of highly disturbed black holes.

II. OBSERVATION

On September 14, 2015 at 09:50:45 UTC, the LIGO Hanford, WA, and Livingston, LA, observatories detected the coincident signal GW150914 shown in Fig. 1. The initial detection was made by low-latency searches for generic gravitational-wave transients [41] and was reported within three minutes of data acquisition [43]. Subsequently, matched-filter analyses that use relativistic models of compact binary waveforms [44] recovered GW150914 as the most significant event from each detector for the observations reported here. Occurring within the 10-ms intersite

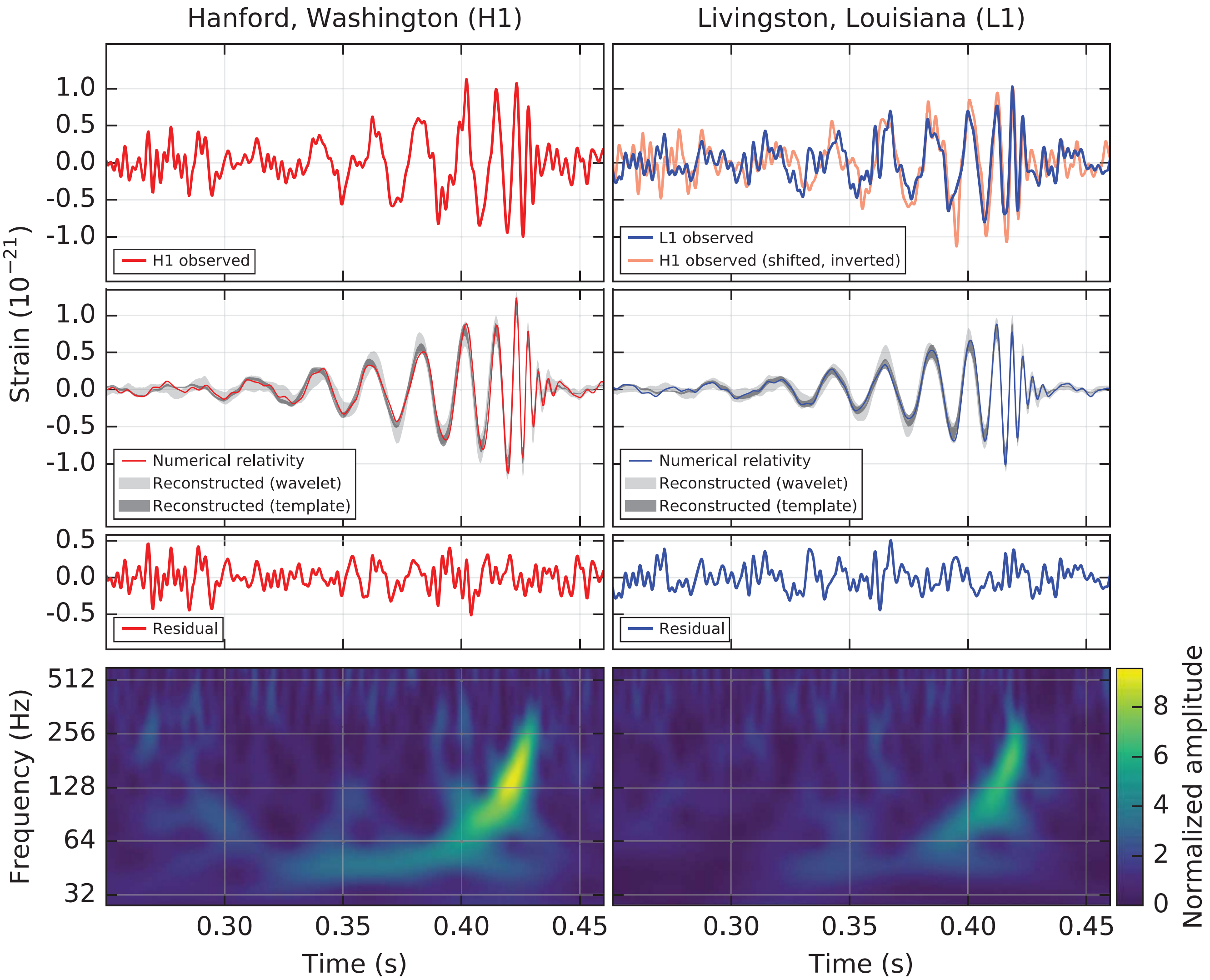

FIG. 1. The gravitational-wave event GW150914 observed by the LIGO Hanford (H1, left column panels) and Livingston (L1, right column panels) detectors. Times are shown relative to September 14, 2015 at 09:50:45 UTC. For visualization, all time series are filtered with a 35–350 Hz bandpass filter to suppress large fluctuations outside the detectors' most sensitive frequency band, and band-reject filters to remove the strong instrumental spectral lines seen in the Fig. 3 spectra. *Top row, left:* H1 strain. *Top row, right:* L1 strain. GW150914 arrived first at L1 and $6.9^{+0.5}_{-0.4}$ ms later at H1; for a visual comparison, the H1 data are also shown, shifted in time by this amount and inverted (to account for the detectors' relative orientations). *Second row:* Gravitational-wave strain projected onto each detector in the 35–350 Hz band. Solid lines show a numerical relativity waveform for a system with parameters consistent with those recovered from GW150914 [37,38] confirmed to 99.9% by an independent calculation based on [15]. Shaded areas show 90% credible regions for two independent waveform reconstructions. One (dark gray) models the signal using binary black hole template waveforms [39]. The other (light gray) does not use an astrophysical model, but instead calculates the strain signal as a linear combination of sine-Gaussian wavelets [40,41]. These reconstructions have a 94% overlap, as shown in [39]. *Third row:* Residuals after subtracting the filtered numerical relativity waveform from the filtered detector time series. *Bottom row:*A time-frequency representation [42] of the strain data, showing the signal frequency increasing over time.