GROUP 4 ANALYSIS: Missing information

Supplementary Article	Information Gap	"Missing' information *Input section number and relevant quotes*
Gravitational waves detected 100 years after Einstein's prediction	**Move 7 (Explain the results)** Why are scientists certain the measurement is valid? Why are gravitational waves a valid prediction of the theory of general relativity?	Why are scientists certain the measurement is valid? "Several universities designed, built, and tested key components for Advanced LIGO: The Australian National University, the University of Adelaide, the University of Florida, Stanford University, Columbia University of the City of New York, and Louisiana State University." (Section 9) "LIGO research is carried out by the LIGO Scientific Collaboration (LSC), a group of more than 1000 scientists from universities around the United States and in 14 other countries. More than 90 universities and research institutes in the LSC develop detector technology and analyze data; approximately 250 students are strong contributing members of the collaboration. The LSC detector network includes the LIGO interferometers and the GEO600 detector. The GEO team includes scientists at the Max Planck Institute for Gravitational Physics (Albert Einstein Institute, AEI), Leibniz Universität Hannover, along with partners at the University of Glasgow, Cardiff University, the University of Birmingham, other universities in the United Kingdom, and the University of the Balearic Islands in Spain." (Section 11) Shows that it was **designed**, **built**, and **tested** by numerous (More than 1000 scientists) credible Universities and persons. "Independent and widely separated observatories are necessary to determine the direction of the event causing the gravitational waves, and also to verify that the signals come from space and are not from some other local phenomenon.' (Section 22) Verifies the validity as the results could have widely varied at different places, and that for the results to be truly correct, it should not have any differing measurement results at different areas. This was accounted for as 14 countries would have observatories widely separated.
		Why are gravitational waves a valid prediction of the theory of general relativity? 'Based on the observed signals, LIGO scientists estimate that the black holes for this event were about 29 and 36 times the mass of the sun, and the event took place 1.3 billion years ago. About 3 times the mass of the sun was converted into gravitational waves in a fraction of a second—with a peak power output about 50 times that of the whole visible universe. By looking at the time of arrival of the signals—the detector in Livingston recorded the event 7 milliseconds before the detector in Hanford—scientists can say that the source was located in the Southern Hemisphere.' The LIGO interferometer measures the time interval between two different directional paths of light. When a gravitational wave passes through, the path of the two light beams change due to stretching of space, resulting in delays between signals. Multiple observations are then carried out to confirm that the wave indeed passed through; after all we do not want any false alarms! After years of searching, an experiment by LIGO has finally detected this interval and proven a prediction. 'According to general relativity, a pair of black holes orbiting around each other lose energy through the emission of gravitational waves, causing them to gradually approach each other over billions of years, and then much more quickly in the final minutes.' General relativity tells us that when two black holes, or massive objects in space, orbit one another, they lose energy from the emission of gravitational waves. As they lose energy, the distance of their orbit decreases, causing them to fall into each other over billions of years before finally smashing into one another in a mere instant at the end.

Yes, section 22, good

Consider sections 4-5

GROUP 4 APPLICATION

Instructions: Write a paragraph incorporating information from the supplementary sources to address the information gaps in the main article.

How are scientists certain that the measurement is valid? From an article by LIGO Caltech, measurements from observatories that are independent and far apart were necessary to determine the pathway of the even causing the gravitational waves. It was also required to verify that the signals were from space and not due to the special occurrences at certain regions on the earth. This verifies the validity as the results could have widely varied at different places, and that for the results to be truly correct, it should not have any differing measurement results at different areas. LIGO research is carried out by the LIGO Scientific Collaboration (LSC), a group of more than 1000 scientists from universities from more than 14 countries, which would account for having observatories widely separated. They are the organization responsible for building and operating the interferometer responsible for the detection of gravitational waves.

The validity of this can be explained with how the results. The LIGO interferometer measures the time interval between two different directional paths of light. When a gravitational wave passes through, the path of the two light beams change due to stretching of space, resulting in delays between signals. Multiple observations are then carried out to confirm that the wave indeed passed through; after all we do not want any false alarms! After years of searching, an experiment by LIGO has finally detected this interval and proven a prediction. Gravitational waves are nothing new, they were predicted by Einstein decades ago!

To understand how gravitational waves are a valid prediction of the theory of general relativity, we need to know what general relativity tells us. From the same article by LIGO Caltech, general relativity tells us that when two black holes, or massive objects in space, orbit one another, they lose energy from the emission of gravitational waves. As they lose energy, the distance of their orbit decreases, causing them to fall into each other over billions of years before finally smashing into one another in a mere instant at the end. Hence, detecting gravitational waves are proof that Einstein's theory of general relativity is proven!

Refer to Week 4 Tutorials and post-lesson notes to review how to acknowledge sources in news articles.

Collaborative and Cognitive Engagement

GROUP 3 FEEDBACK

Instructions for Group 3
Comment on Group 4's writing based on:
a) selection of information from supplementary sources
b) acknowledgement of sources
c) paraphrasing and clarity

In general, logical flow of the paragraphs could be improved upon. It is difficult for the reader to understand what they are trying to talk about at first glance :(
But we do understand the article and technical terms are difficult to understand.. good effort

Who/What is LIGO? What makes them a credible source - might want to write out full name once.

The first paragraph's main gist could be expressed in a clearer manner (that multiple observations were conducted to verify the direction etc. of gravitational wave)

Paragraph 2 not very clear how Einstein's theory was proven correct. Maybe could have structured it in terms of "predicted outcome vs actual measurements" and how they matched up.

Good points from Group 3 Consider explanatory strategies to help make things clearer

Behavioural Engagement

Gravitational waves detected 100 years after Einstein's prediction. (2016, February 11). LIGO Caltech. https://www.ligo.caltech.edu/news/ligo20160211