



Colorado Science and Engineering Fair

2025 Individual Project Abstract Form

Please print 2 copies of the completed form. Sign both copies, keep 1 for your notebook and submit 1 copy to your Regional Fair Director with your other paperwork.

Title of Project: Analysis and Comparison of Gravitational Wave Event Parameters

Finalist's Name: Lillian Prime

School and City: Palmer High School, Colorado Springs

Sponsor's Name: Nathaniel Lohmann

Category: Physics & Astronomy

Division: Senior (grades 9 - 12)

Abstract (250 words or less):

Gravitational waves are ripples in spacetime created mainly by massive bodies in space merging, this project focuses on black hole mergers (BBHs). The purpose of this experiment is to determine the event parameters – time of event, initial masses, remnant mass, and sky location – of two gravitational wave events (GW150914 and GW190412) and compare them to each other and results found by others. By collecting data from an online source of gravitational wave data and manipulating it with analysis techniques – such as fourier transforms, whitening, bandpassing, and others – it is possible to lessen the noise around the potential event to create an accurate picture of what happened, which this project covers. It is then also possible to create a waveform – what the event could look like given specific parameters – and match it to the initial signal, allowing for a more complete understanding of what the black holes that merged looked and behaved like. Based on the data used, two gravitational wave events did occur, one on September 14, 2015, and the other on April 12, 2019, however, this project was unable to be completed within the allotted time, so these were the only parameters to be determined. This research can also be used to support Einstein's general theory of relativity, along with helping us to understand our universe in general.

I hereby certify that the above statements are correct and the information provided in the Abstract is the result of one year's research. I also attest that the above properly reflects my own work.

Finalist's Signature:

Date:

In addition, all students must complete the ISEF Student Checklist (1A), Research Plan, Approval Form (1B), and Checklist for Adult Sponsor (1), and any other ISEF forms required for this type of project. See the International Rules and Guidelines for form requirements. Return COPIES of all of these forms to your Regional Fair Director with you Finalist Verification/Permission Form. **A signed copy of this form must be included in your notebook.**