

# “LIGO in the Gravitational Wave Detection Era”

## A Lecture by Corey Austin

On February 6th, 2019 the Sam Houston State University Physics Department hosted Corey Austin to present a lecture over his recent work in collaboration with the Laser Interferometer Gravitational Wave-Observatory (LIGO). Corey Austin is from Louisiana, where he received his Bachelors of Science degree in general studies at Louisiana State University in 2005. He then moved on to work in the petroleum industry for 7 years. In 2013, Austin decided to return to school to earn a master's degree in Engineering Physics/Applied Physics at Louisiana Tech University. He now works as a Ph.D. student research assistant at the LIGO Livingston Observatory.

During Austin's presentation, he discussed what LIGO is, what it is currently doing, and how it is used to detect gravitational waves in the cosmic atmosphere. Corey also briefly discussed the space and time correlation; space tells time how to bend and time tells space when to move. LIGO is based on the ground which, he explained, has some complications because certain events can cause the ground to move, affecting the data output. Things such as the wind, ocean waves, and weather can limit the abilities of LIGO. Generally, researchers are able to eliminate these natural effects from the data, which helped lead to their first discovery. In September 2015, the LIGOs in Livingston and Hanford both detected gravitational waves of black holes. It was discovered that the detected event had happened roughly 1.3 billion years ago. This event consisted of two black holes slowly getting closer to each other. They began circling one another until they became too close, collided, and created a single, massive black hole. An event like this emits a burst of gravitational waves, which is what both LIGOs in the United States were able to detect. Interestingly, another LIGO called VIRGO, located in Italy, did not detect this event; leading the team to conclude that this event was out of Virgo's detectable reach.

There are a total of 6 LIGO sites located around the world, four of which are currently operational: LIGO Livingston, LIGO Hanford, GEO600 (Germany) and Virgo. Another is under construction in Japan, the KAGRA, which is being built within a mountain through various tunnels. The final site is planned to be built in India. LIGO is a massive project built by a large team, including multiple universities and organizations such as Penn State, Texas Tech, University of Chicago and the University of Glasgow. As the LIGO team moves forward, they plan to build more detectors and increase the size of the team, along with other future goals that they are working towards: to introduce a higher powered laser, squeeze light injectors, and to install a stray light controller. LIGO is planning for a 3rd detection run in the spring of 2019.

For more information about LIGO you can visit:

<https://www.ligo.caltech.edu/page/about>

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