

Eclipse Extravaganza

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In 1919, a famous scientist by the name of Sir Arthur Eddington conducted a very important experiment. During a total solar eclipse, he gazed up at this amazing stellar event to peak into the mystery of the stars hidden by the Sun's bright light. The purpose of this experiment was to measure the deflection of starlight due to the Sun's gravity. By doing this, he would be testing Einstein's Theory of General Relativity. However, imaging things that are in close proximity to the Sun visually can be difficult, due to the Sun's intense light. We all know looking directly at the Sun isn't a great idea, but, by taking advantage of a total solar eclipse Eddington was able to image these stars, and measure the deflection.

Since 1919, the Eddington experiment has been repeated during subsequent solar eclipses. When the moon blocks out the sun, the ability to run the experiment becomes available. The 2017 total solar eclipse was one such time. By doing Eddington's experiment with more refined and sophisticated equipment, the deflection can be measured much more accurately. Every repeated run of the experiment helps refine the data. This is a great opportunity for physicists around the world to collaborate!

During the 2017 solar eclipse, Donald Bruns repeated the experiment with more modern equipment. Using a camera and a telescope, he was able to capture hundreds of photos of specific stars during the eclipse. At first, not much can be done with the raw photos, but, the photos can be processed into data that can then be analyzed[1].

The first step is to make sure all the photos are aligned. Sometimes, during the photo taking process, things shift. So by aligning all the photos, you can make sure the stars you are observing are matched up. This is done with special computer software. Then, the photos were "stacked". Stacking the photos on top of one another helps a digital program identify stars based on their

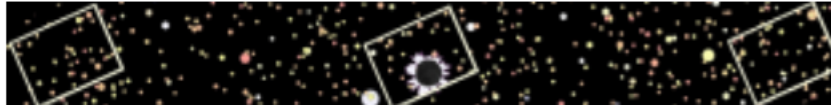


Figure 1: The star field as seen during the total solar eclipse[1]

brightness! You can create images like Figure 1, which are really cool to look at! Once a stacked photo is created, a software program analyzed it for “centroids”. A centroid (basically, the center point of the object) is used to intensify a stars position down to the smallest pixel [1]. This gives us the desired position, which can help us measure deflection! The 2017 experiment was considered successful, with few known equipment failures or weather obstructions. [1]

This experiment leads the way for lots of other physics and space enthusiasts to participate during future solar eclipses. The more the experiment is done, the more repeatable it becomes!

References

- [1] D. G. Bruns, “Gravitational starlight deflection measurements during the 21 august 2017 total solar eclipse,” *Classical and Quantum Gravity*, vol. 35, no. 7, p. 075009, 2018.