Using Stellarium To Cyber-Observe The Great American Eclipse

By: Ellie R. Prim and **David J. Sitar**

Abstract

The Great American Eclipse is over. Somewhat sad, is it not? Individuals who were unable to experience the event on August 21, 2017, can now cyber-observe the eclipse with Stellarium (http://www.stellarium.org). In the authors' opinion, it is fun and has many great applications in the classroom. In addition it is open source and available for Android, iOS, and Linux users. We here at Appalachian use it in our introductory astronomy labs for specific activities such as investigating coordinate systems, discovering differences between solar and sidereal days, as well as determining why your "astrological sign" is most often not your "astronomical sign."

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Using Stellarium to cyber-observe the Great American Eclipse

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The Great American Eclipse is over. Somewhat sad, is it not? Individuals who were unable to experience the event on August 21, 2017, can now cyber-observe the eclipse with Stellarium (http://www.stellarium.org). In the authors' opinion, it is fun and has many great applications in the classroom. In addition it is open source and available for Android, iOS, and Linux users. We here at Appalachian use it in our introductory astronomy labs for specific activities such as investigating coordinate systems, discovering differences between solar and sidereal days, as well as determining why your "astrological sign" is most often not your "astronomical sign."

Motivation and application

Stellarium is a virtual planetarium application that the authors used during presentations to inform and educate the public prior to this total solar eclipse. The software has multiple options that allow users to change coordinates, date, time, and location while observing celestial objects, events, or, in our case, the Great American Eclipse. Stellarium can demonstrate what happened during this special occurrence and why totality was not observable at all locations.

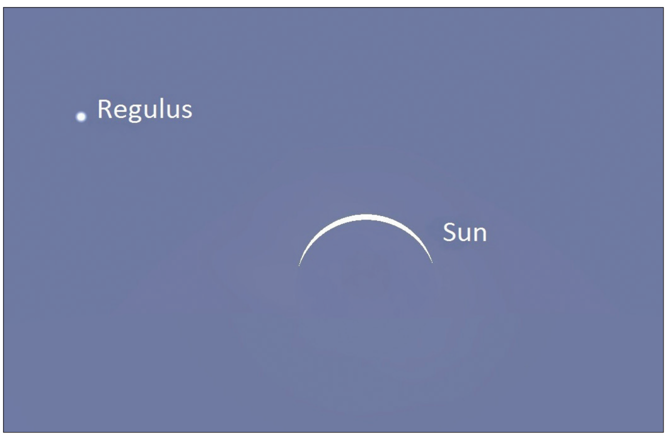

Fig. 1. Screenshot from Stellarium of the partial eclipse from approximately 36°N and 81°W.

Solar eclipses are unique astronomical events that many individuals do not get to experience. August 21, 2017, was a total solar eclipse spanning across the United States for the first time in 99 years. This paper explores how simulating the eclipse can provide the public with a deeper understanding of fundamental eclipse concepts.

Using Stellarium

The observation window for viewing a solar eclipse is usually limited to a small population of people. However, Stellarium allows everyone globally to cyber-observe the eclipse, along with many other historical or future astronomical events.

By manipulating the coordinates, users can input the longitude and latitude of a location outside the path of totality. This allows the user to see the percentage of sunlight peeking through, making the eclipse partial (Fig. 1). The user is now able to zoom out, visualizing the effect the Moon's disk has in contrast to the Sun's disk.

As for a total eclipse, the user can change the location to be within the limits of totality. One will now be able to see the beautiful glow of the corona that appears when the Moon is completely covering the Sun, along with the shift between day and night (Fig. 2). When this happens, planets and stars will slowly appear on the screen as they would in real life.

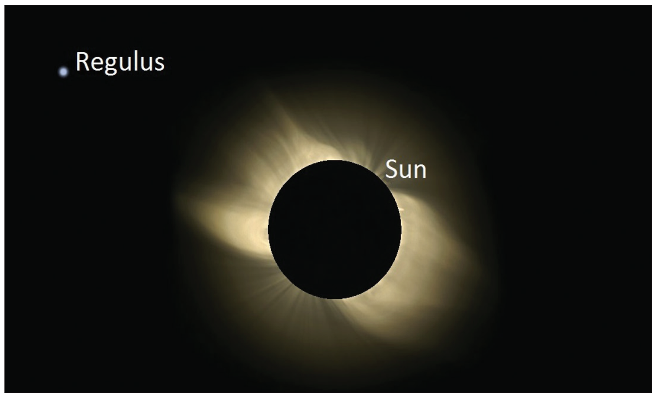

Fig. 2. Screenshot from Stellarium of the total eclipse from approximately 35°N and 83°W.

The viewer's location can also be changed to different celestial objects, like the Moon and Sun. This allows for a change in perspective. We can simulate the eclipse from the point of view of an observer on the Moon looking back at Earth (Fig. 3). The Moon casts a shadow on Earth, and as time advances the shadow moves.

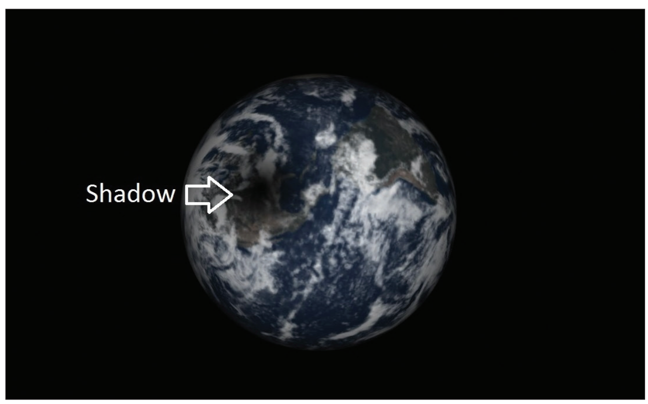

Fig. 3. Screenshot from Stellarium of the Moon's shadow displaced on Earth.

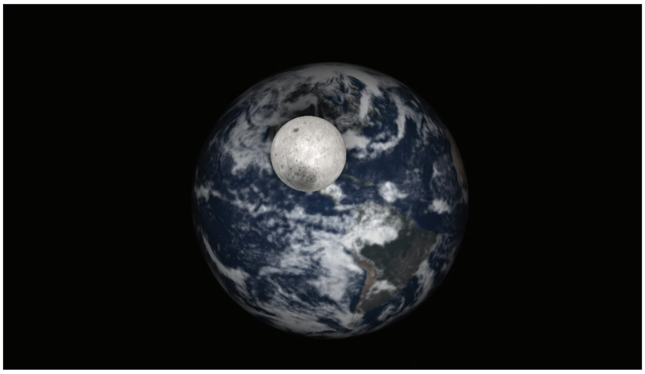

Fig. 4. Screenshot from Stellarium of the solar eclipse as seen from the Sun.

One can also view the eclipse from the Sun and watch the Moon traverse across Earth (Fig. 4).

A concept that is sometimes difficult for individuals to grasp is why an eclipse does not happen every new or full Moon. This is because of the 5.2° tilt of the Moon's orbital plane with respect to the ecliptic. In order for an eclipse to happen, the Moon's orbital plane must be oriented relative to the ecliptic so that the Sun, Moon, and Earth are all in a line; and that line coincides with the line of nodes. When this does not happen, the Moon is either too high or too low for an eclipse (Fig. 5). Stellarium can illustrate this when observing from the Sun's point of view. By inputting an upcoming new or full Moon in the "Date/time window," users can analyze the Moon being above or below the Sun.

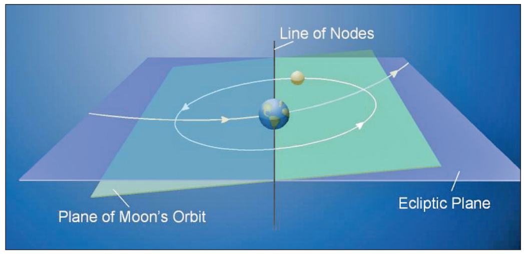

Fig. 5. Demonstrating when eclipses can happen. Image reproduced from the Astronomy Education at the University of Nebraska-Lincoln Website (http://astro.unl.edu).

Conclusion

For those who were unable to experience the Great American Eclipse, Stellarium is your own mini time machine! It is also a wonderful pedagogical tool for teachers around the world wanting to demonstrate and explain celestial content. This can create opportunities for teachers to implement technology in the classroom, granted that computers are available.

Acknowledgments

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What's Happening!

First AAPT/ALPhA Awardees Named

The AAPT/ALPhA Award recognizes outstanding work in the development of an advanced laboratory apparatus/experiment by an undergraduate physics student at his/her home institution within the greater United States. The AAPT/ALPhA Award Committee has announced the first recipients of the award – Brandon Thacker, California State University, Chico (2015), and Ryan Scott, Rochester Institute of Technology (2016). TeachSpin is currently funding the award.

A Note to Contributors

As of August 1, 2014, the submission process for articles for *The Physics Teacher* has changed. Authors should now submit their article and cover letter at this website: ***www.editorialexpress.com/tpt.*** Papers should be prepared in MS Word or other text processing software, but for the initial submission process we require that authors submit a single, self-contained PDF file which includes the complete manuscript, with figures, tables, and reference lists. Author information should not be included in the manuscript document (so that papers may be reviewed anonymously).

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