Eclipse to shed light on weather in space and on Earth

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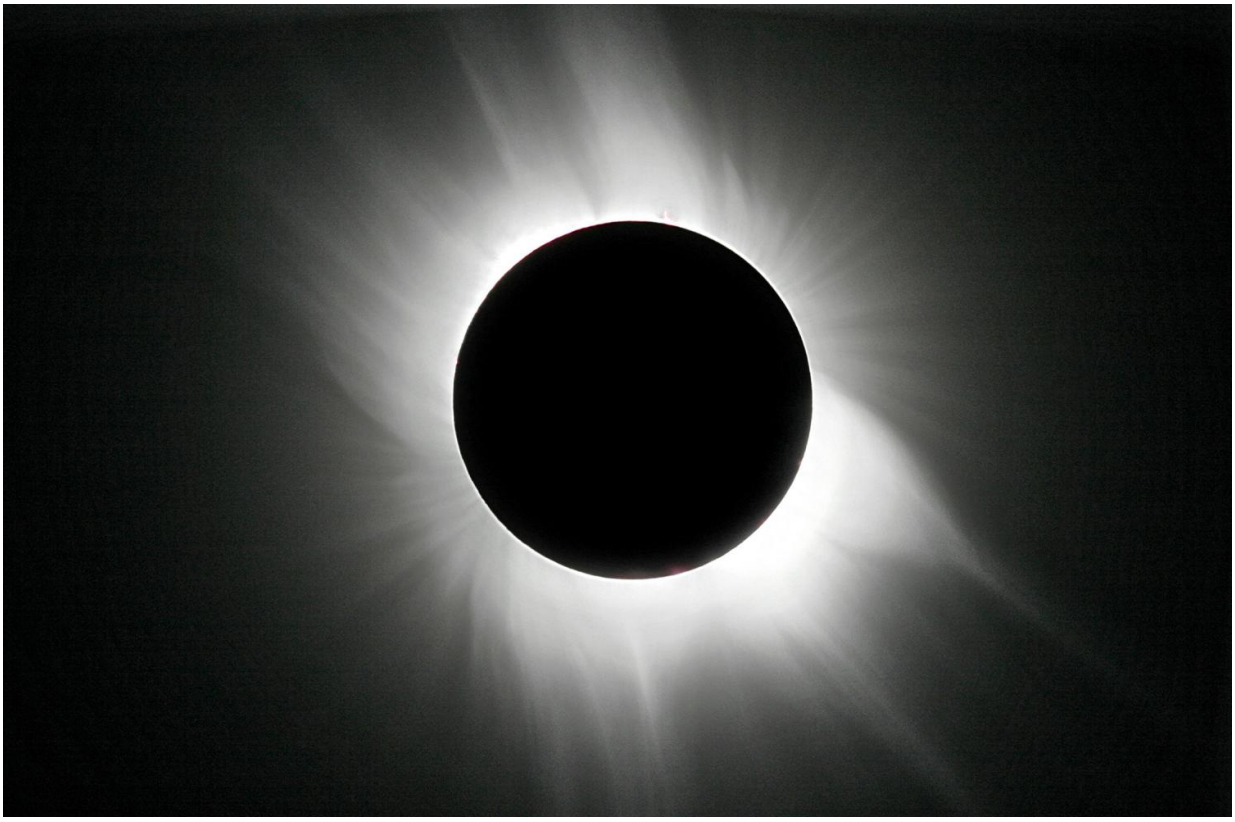

UMass Lowell faculty and student researchers will fan across the country on Aug. 21 along the track of the total eclipse that will sweep across U.S. skies. The research aims to take images of space weather during the event with the goal of aiding weather forecasting on Earth and improving wireless communications. This composite image illustrates what sky watchers from Oregon to South Carolina may witness during the solar event. Credit: Edwin Aguirre -Joson Images

When a total solar eclipse sweeps across U.S. skies on Monday, Aug. 21, UMass Lowell faculty and students will be stationed around the country, conducting research that will be used to better predict the weather and improve GPS, satellite and shortwave-radio communications.

Known as both the "All-American Eclipse" and "Great American Eclipse," the event will be the first time in nearly 100 years a complete solar eclipse will be visible from coast to coast. An estimated 12.2 million people live along the eclipse's "path of totality" from Salem, Ore., to Charleston, S.C., where viewers will see the moon entirely block the sun for up to 2 minutes and 40 seconds. In New England, sky watchers will see a partial eclipse, with about 60 percent of the sun blocked from view.

The astronomical event is predicted to be the most widely watched and photographed total solar eclipse in history.

UMass Lowell faculty and student researchers with the university's Lowell Center for Space Science and Technology (LoCSST) will conduct experiments during the eclipse that will examine space weather, work that aims to improve weather forecasting on Earth and enhance GPS, satellite and other wireless communications.

Led by UMass Lowell research scientist Susanna Finn, the team will use imaging instruments built at UMass Lowell to gather data before, during and after the event in locations across the U.S. along the total eclipse's track. The goal of the research, funded by the National Science Foundation, is to capture disturbances in space known as gravity waves, which will be created as the moon's shadow passes over the sun. The devices, each measuring about a yard long and weighing about 50 pounds, are known as High Throughput Multi-Slit Imaging Spectrographs, (HiT&MIS).

"These instruments can see very faint emissions high up in the atmosphere, some 100 to 300 kilometers above the Earth's surface at all times, day and night," said UMass Lowell Physics Prof. Chakrabarti, director of the space center. "The disappearance and reappearance of the sun in such a short period creates waves similar to those that form at the bow of a ship as it moves through water. We are hoping to see and characterize this phenomenon, as inclement space weather such as this can affect GPS navigation, shortwave radio, satellite communications and much more."

Space scientists have a variety of theories about the altitude at which the waves form and how they travel, according to Finn, a Somerville resident. Images captured by the spectrographs hope to answer these questions. The instruments are designed to observe light coming from different altitudes in space, allowing the researchers to identify the waves and see where they go.

"Better understanding of gravity waves can help improve weather-forecasting models, particularly in wind predictions. As the waves travel to the upper atmosphere and ionosphere, this is where we might also see the waves' effects on radio communications, due to induced irregularities," she said.

The researchers will be divided into two groups for the eclipse. By deploying the devices at separate sites, the researchers are maximizing their chances of gathering data at a cloud-free location.

In Jackson, Wyo., Chakrabarti and UMass Lowell Physics Prof. Timothy Cook of Newton will operate one of the HiT&MIS instruments. More than a thousand miles to the east, UMass Lowell students Saurav Aryal and George Geddes, both research assistants working toward their Ph.D. in physics, will operate a second HiT&MIS spectrograph as the eclipse passes over Carbondale, Ill.

Carbondale, located in southern Illinois east of St. Louis, is the sweet spot for eclipse-viewing, as it's the closest city to where the total eclipse will last the longest, according to the researchers. Geddes and Aryal, both of Lowell, are excited that they will be stationed in such an important location and will contribute to the UMass Lowell research project.

"It's a pretty big deal to get to participate in something on this scale. Carbondale is the place to go," Geddes said.

Other UMass Lowell researchers will view the total eclipse from other locations. Physics Prof. Paul Song of Andover, will view the event in Salem, Ore., while Prof. Silas Laycock, director of UMass Lowell's astronomical observatory, will watch the event unfold from Sun Valley, Idaho. Laycock, a Newburyport resident, will use the experience to inform the "Astronomy Roadshow" he brings to K-12 schools to inspire young people to study the universe and pursue careers in STEM fields (science, technology, engineering and mathematics). To date, Laycock has presented the program in schools in Massachusetts, Maine and Haiti.

UMass Lowell student Thomas Heywosz, a math major from Charlton who is the "Astronomy Roadshow" outreach coordinator, will observe the eclipse from campus, where it will be 63 percent visible, through a 10-inch telescope with a solar filter.

"The images and media collected during the eclipse will be shown to schools to help illustrate scientific concepts most students learn about and to generate interest in the field," said Heywosz, who works on the roadshow's curriculum through UMass Lowell's UTEACH program for undergraduates who aspire to become teachers in STEM subjects.

Finn will be near Mitchell, Ore., where the total eclipse will be visible. She plans to view it through solar-eclipse glasses specially designed to

protect the wearer's eyesight. She warns that, in order to safeguard one's vision, no one watching the eclipse - whether total or partial - should look directly at the sun. Instead, they should use specialized glasses or a camera, telescope or binoculars fitted with an appropriate solar filter.

Provided by University of Massachusetts Lowell