

Scientists prepare for the American total solar eclipse of August 21

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The path of totality of the August 21, 2017, solar eclipse, will sweep across the United States from coast to coast for the first time in 99 years, since 1918. Astronomer Jay Pasachoff is leading an international team of astronomers in preparing scientific observations to study the sun's outer layer, the solar corona, and also the effect of the eclipse on the Earth's atmosphere. He is also coordinating visiting astronomers from around the globe, giving reciprocity for their hospitality in decades of past eclipse expeditions. At the American Physical Society meeting, Pasachoff is presenting a paper about scientific observations of solar eclipses and their potential consequences for astrophysics.

In his talk at the American Physical Society's Division of Astrophysics, Pasachoff described a variety of professional efforts scheduled to observe the [eclipse](#). His own group includes scientists from Slovakia and Greece, in addition to students and colleagues from the United States. They will study the dynamics of the [solar corona](#) and study the frequency of oscillations as seen through special coronal filters, part of testing models of how the corona is heated to millions of degrees. They are linking the shape of the corona, held in place by the magnetic field, to the phase of the sunspot cycle, with potential implications for the next cycle, given that we have recently entered sunspot minimum. Prof. Shadia Habbal of the University of Hawaii observes with an international group she calls the Solar Eclipse Sherpas. They use a set of filters in visible and infrared light to study the shape of the corona and its polarization, which reveals the orientation of the solar magnetic field. They are also studying the dynamics of the corona, and using imaging

through special filters that show high-temperature coronal gas to map the transition between types of radiation in the corona. Prof. Alexander Kosovichev of the New Jersey Institute of Technology, working with Dr. Serge Koutchmy of the Institute of Astrophysics of Paris, also plans to study coronal polarization. Koutchmy has special methods for high-contrast and high-resolution processing of coronal images. Many eclipse astronomers work with the image-processing skills of Prof. Miloslav Druckmuller of Brno, Czech Republic.

Prof. Hugh Hudson and Laura Peticolas of the Space Science Laboratory of the University of California, Berkeley, are heading a Megamovie project to use thousands of images taken by members of the general public, so-called citizen scientists, to provide an animation of variations in images over the 90 minutes that the Moon's shadow will take to cross the continental United States. In a separate citizen-science plan, Dr. Matt Penn of the National Solar Observatory is planning a Citizen Continental-America Telescope Eclipse Experiment (Citizen CATE), with 60 identical solar telescopes spaced across the path of totality to make an animation of highly calibrated identical images to show coronal dynamics.

A National Science Foundation plane will travel at high altitude to study coronal spectra in the infrared, in a plan led by Drs. Leon Golub and Dr. Ed DeLuca of the Harvard-Smithsonian Center for Astrophysics, with graduate-student Jenna Samra.

Pasachoff tries to bring across to the general public how exciting it is to be outdoors in the path of totality of a solar eclipse. It is particularly important for students of all ages to be outdoors during the eclipse, since the phenomenon can be inspiring. He stresses that "being even 10 or 100 miles outside the path is like being outside a football stadium, technically 'at the stadium' but actually missing seeing the main event." He would like to convince 300 million Americans from all over the

country to join the 12 million people who live within the path of totality for the 2 or so minutes of totality on August 21. (An additional 76 million people live within a 200-mile drive of the path, according to map-maker Michael Zeiler of Santa Fe.)

Science consultant and expert in school science Charles Fulco will join in the conference, describing activities that K-12 (kindergarten through high-school) students can participate in to ready them for the eclipse and to be inspired by observing it.

Pasachoff has seen more solar eclipses than anyone ever: the August 21 solar will be his 66th [solar eclipse](#) and his 34th total eclipse. He is Chair of the International Astronomical Union's Working Group on Solar Eclipses, a joint Working Group of the Solar and the Education/Outreach/Heritage commissions. He is also a member of the Eclipse 2017 Task Force of the American Astronomical Society. Pasachoff is Field Memorial Professor of Astronomy at Williams College, and holds a visiting appointment at Caltech. His degrees are from Harvard and he is a Fellow of the American Physical Society.

His scientific observations at the 2017 total eclipse are sponsored by the Committee for Research and Exploration of the National Geographic Society and the Solar Terrestrial Program of the U.S. National Science Foundation. In addition to his research, he has long worked to spread information about how wonderful it is to observe a [total eclipse](#) and how to observe it safely. He is giving papers on such subjects at the meeting of the American Astronomical Society in Texas, at the American Physical Society meeting in Washington, DC, on January 31, and at the American Association of Physics Teachers meeting in Atlanta on February 19, where he is receiving the society's Richtmyer Memorial Lecture Award. He has organized a session on the eclipse at the meeting in Boston on February 17 of the American Association for the Advancement of Science. He is completing articles on the Sun and the

eclipse for *Scientific American* and *Nature Astronomy*, in addition to providing a Resource Letter on Solar Eclipses for the *American Journal of Physics*.

Pasachoff is coauthor, with Leon Golub, of a popular book about the Sun: *Nearest Star: The Surprising Science of Our Sun*, and of a technical book, *The Solar Corona*. The books will be assigned as part of the reading of a spring-semester course he is giving at Williams College on solar physics, in which the students will have the opportunity to prepare for eclipse observing and to accompany the research team to the eclipse itself. Pasachoff and Golub have prepared a new book, *The Sun*, for the Science Museum, London, to be published in June. The latest printing of his *Peterson Field Guide to the Stars and Planets* contains two dozen pages about eclipse observing. Pasachoff is working with PBS's NOVA to prepare a television show to air two nights after the eclipse.

Provided by Williams College

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